

School of Psychology and Speech Pathology

**The hidden language skill: oral inferential comprehension in
children with developmental language disorder**

Emily Catherine Dawes

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Doctor of Philosophy
of
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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Numbers #PSYCHSP 2014-07 and #HR79/2015.

Signature:

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Peer-reviewed Presentations Arising from this Thesis

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Abstract

Children with developmental language disorder (DLD) experience significant difficulty with language development. One key area of difficulty shown by both younger and older children with DLD is inferential comprehension, a skill which is fundamental for successful oral communication and reading comprehension.

While much research literature has investigated the processes involved in, and intervention to improve, reading comprehension, little is known about the profile of difficulties which contribute to poor *oral* inferential comprehension in children with DLD. In addition, although oral inferential comprehension is an area of known weakness in children with DLD, there are few intervention studies targeting this skill. These represent critical gaps in the research literature and evidence related to oral inferential comprehension in children with developmental language disorder. In response to the identified gaps, this research aimed to: a) profile the language and cognitive skills which underpin oral inferential comprehension in young children with DLD and, b) to use the profile and past literature to develop, trial, and evaluate an intervention targeting inferential comprehension in this population.

Two studies were completed to address these aims. For the first study, a literature review was completed to identify language and cognitive skills which were hypothesised to be predictors of oral inferential comprehension in young children with DLD. Assessments measuring oral inferential comprehension of narratives and the range of language and cognitive skills identified in the literature review were completed with 76, 5 to 6 year old children with DLD in the first study. Analyses identified the skills which were significant predictors of inferential comprehension scores. The resulting profile demonstrated that narrative retelling, literal comprehension, theory of mind, and vocabulary were significant individual predictors of inferential comprehension of narratives in the group of 5 to 6 year old children with DLD. The profile identified a range of skills which contribute significantly to oral inferential comprehension in children with DLD, and highlighted the importance of considering these as intervention targets to improve inferential comprehension in this population.

The second study integrated this profile with prior intervention research to develop and trial a small-group intervention targeting oral inferential comprehension.

Past intervention studies targeting literal and inferential oral and reading comprehension, both directly and indirectly, were reviewed in order to identify common intervention strategies used to support comprehension. The Study One profile was combined with findings from the review of intervention studies to develop a range of intervention principles. These 13 intervention principles were used to develop a small-group oral inferential comprehension intervention in the context of book-sharing. A randomised controlled trial (RCT) of the intervention was completed with 37, 5 to 6 year old children with DLD. The results of the RCT demonstrated that the intervention was effective at improving oral inferential comprehension across the narrative context, and that improvement was maintained over time. The findings of Study Two provided support for the intervention, the intervention principles, and the Study One profile underlying the intervention.

The outcomes of the research include: a) a profile of the skills underlying oral inferential comprehension of narratives in a group of 5 to 6 year old children with DLD and, b) an intervention which was effective at improving oral inferential comprehension of narratives in this population. This research contributes valuable information to the theoretical and clinical evidence-base for clinicians and researchers in the understanding and treatment of inferential comprehension difficulties in children with developmental language disorder. Future research should further investigate this important area and replicate both studies with larger sample sizes and wider age ranges of children with DLD.

Glossary of Abbreviations

| | |
|---------|--|
| ASD | Autism Spectrum Disorder |
| CCC-2 | Children's Communication Checklist – Second Edition |
| CELF-P2 | Clinical Evaluation of Language Fundamentals Preschool – Second Edition |
| CTOPP | Comprehensive Test of Phonological Processing |
| DLD | Developmental Language Disorder |
| EVT-2 | Expressive Vocabulary Test – Second Edition |
| IC | Inferential Comprehension |
| NCA | Narrative Comprehension Assessment |
| PA | Phonological Awareness |
| PIPA | The Preschool and Primary Inventory of Phonological Awareness |
| PLI | Pragmatic Language Impairment |
| PPVT-4 | Peabody Picture Vocabulary Test – Fourth Edition |
| RCT | Randomised Controlled Trial |
| SLI | Specific Language Impairment |
| TNL | Test of Narrative Language |
| TOLD-P3 | Test of Language Development – Primary, Third Edition |
| ToM | Theory of Mind |
| ToMI | Theory of Mind Inventory |
| TROG-2 | Test for Reception of Grammar – Second Edition |
| WPPSI-3 | Wechsler Preschool and Primary Scale of Intelligence – Third Edition |

Contents

| | |
|--|----------|
| Declaration | I |
| Acknowledgements..... | II |
| Peer-reviewed Presentations..... | IV |
| Abstract..... | V |
| Glossary of Abbreviations..... | VII |
| List of Tables | XIII |
| List of Figures..... | XV |
| Chapter 1: Thesis Overview | 1 |
| Background..... | 1 |
| Research Aims..... | 2 |
| Overview of Thesis Chapters | 3 |
| Chapter 2: Study One Literature Review | 4 |
| Chapter Overview | 4 |
| Developmental Language Disorder | 4 |
| Definition..... | 5 |
| Characteristics and diagnosis | 6 |
| Language Comprehension | 8 |
| Discourse Comprehension | 10 |
| Inferential Comprehension | 14 |
| Development of Inferential Comprehension | 15 |
| Inferential Comprehension in Children with Developmental Language Disorder ... | 19 |
| Skills Required for Inferential Comprehension | 22 |
| Oral Comprehension and Reading | 24 |
| Summary | 25 |
| Language and Cognitive Skills Contributing to Inferential Comprehension..... | 26 |
| Vocabulary..... | 26 |
| Grammar | 29 |
| Narrative..... | 31 |
| Working memory..... | 33 |
| Linguistic processing | 35 |
| Executive Functioning (Inhibition) | 38 |
| Theory of mind..... | 40 |

| | |
|---|-----------|
| Summary of domains contributing to oral inferential comprehension..... | 43 |
| Significance | 44 |
| Chapter 3: Study One | 45 |
| Chapter Overview | 45 |
| Research Rationale | 45 |
| Aims and Hypothesis | 46 |
| Methods | 46 |
| Participants..... | 46 |
| Measures..... | 50 |
| Procedures | 58 |
| Analysis Plan and Rationale | 60 |
| Results..... | 61 |
| Stage 1: Descriptive statistics | 61 |
| Stage 2: Assumption testing | 63 |
| Stage 3: Power analysis. | 64 |
| Stage 4: Bivariate correlational analyses using Spearman’s rho | 64 |
| Stage 5: Testing for potentially confounding covariates | 66 |
| Stage 6: Bivariate relationships between inferential comprehension and the language and cognitive variables..... | 66 |
| Discussion | 68 |
| Profile of skills contributing to oral inferential comprehension | 68 |
| Skills which contributed significantly to oral inferential comprehension | 72 |
| Skills which did not contribute significantly to oral inferential comprehension..... | 80 |
| Limitations | 91 |
| Study One Conclusion | 93 |
| Chapter 4: Study Two Literature Review | 94 |
| Chapter Overview | 94 |
| Interventions for Children with Developmental Language Disorder | 94 |
| Reading Comprehension Interventions | 95 |
| Reading comprehension interventions in typically developing and ‘poor’ readers | 96 |
| Reading comprehension interventions in developmental language disorder | 102 |
| Summary of reading comprehension interventions | 103 |
| Narrative-based Interventions | 106 |

| | |
|---|------------|
| Developmental language disorder | 112 |
| Learning difficulties | 114 |
| Summary of narrative-based interventions..... | 116 |
| Theory of Mind Interventions..... | 117 |
| Summary of theory of mind interventions..... | 121 |
| Inferential Comprehension Interventions..... | 122 |
| Summary of inferential comprehension interventions..... | 126 |
| Summary of Intervention Studies | 127 |
| Chapter 5: Study Two | 129 |
| Chapter Overview | 129 |
| Research Rationale | 129 |
| Aims..... | 130 |
| Inferential Comprehension Intervention..... | 130 |
| Rationale for Intervention Principles..... | 133 |
| Intervention Study | 146 |
| Hypotheses | 146 |
| Methods | 146 |
| Participants..... | 146 |
| Interventions | 147 |
| Measures | 152 |
| Procedures | 154 |
| Randomisation..... | 157 |
| Inter-rater Reliability..... | 158 |
| Intervention Attendance | 159 |
| Analysis Plan | 160 |
| Results..... | 160 |
| Stage 1: Descriptive Statistics..... | 160 |
| Stage 2: Assumption testing | 161 |
| Stage 3: Generalised Linear Mixed Models..... | 162 |
| Discussion | 171 |
| Inferential comprehension..... | 171 |
| Literal comprehension..... | 177 |
| Limitations | 179 |

| | |
|---|-----|
| Study Two Conclusion | 181 |
| Chapter 6: General Discussion | 182 |
| Chapter Overview | 182 |
| Research Overview..... | 182 |
| Theoretical Implications | 183 |
| Discourse comprehension theory..... | 183 |
| Underlying deficits in developmental language disorder | 186 |
| Clinical Implications | 188 |
| Strengths and Limitations..... | 191 |
| Future Research Directions..... | 193 |
| Conclusion | 194 |
| References | 196 |
| Appendix A: Copyright permissions..... | 220 |
| Appendix B: Study One Information Letters and Consent Forms..... | 225 |
| Study One Principal Information Letter | 225 |
| Study One Principal Consent Form | 230 |
| Study One Parent/Carer Information Letter | 231 |
| Study One Parent/Carer Consent Form | 234 |
| Study One Participant Information Letter..... | 235 |
| Study One Participant Consent Form | 236 |
| Appendix C: The Squirrel Story Narrative, NCA and Scoring Guide..... | 237 |
| The Squirrel Story Narrative..... | 237 |
| The Squirrel Story – Narrative Comprehension Assessment..... | 238 |
| The Squirrel Story Narrative Comprehension Assessment Scoring Guide | 240 |
| Appendix D: Peter and the Cat Narrative, NCA and Scoring Guide..... | 247 |
| Peter and the Cat Narrative..... | 247 |
| Peter and the Cat – Narrative Comprehension Assessment..... | 248 |
| Peter and the Cat Narrative Comprehension Assessment Scoring Guide | 250 |
| Appendix E: Inhibition (Executive Functions) Assessments | 257 |
| Appendix F: Theory of Mind Inventory Example Report..... | 259 |
| Appendix G: Study One Compromised Multiple Regression Models..... | 261 |
| Appendix H: The Squirrel Story NCA Pilot Study | 267 |
| Appendix I: Study Two Information Letters and Consent Forms..... | 270 |

| | |
|--|------------|
| Study Two Principal Information Letter | 270 |
| Study Two Principal Consent Form | 275 |
| Study Two Parent/Carer Information Letter | 276 |
| Study Two Parent/Carer Consent Form | 280 |
| Study Two Participant Information Letter..... | 281 |
| Study Two Participant Information Consent Form | 282 |
| Appendix J: Inferential Comprehension Intervention..... | 283 |
| Example Intervention Session Plans..... | 283 |
| Example Session Resources..... | 296 |
| Appendix K: Control Phonological Awareness Intervention | 299 |
| Intervention Structure | 300 |
| Intervention Session Plans | 300 |
| Phonological Awareness Intervention Results | 301 |
| Discussion of Phonological Awareness Results | 305 |

List of Tables

| | |
|---|-----|
| Table 1: Assessment Battery..... | 50 |
| Table 2: Inter-rater Reliability of Measures | 59 |
| Table 3: Means, Standard Deviations and Ranges of Measures | 63 |
| Table 4: Spearman’s Rho Correlations among Language and Cognitive Measures | 65 |
| Table 5: Relationships between Inferential Comprehension and Each Predictor in the Regression Analyses..... | 67 |
| Table 6: Common Strategies in Reading Comprehension Interventions | 104 |
| Table 7: Common Strategies in Narrative-based Interventions..... | 116 |
| Table 8: Common Strategies in Theory of Mind Interventions related to Inferential Comprehension..... | 121 |
| Table 9: Common Strategies in Inferential Comprehension Interventions | 127 |
| Table 10: Oral Inferential Comprehension Intervention Principles | 130 |
| Table 11: Sequence of Narrative Texts | 148 |
| Table 12: Intervention Sessions Outline | 149 |
| Table 13: Study Two Assessments | 154 |
| Table 14: Pre-Intervention Means and Standard Deviations of Intervention Groups | 158 |
| Table 15: Inter-rater Reliability | 159 |
| Table 16: Number of Sessions Attended by Intervention Participants..... | 160 |
| Table 17: Means, Standard Deviations & Ranges of The Squirrel Story NCA Scores | 161 |
| Table 18: Means, Standard Deviations & Ranges of Peter and the Cat NCA Scores | 161 |
| Table 19: Crosstabulation of Reliable Change | 166 |
| Table 20: Participant Pre- to Post-Intervention Inferential Comprehension Change Scores (The Squirrel Story NCA)..... | 166 |
| Table 21: IC Group Pre- and Post-Intervention (Ix) Inferential Comprehension Question Means | 168 |
| Table 22: Pre- and Post-intervention Responses of IC Group Participants..... | 170 |
| Table 23: Similarities and differences between inferential comprehension intervention studies..... | 176 |
| Table 24: PCA Variance Explained | 262 |

| | |
|---|-----|
| Table 25: PCA Pattern Matrix..... | 263 |
| Table 26: Component Correlation Matrix..... | 263 |
| Table 27: GLMM Results..... | 264 |
| Table 28: GLMM1 (Discourse) Results..... | 265 |
| Table 29: GLMM2 (Language Memory and Structure) Results..... | 265 |
| Table 30: GLMM3 (Semantic-Pragmatic) Results..... | 265 |
| Table 31: GLMM4 (Processing) Results..... | 266 |
| Table 32: Means, Standard Deviations & Ranges of Phonological Awareness Scores | 301 |

List of Figures

| | |
|---|-----|
| Figure 1. Model of Stages in Comprehension, Bishop (2014b). | 10 |
| Figure 2. Simple visual depiction of the discourse comprehension model by van Dijk and Kintsch (1983)..... | 12 |
| Figure 3. "The perceptual-language distances underlying the scale of abstraction" Blank et al. (1978a)..... | 18 |
| Figure 4. Study One Research Process Flow Chart | 49 |
| Figure 5. Profile of skills contributing to inferential comprehension in children with DLD. | 69 |
| Figure 6. Study Two Research Process Flow Chart | 156 |
| Figure 7. Group x Time interaction for inferential comprehension scores. | 163 |
| Figure 8. Time effect for literal comprehension scores. | 164 |
| Figure 9. Group x Time Interaction for Rhyme Scores. | 303 |
| Figure 10. Group x Time Interaction for Phoneme Segmentation Scores..... | 304 |
| Figure 11. Time Effect for Letter Knowledge Scores | 305 |

Chapter 1: Thesis Overview

“Language is so readily acquired and so universal in human affairs that it is easy to forget what a complex phenomenon it is.” (Bishop, 2014b, p. 1)

Background

The development and use of language is indeed an extremely complex process. Approximately 7% of children experience significant difficulty with acquiring language for no clear reason (Norbury et al., 2016; Tomblin et al., 1997). These children can be diagnosed with ‘developmental language disorder’ (DLD) (Leonard, 2014). Although the profiles of language difficulties seen in children with DLD are heterogeneous, a number of key weaknesses are apparent, including inferential comprehension (Adams, Clarke, & Haynes, 2009; Bishop & Adams, 1992; Norbury & Bishop, 2002). Inferential comprehension involves going beyond what has been explicitly presented by linking information, and typically occurs automatically, and effectively, during oral communication and reading.

Adequate inferential comprehension is particularly important during discourse-level communication in order to understand the coherent whole, or ‘gist’, of the discourse (Bishop, 2014b). Although comprehension is a silent skill, difficulties with discourse comprehension can have significant and adverse impacts on communication and learning, affecting almost every aspect of everyday life (Cain & Oakhill, 2007b). Successful inferential comprehension is essential for effective participation across all aspects of oral and written communication, such as conversations and stories (including fiction and non-fiction books, newspapers, TV shows, and movies). In addition, *oral* inferential comprehension underpins *reading* comprehension, which is fundamental to learning (Nation & Norbury, 2005; Oakhill & Cain, 2012; Oakhill, Cain, & Bryant, 2003; Spencer, Quinn, & Wagner, 2014). The act of reading and understanding this thesis effectively will require complex inferential comprehension dependant on specialist background knowledge in language and communication.

Understanding the processes involved in both successful comprehension, and comprehension difficulties, have been a challenge for both clinicians and researchers. Law, Garrett and Nye (2004) noted the increased risk of long-term

language, emotional, and behavioural difficulties associated with children who have language comprehension difficulties (Conti-Ramsden, Mok, Pickles, & Durkin, 2013) and, in summarising their meta-analysis of interventions for children with speech and language delays and disorders, highlighted “The most apparent area of need is receptive language difficulties” (Law et al., 2004, p. 936).

While research has demonstrated that most children with DLD show poor oral inferential comprehension, there is a lack of integrated evidence supporting our understanding of, and a paucity of research aiming to improve, inferential comprehension in this population. Therefore, this research has focused on improving our understanding of the hidden language skill: oral inferential comprehension in children with developmental language disorder.

Research Aims

A significant body of research has examined inferencing as a component of *reading* comprehension in both typically developing children and poor readers (Cain & Oakhill, 1999, 2006; Nation, Cocksey, Taylor, & Bishop, 2010; Oakhill, 1984; Oakhill & Cain, 2012; Oakhill et al., 2003). Some studies have also investigated the skills contributing to *oral* comprehension in young typically developing children (Currie & Cain, 2015; Florit, Roch, & Levorato, 2011; Lepola, Lynch, Laakkonen, Silvén, & Niemi, 2012; Potocki, Ecalle, & Magnan, 2013). To date, however, no research could be found which comprehensively investigated the language and cognitive skills contributing to oral inferential comprehension in young children with DLD. As such, the first study in this doctoral research aimed to explore the language and cognitive skills which significantly contribute to oral inferential comprehension ability in a cohort of young children with developmental language disorder in order to develop an evidence-based profile of the skills which underpin oral inferential comprehension. Such an understanding is crucial in order to develop our theoretical understanding of this complex area and to support the development of evidence-based, theoretically-driven interventions targeting the skills which underpin inferential comprehension in this population.

Due to the integral nature of inferential comprehension to competence in both oral communication and reading comprehension, it is a pertinent intervention target for *young* children who show poor oral inferential comprehension ability. Few studies have specifically measured inferential comprehension as an outcome of intervention,

nor targeted oral inferential comprehension directly in intervention. In addition, there are a number of methodological limitations with the small evidence base reviewed within this thesis (e.g. lack of control group, blinding, maintenance follow-up). Therefore, drawing on the Study One profile of language and cognitive skills which significantly contribute to inferential comprehension and a literature review of past intervention studies, the second study in this research aimed to develop, trial, and evaluate an intervention to improve oral inferential comprehension in young children with DLD.

Overview of Thesis Chapters

The following section presents a brief outline of the remaining chapters in this thesis.

Chapter two discusses the background literature which underpins this research. Developmental language disorder and inferential comprehension are examined, in addition to a range of language and cognitive skills hypothesised to be related to oral inferential comprehension ability in children with DLD.

Chapter three presents the profiling study (Study One) which identified the language and cognitive skills which significantly contributed to oral inferential comprehension of narratives in a cohort of young children with DLD.

Chapter four integrates the results of Study One with past literature to describe and critique interventions and common intervention strategies which target literal and inferential comprehension in children with DLD, children with typically developing language, and children with other developmental disorders.

The results of Study One and the literature review (chapter four) are drawn on in chapter five to present a novel inferential comprehension intervention developed for young children with DLD as part of this research. The results of a randomised controlled trial of the novel oral inferential comprehension intervention (Study Two) are presented and discussed.

In chapter six, the results of both studies are integrated in a general discussion, relating back to past literature and discourse comprehension theory. The clinical and theoretical implications, and strengths and limitations of the research are discussed, and areas for future research are identified.

Chapter 2: Study One Literature Review

Chapter Overview

This chapter will introduce and describe developmental language disorder. It will discuss the processes and skills involved in oral inferential comprehension and the evidence demonstrating this as a key difficulty shown by children with developmental language disorder. This will be followed by a review of the language and cognitive skills which are hypothesised to contribute to oral inferential comprehension in this population.

Developmental Language Disorder

“There were some occasions when I got really angry that I’d just walk out the class or something like that. It just came to a point when I just didn’t want to do homework coz I just felt stupid and I just looked at the paper, and if I didn’t, if I didn’t understand the question one I would just put it back in my bag, just go off to my room.... Well because I didn’t do my homework, teachers began to get a bit angry with me and then it would come to a point where they’d shout at me which would make me even more upset... so yeh... going to school wasn’t the best thing” – Harry, aged 16 (RALLI Campaign, 2012)

“Really frustrated, and really annoyed, annoyed with myself because I don’t really understand so I just gave up.” – Stephanie, aged 10 (RALLI Campaign, 2012)

Language is often viewed as a basic element of human development. However, while fundamental, it is also an extremely complex cognitive ability unique to humans. As with other areas of development – such as social, emotional and physical – the development of language does not always progress as expected and for some, development is disordered. Children whose language development is significantly disordered, which cannot be attributed to neurological, psychosocial, or physical delays or disorders, can be diagnosed with ‘Developmental Language Disorder’ (DLD) (Bishop, Snowling, Thompson, Greenhalgh, & CATALISE-2 Consortium, 2016; Leonard, 2014). Approximately 7% of children are diagnosed with developmental language disorders (Norbury et al., 2016; Tomblin et al., 1997). DLD occurs across languages, although the profile of difficulties can vary depending on

the language (Leonard, 2014). Researchers are continuing to investigate the aetiology of DLD, with genetics thought to be a key contributor (Rice, 2013).

Definition

A wide variety of terms have been used to describe the population of children with developmental language disorders, including specific language impairment, communication disorder, developmental aphasia/dysphasia, and speech and language difficulties (Bishop, 2014a; Reilly, Bishop, & Tomblin, 2014). Although specific language impairment has been the most prevalent term in the research literature, the term has increasingly become a point of debate and discussion, in particular around the notion of 'specificity' (Bishop, 2014a). Research has shown that some children with language difficulties present with difficulties in other areas of development (e.g. motor skills) and that language difficulties can co-occur with other neurodevelopmental disorders – commonly dyslexia and attention deficit hyperactivity disorder (Ebert & Kohnert, 2011; Finlay & McPhillips, 2013; Gooch, Hulme, Nash, & Snowling, 2013; Hill, 2001; Webster, Majnemer, Platt, & Shevell, 2005).

There has been ongoing discussion between researchers and clinicians with the aim of deciding on universal terminology and specific classification of unexplained language difficulties (Bishop, Snowling, Thompson, Greenhalgh, & CATALISE Consortium, 2016; Reilly, Bishop, et al., 2014; Reilly, Tomblin, et al., 2014). A recent consensus paper by the CATALISE Consortium agreed on a move to use the standard terminology 'developmental language disorder' in research and clinical practice to describe children who show significant language development difficulties which are not associated with a known biomedical aetiology, are likely to endure over time, and which require specialist support (Bishop et al., 2016). The consortium was comprised of 54 individuals representing a range of nationalities and backgrounds (including professions related to language development and difficulties, and relatives of individuals with such difficulties).

The use of 'developmental language disorder' is similar to 'language disorder' used in the Diagnostic and Statistical Manual of Mental Disorders (DSM–V) (American Psychiatric Association, 2013). While diagnosis of specific language impairment has typically been defined by at least 'average' non-verbal IQ, diagnosis of DLD does not necessitate this. This has been supported by research (Reilly,

Tomblin, et al., 2014), including the results of a large study which found that children with language difficulties who scored in the low-average range for non-verbal IQ did not differ significantly from those with average non-verbal IQ in language disorder severity, educational achievements, or in social, emotional, and behavioural problems (Norbury et al., 2016).

As outlined by Bishop (2014a), other developmental disorders such as autism and dyslexia have commonly accepted terminology. The lack of consistent terminology for language difficulties causes confusion in research and clinical practice, and impacts funding and access to services for individuals, in addition to advocacy (Bishop, 2014a). The recent consensus study by Bishop et al. (2016) has provided clear terminology to enable consistent use among researchers, clinicians and the community. Therefore, as recommended by Bishop et al. (2016), this thesis will adopt the term developmental language disorder (DLD) to refer to children who present with unexplained language development difficulties. As mentioned, specific language impairment (SLI) has been the most prevalent term in the research literature, typically defined by significant language difficulties and average non-verbal IQ. The research literature discussed in this thesis which included participants labelled as SLI who met the criteria of unexplained language difficulties, with a profile of poor language and (generally) non-verbal IQ in the average range, will henceforth be referred to as DLD. While both studies in this thesis were completed prior to the publication of the consensus study by Bishop et al. (2016), only the first study used non-verbal IQ (low average or above) as selection criteria.

Characteristics and diagnosis

Diagnosis of developmental language disorder involves a child demonstrating significant limitations in their language development (Leonard, 2014). Many children with DLD initially present with delayed expressive language development. While delayed patterns may continue, development also follows a different trajectory to that of typically developing children. Particular language error patterns and weaknesses develop, hence, the classification of 'disorder' rather than 'delay' (Leonard, 2014). The disorder may involve expressive and/or receptive language across a number of domains, including phonology, morphology, syntax, and semantics (Leonard, 2014). While many English-speaking children with DLD present with a mixed profile of difficulties, two particular areas of difficulty are poor expressive and receptive

morpho-syntax, and poor phonological memory (as reflected by performance on non-word repetition tasks) (Leonard, 2014).

Many children diagnosed with DLD at a young age present with continuing language and literacy difficulties in adolescence and adulthood (Conti-Ramsden, St Claire, Pickles, & Durkin, 2012; Tomblin, Zhang, Buckwalter, & O'Brien, 2003). Such ongoing difficulties with the understanding of and ability to use language can have significant adverse impacts on quality of life, including performance at school, development and maintenance of friendships, self-esteem and opportunities for employment and further education (Conti-Ramsden & Botting, 2004; Conti-Ramsden & Durkin, 2012; Conti-Ramsden et al., 2013; Hubert-Dibon, Bru, Gras Le Guen, Launay, & Roy, 2016; Lindsay & Dockrell, 2012; Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006; Whitehouse, Watt, Line, & Bishop, 2009; Yew & O'Kearney, 2013; Young et al., 2002).

Identifying clear subgroups of presentations of DLD is problematic due to the heterogeneous nature of language and the disorder, however, identification of subgroups would assist both clinicians and researchers. There were a number of early attempts to identify subgroup profiles of DLD based on language assessments or clinical judgements (Aram and Nation, 1975; Rapin and Allen, 1983; as cited in Leonard, 2014), while later studies used batteries of standardised psychometric assessments. However, most attempts have not resulted in clear-cut subgroups.

Language, speech, and reasoning assessments, in addition to teacher interviews, with a group of 242 British children aged 6 to 8 years with DLD identified six subgroup, or cluster, presentations of language disorder (Conti-Ramsden, Crutchley, & Botting, 1997). The language abilities in each cluster varied: in most of the clusters children presented with skills within the typical range on some assessments, but scored poorly on other assessments, such as vocabulary, phonology, and reading or discourse-level skills (Conti-Ramsden et al., 1997). When the children were reassessed one year later, the same clusters of difficulty emerged, however almost half of the children's profiles had shifted to a different subgroup (Conti-Ramsden & Botting, 1999). These findings demonstrated that, although the global pattern of skill presentations in DLD may be consistent, the individual profiles of children can change and may vary across subgroups over time (Conti-Ramsden & Botting, 1999).

More recently, 110 Dutch-speaking children aged 4 years with speech and language disorders were assessed, and four skill profile subgroups were identified: 'lexical-semantic' ; 'speech production'; 'syntactic-sequential'; and, 'auditory perception' (van Daal, Verhoeven, & van Balkom, 2004). The population of children, assessments used, and language differed to the Conti-Ramsden et al. (1997) study, however there is similarity in some of the key weaknesses shown in the subgroups, particularly in the expression and comprehension of syntax, phonology, and discourse-level skills. Such studies demonstrate that a number of subgroup profiles of children with DLD may exist and, overall, indicate a broad range of difficulties across both expressive and receptive language which may change in individuals over time.

Although it was initially accepted that language comprehension deficits were not uniform across the population of children with DLD, research over recent years has demonstrated the reverse (Bishop, 2014b). As shown in sub-grouping studies, many children with DLD have particularly poor syntactic comprehension (Conti-Ramsden et al., 1997; van Daal et al., 2004). In addition, children with DLD perform particularly poorly in oral comprehension tasks which tax higher cognitive and processing skills, such as the ability to infer (Bishop & Adams, 1992; Botting & Adams, 2005; Norbury & Bishop, 2002). A number of studies have demonstrated that children with DLD demonstrate particular difficulty with inferential comprehension (Adams et al., 2009; Bishop & Adams, 1992; Letts & Leionen, 2001; Norbury & Bishop, 2002). Despite this, comprehension remains a relatively under-researched area, with a particular gap in our understanding of the skills which underpin comprehension in children with DLD and intervention to improve discourse comprehension. Therefore, this thesis will add to the evidence base by investigating the skills which contribute to oral inferential comprehension in children with DLD, and developing and evaluating an intervention to improve inferential comprehension in this population.

Language Comprehension

“Comprehension is the ultimate aim of reading and listening: It enables us to acquire information, to experience and be aware of other (fictional) worlds, to communicate successfully, and to achieve academic success.” Cain and Oakhill (2007, p. xi).

Broadly, language comprehension is the ability to understand spoken and written words, sentences, and discourse (Bishop, 2014b). As Bishop (2014b, p. 253) notes, “A critical point in the comprehension process is reached when the listener understands not just what the speaker said, but what was meant”. Thus, the goal of comprehension is to understand meaning, and is considered successful if an individual understands what a speaker or writer meant. As this process involves going beyond the literal interpretation of language, inferencing is critical to successful comprehension. The development of language comprehension generally precedes that of expression, as infants learn to recognise and react to people, objects and events by linking them to heard words (Owens, 2008). The development of these stored word meanings, or vocabulary, develops in both a receptive and an expressive capacity (Owens, 2008). Language comprehension evolves exponentially from understanding single words, to phrases, sentences, and discourse-level language (such as conversations, stories, and movies).

Comprehension is a complex concept which involves processing of the speech sound signal, attaching the appropriate meaning to the processed information, and synthesising this information to form an ‘understanding’ at the word, sentence, and discourse-level (Bishop, 2014b). Typically, comprehension happens silently, automatically, and constantly – in order to ensure that information has been understood appropriately, the individual must constantly be processing incoming language, or critical information could be missed which will impede successful comprehension (van Dijk & Kintsch, 1983).

In her seminal work on language comprehension development and issues in children, Bishop (2014b, first edition published 1997) considered bottom-up and top-down processes during language comprehension. At the bottom-up level, understanding begins with auditory processing and speech perception, followed by processes which involve breaking the speech signal into phonological components, ordering and recognising words and word meanings, assigning syntactic roles, and assigning meaning to the information as a whole (Bishop, 2014b). Effective comprehension also involves a significant contribution from top-down processes, such as using the environmental and social context, prior knowledge and experiences, and integrating information in order to build a mental (or situation) model for understanding of discourse (Bishop, 2014b). As Bishop (2014b, p. 252) notes, “Understanding of a speaker’s communicative intention is the ultimate goal in

comprehension, and involves going beyond the literal propositional meaning of an utterance.”. Successful comprehension can therefore be considered as the culmination of a variety of cognitive and linguistic skills, in addition to the physical processes of speech perception.

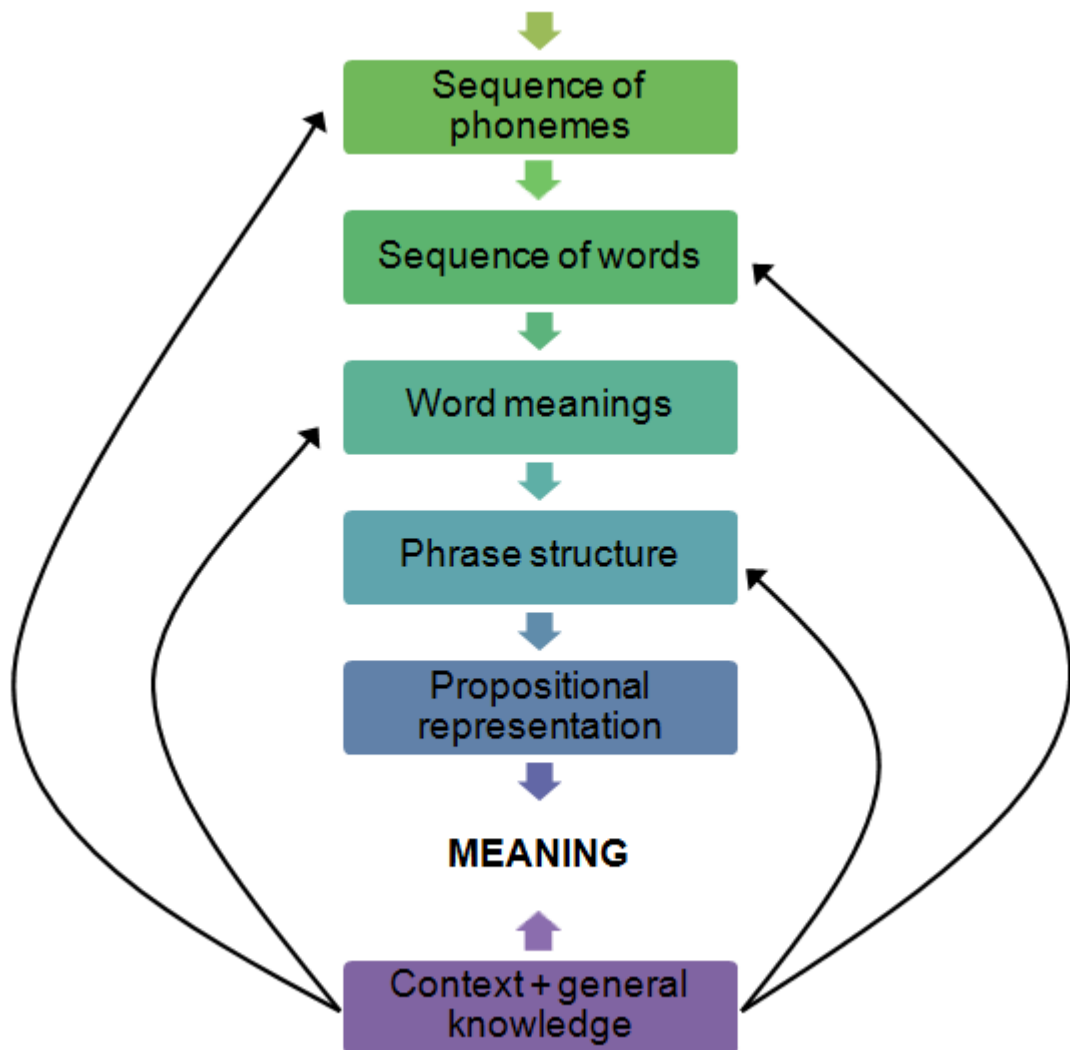


Figure 1. Model of Stages in Comprehension, Bishop (2014b, p.18)¹.

Discourse Comprehension

In order to better understand the top-down processes which contribute to comprehension ability, it is pertinent to consider discourse comprehension. The comprehension of discourse is considered the most complex level of comprehension, as it is necessary to remember, integrate, and draw links between information stated to understand the whole – to comprehend the meaning or ‘gist’ of

¹ Please see copyright permissions in Appendix A.

a discourse (van Dijk & Kintsch, 1983). The comprehension of discourse is therefore hypothesised to draw on a number of lower and higher level language and cognitive skills, including vocabulary, working memory, and pragmatic knowledge (Bishop, 2014b; van Dijk & Kintsch, 1983).

Van Dijk and Kintsch (1983) suggested that written discourse comprehension uses multilevel processing, across three specific levels which involve constant feedback. The first level, the surface representation, is the exact, literal representation of what has been read (van Dijk & Kintsch, 1983). This level represents the initial bottom-up processing depicted by Bishop (2014b). The surface representation is fleeting, but what remains after the surface representation decays from memory is a second level called the textbase, the online representation of meaning that has been taken from the surface representation (Graesser, Millis, & Zwaan, 1997). The textbase is formed from propositions, which are smaller, interconnected individual units of meaning (Frank, 2004; van Dijk & Kintsch, 1983). As Graesser, Singer & Trabasso (1994, p. 373) state “The textbase provides a shallow representation of the explicit text but does not go the distance in capturing the deeper meaning of the text.”. The textbase reflects the propositional representation described by Bishop (2014b), an integration of bottom-up processes which represents the shallow meaning of the language input. The highest level of discourse comprehension activated is the situation model, which is the representation of knowledge (general knowledge, prior experiences, people, etc) that is related to the text (van Dijk & Kintsch, 1983). The situation model, or ‘mental model’, reflects top-down processing, containing summary representations of information which are built by the individual to encode the ‘gist’ of a discourse (Bishop, 2014b). Existing situation models can be used, updated and modified when encountering a new discourse (van Dijk & Kintsch, 1983). Situation models are built from pre-existing schemas, which are conceptual representations of stereotypical situations or structures (e.g. fictional narrative macrostructure) (van Dijk & Kintsch, 1983; Zwaan & Radvansky, 1998). The situation model allows for the establishment of coherence, as Graesser, Singer, & Trabasso (1994, p. 372) note “...readers attempt to construct a meaningful referential situation model that addresses the readers’ goals, that is coherent, and that explains why actions, events, and states are mentioned in the text.”.

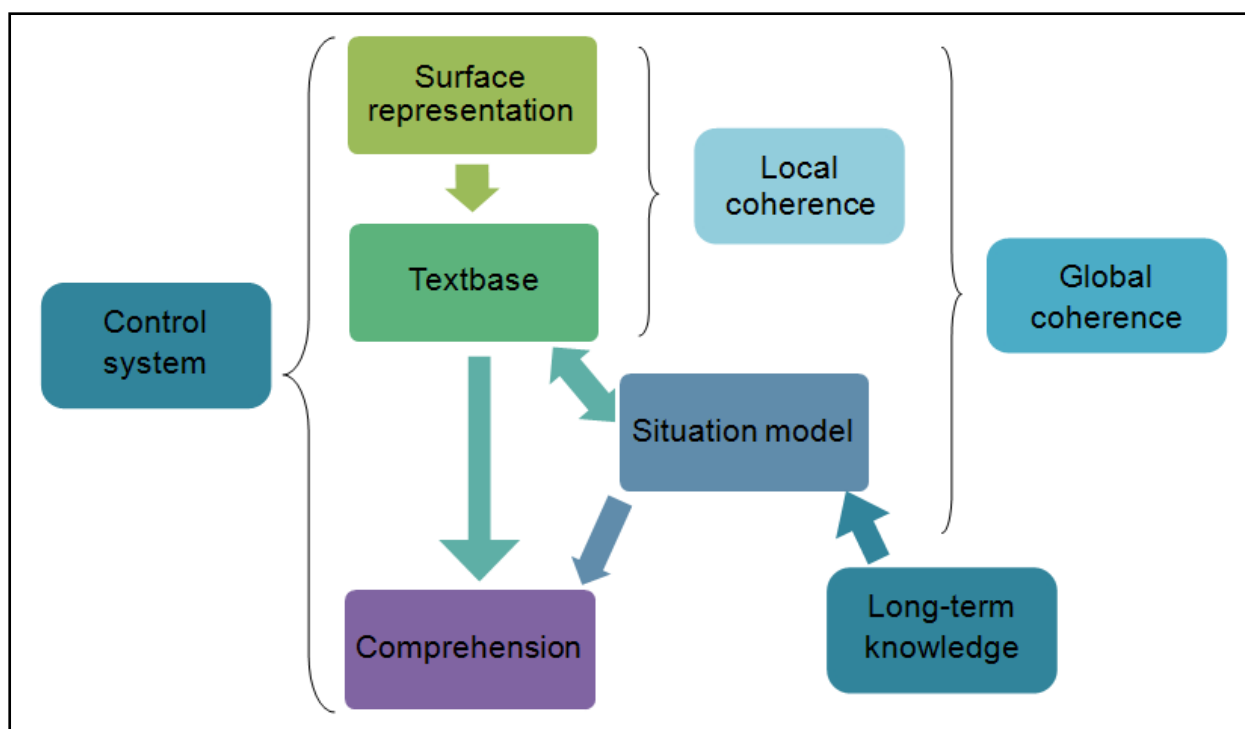


Figure 2. Simple visual depiction of the discourse comprehension model by van Dijk and Kintsch (1983).

The entire process works under the influence of a control system, which draws on information about the situation (pragmatic context), type of discourse, text macrostructure and related themes, and the overall comprehension goals of the listener/reader (van Dijk & Kintsch, 1983). The control system activates and monitors necessary resources (e.g. short term memory, situation model, long-term knowledge, etc). In this way, the process of discourse comprehension is strategic, working towards and maintaining consistency with the individual's overall goals for understanding (van Dijk & Kintsch, 1983).

The textbase and situation model are continuously compared and updated (van Dijk & Kintsch, 1983). The use and integration of the situation model with the on-line semantic representation of discourse meaning – the textbase – allows for comprehension of discourse (Bishop, 2014b; van Dijk & Kintsch, 1983).

Theoretically, it is thought to be during the process of comparison between the textbase and situation model that inferences are made, as information from one level of processing can be linked to the other (Graesser et al., 1997; van Dijk & Kintsch, 1983). This interplay between the textbase and situation model allows inferences to be drawn and local and global coherence of the discourse to be established, thus

providing a solid foundation for discourse comprehension (Bishop, 2014b; van Dijk & Kintsch, 1983).

During discourse comprehension it is important for the textbase to reach local and global coherence. Local coherence requires each sentence to be meaningfully related to the successive sentences in the discourse (Frank, 2004; Graesser, Singer, & Trabasso, 1994 ; van Dijk & Kintsch, 1983). In addition, each statement must relate to the entire body of discourse to establish global coherence (Frank, 2004; Graesser et al., 1997; van Dijk & Kintsch, 1983). Comprehension, or understanding of the discourse, is achieved through evaluation of the textbase, including the establishment of local and global coherences, and the related situation model (van Dijk & Kintsch, 1983).

The constructionist theory of inference generation aimed to account for knowledge based inferences made on-line during text comprehension (Graesser et al., 1994). The constructionist theory was developed from the model presented by van Dijk & Kintsch (1983), in that discourse comprehension consists of three main information sources: the text, background knowledge and the pragmatic context; information processing at three levels (the surface representation, the textbase and the situation model); and that the entire process of discourse comprehension is impacted upon by working-, short term- and long term- memory (Graesser et al., 1994). However, it differed from earlier theories in the central principle that readers attempt to search for meaning (Graesser et al., 1994). The authors suggest that, during discourse comprehension, an individual searches for meaning and that inferences arise as a result of this effort to attain meaning (Graesser et al., 1994). Thus, if an individual does not have an adequate knowledge base for meaning, or if they are not adept at recognising when to search for meaning, a breakdown in inferential comprehension is likely.

Comprehension is a silent cognitive process, and there is still much we have yet to discover in terms of how it takes place and how errors occur. However, as the above theories of discourse comprehension demonstrate, the process of comprehension requires the integration of top-down and bottom-up processes. The influence of top-down cognitive processes is of particular interest when considering effective discourse comprehension (Bishop, 2014b; van Dijk & Kintsch, 1983). However, much of the available research and empirical evidence testing discourse comprehension theories have examined *reading* comprehension in children and

adults, or in adults with aphasia, with less of a focus on the development of and the factors contributing to *oral* comprehension ability (Chesneau & Ska, 2015; Graesser et al., 1997; Harris Wright & Capilouto, 2012; Meteyard, Bruce, Edmundson, & Oakhill, 2015; Rader & Sloutsky, 2002; Zwaan, Langston, & Graesser, 1995). Additionally, there is little empirical evidence testing oral discourse comprehension theory and investigating the skills which contribute to discourse comprehension in both typically developing children and populations with poor discourse comprehension, such as children with DLD. As such, an understanding of the skills necessary for successful *oral* discourse comprehension in children with DLD – and, thus, those which may contribute to poor comprehension – is currently lacking.

Inferential Comprehension

Successful discourse comprehension in oral and written communication involves both inferential and literal comprehension. Inferential comprehension involves the ability to link information to develop understanding (Bishop, 2014b). In contrast, literal comprehension involves the ability to understand information which has been explicitly presented (Bishop & Adams, 1992; van Kleeck, Vander Woude, & Hammett, 2006). Inferential comprehension processes include drawing links to fill gaps in the information provided, drawing meaning from prior knowledge, linking stated and unstated relations between information, and forming predictions (Bishop, 2014b; Cain & Oakhill, 2007b; van Dijk & Kintsch, 1983; van Kleeck, 2008). Successful linking of information typically enhances the comprehension of information which has been directly presented, and is often necessary to ensure that a speaker or writer's intended meaning is appropriately understood (Bishop, 2014b; Cain & Oakhill, 2007b; van Dijk & Kintsch, 1983).

Inferential comprehension is a hidden, but critical, skill in everyday communication – inferences are usually drawn automatically to facilitate comprehension and allow the individual to participate effectively in communication. The significance of inferential comprehension to our everyday communication often only becomes apparent when there is a breakdown in the process. A clear example of this is evident in the communication of individuals with DLD, pragmatic language disorder, and autism spectrum disorder, who tend to over-rely on literal comprehension. These individuals therefore often experience breakdown in inferential comprehension – for example, missing the 'gist' of a joke or story,

responding inappropriately to or missing social cues in conversation, having difficulty inferring how someone might be feeling or making an appropriate prediction, and so on (Åsberg, 2010; Bodner, Engelhardt, Minshew, & Williams, 2015; Conti-Ramsden & Botting, 2004; Gerber, Brice, Capone, Fujiki, & Timler, 2012).

The ability to form inferences effectively and efficiently is not only necessary for children's learning and participation in the early school years, but is also crucial for later reading comprehension, and thus academic achievements (Cain & Oakhill, 2007a; Spencer et al., 2014; van Kleeck, 2008). Silva and Cain (2015) found that inferential comprehension of narratives in 4 to 6 year old typically developing children was a significant predictor of later reading comprehension ability. Similarly, inferential comprehension of narratives in 4 to 6 year old typically developing Finnish-speaking children was found to be predictive of later narrative retelling and oral comprehension ability (Lepola et al., 2012). As such, poor inferential comprehension can have a significant impact on a child's participation in social and learning situations, such as understanding conversations and play with friends, developing vocabulary, and participating in oral and written classroom discourse including narratives – an important bridge to literate language (van Kleeck, 2008).

Development of Inferential Comprehension

As a complex skill, inferential comprehension develops over time. Early research investigating inferential comprehension in children demonstrated that the ability to form different kinds of inferences improves with age: young children are less likely than adults to establish local and global coherence and form inferences during discourse comprehension (Ackerman, 1986, 1988; Paris, Lindauer, & Cox, 1977). In young typically developing children, the ability to answer inferential questions develops gradually along a continuum of difficulty (Filiatrault-Veilleux, Bouchard, Trudeau, & Desmarais, 2015). A study of typically developing French-speaking children found that children are able to form causal inferences (e.g. a character's emotional response to an event) from 3 years of age, while more complex inferential comprehension skills (e.g. prediction) emerge from 5 to 6 years of age (Filiatrault-Veilleux, Bouchard, Trudeau, & Desmarais, 2016).

Barnes, Dennis and Haefele-Kalvaitis (1996) demonstrated that coherence and elaborative inferencing develops gradually in older children aged 6 to 15 years, independent of the influence of knowledge. Fifty-one children were taught a new

knowledge base (of a fictional world) and asked inferential questions which required drawing information only from the novel knowledge base (Barnes, Dennis, & Haefele-Kalvaitis, 1996). The mean proportion of correct coherence and elaborative inferences increased gradually from 6 to 15 years of age. Thus, the younger children made fewer correct inferences than older children despite drawing on the same required knowledge base (Barnes et al., 1996). The findings of both Filiatrault-Veilleux et al. (2016) and Barnes et al. (1996) indicate a gradual developmental progression of oral inferential comprehension skill in typically developing children from 3 to 16 years. However, further research is required develop a cohesive understanding of the development of inferential comprehension in typically developing children and, in particular, in populations known to have poor inferential comprehension such as children with DLD (Filiatrault-Veilleux et al., 2015).

Different types of inferences are drawn in different contexts. Van Kleeck (2008) identified three broad types of inferences made by young children during book-sharing: causal, evaluative, and informational. Causal inferences involve making predictions, connecting pieces of information within or across texts/discourse or with prior knowledge, and inferring feelings, attitudes and motives (van Kleeck, 2008). Causal inferences are thought to be the most central type of inference for young children during book-sharing, as they relate directly to the story grammar, or discourse structure. Evaluative inferences require making judgements of morality or convention. Forming informational inferences can involve defining words from given information, elaborating on information using prior knowledge, or providing information on setting which has not been explicitly stated (such as characters, time, and place in a narrative) (van Kleeck, 2008; van Kleeck et al., 2006). These types of inference may be essential for the coherence (bridging) of information in a discourse, and may act to enrich comprehension of the discourse through integration with general knowledge (Cain, Oakhill, & Bryant, 2004; van Kleeck, 2008). As such, if an individual has poor inferential comprehension, they may miss or attach the wrong 'gist' to a discourse, which impacts significantly on language comprehension and overall communicative competence.

In terms of classifying levels of comprehension in young children, one of the most widely used models by speech-language pathologists and educators is the perceptual-language distance scale of comprehension demands in teacher-child interactions proposed by Blank and colleagues (Blank, Rose, & Berlin, 1978a). Blank

et al., (1978a) noted that the level of complexity of questioning used in teacher-child interactions varies greatly, and so they aimed to “study the language of the preschool that fosters higher level intellectual activities.” (p.8). This involved identifying and organising the wide range of teacher-child interactions into levels of questioning complexity which fit into meaningful categories (Blank et al., 1978a).

Blank et al. based their research on a model of discourse processes (Moffett, 1968; as cited in Blank et al., 1978a) which they adapted for preschool aged children. Their adapted model involved three components – the individuals speaking to each other (teacher-child), the topic of discussion (perceptual experiences that are within the child’s comprehension ability), and the level of the discussion. Blank et al., (1978a) proposed four levels of discussion based on the ‘perceptual-language distance’ which reflects the two types of information present in a teacher-child interaction. These are the material being discussed (the *perceptual* information), and the language that the teacher uses to direct the child’s comprehension to the material (the *language* information). The language used by the teacher can vary from being close to, or very far from, the perceptual information being discussed, and, “As the distance between the material and the language widens, increasingly greater demands are placed on the children to abstract the information from the material that is available to them.” (Blank et al., 1978a, p. 13). The four levels of discussion thus aimed to reflect the increasing levels of demand for abstraction – the distance between the perceptual information and language varies from minimal (at the first level of questioning) to very high (the fourth level of questioning).

At the two highest levels of abstraction (levels III and IV), which reflect the greatest perceptual-language distance, the child is required to use reasoning, judgement and evaluation abilities which go beyond the specific perceptual information (material) being discussed, often requiring inferencing. Level III (reordering perception) demands require reordering and restructuring of perceptions in accordance with the constraints of the language used, and at times directly require inferencing (e.g. what will happen next?, what could he say?) (Blank et al., 1978a). Level IV (reasoning about perception) demands represent the most complex level of abstraction, including prediction, identifying causes, justifying responses, and evaluation, all of which require inferencing (e.g. what will happen if...?, why will...?, what could you do...?).

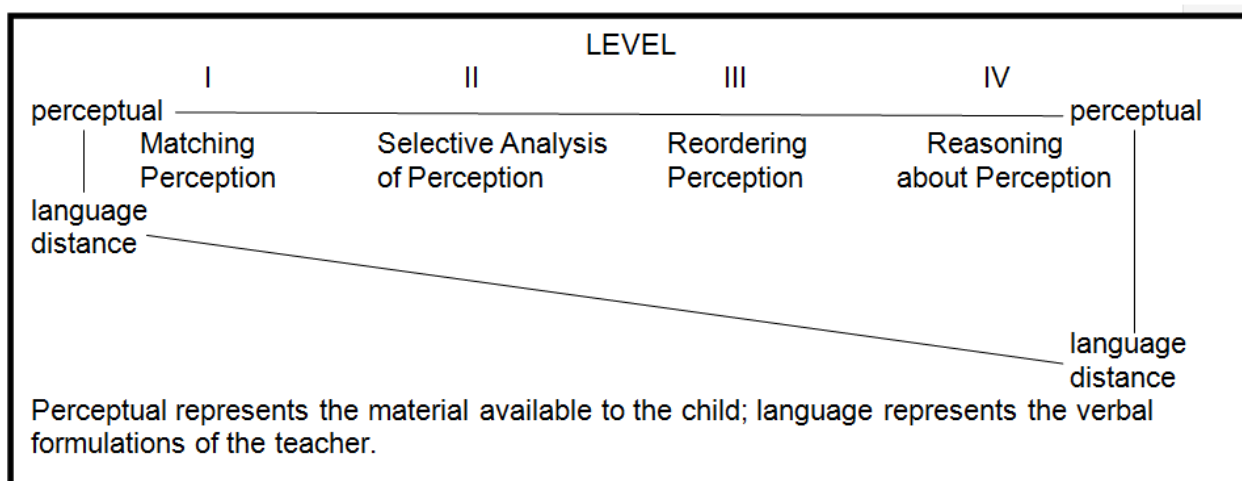


Figure 3. "The perceptual-language distances underlying the scale of abstraction" Blank et al. (1978a, p.17). An illustration of the perceptual-language distance of demands used during teacher-child interactions ².

This model was validated through the development of an assessment based on the perceptual-language distance levels (Blank, Rose, & Berlin, 1978b). The assessment was administered to 288 children aged 3 to 5 years with average IQ from lower-class and middle-class families in the USA. The study demonstrated an increase in children's ability to answer questions between 3 to 5 years, with a clear developmental progression of level I and II responses followed by levels III and IV (Blank et al., 1978a). Overall, 30% of the children had complete mastery (acceptable or fully adequate responses) of the level IV questions at 5 years of age. However, a significant difference was noted in performance on the level four questions between children from lower- and middle- class families. The children growing up in middle-class families demonstrated 50% mastery of the level four questions at 5 years, whereas only 10% of the children from lower-class families demonstrated mastery of these questions at the same age (Blank et al., 1978a).

The scale proposed by Blank et al. (1978a) is used widely in clinical practice and has been used in research investigating intervention for oral inferential comprehension in children with DLD (Desmarais, Nadeau, Trudeau, Filiatrault-Veilleux, & Maxes-Fournier, 2013; van Kleeck et al., 2006). However, this small body of work has identified the need for further evidence to ensure a valid and comprehensive understanding of the sequence of inferential comprehension

² Please see copyright permissions in Appendix A.

development at the discourse-level in children with typically developing language (Filiatrault-Veilleux et al., 2015).

Inferential Comprehension in Children with Developmental Language Disorder

A large body of research has demonstrated that although some children with DLD present with appropriate 'surface' receptive vocabulary and the ability to answer literal comprehension questions, a particular characteristic of their profile is poor inferential comprehension (Adams et al., 2009; Bishop & Adams, 1992; Botting & Adams, 2005; Dodwell & Bavin, 2008; Ford & Milosky, 2003; Ford & Milosky, 2008; Norbury & Bishop, 2002; Weismer, 1981).

In an early study of language comprehension in children with poor language development, Weismer (1981) recruited three groups of participants: 12 children aged 7 to 8 years who had expressive and receptive language delays but normal non-verbal IQ; 12 typically developing children who were matched to the first group on non-verbal IQ and age; and, 12 younger typically developing children aged 5 to 6 years matched to the first group on language comprehension (receptive syntax). The participants answered two yes/no literal (premise) and two yes/no inferential (spatial and causal) comprehension questions following 16 short (three sentence) verbally presented stories, and 16 stories presented visually (without oral text) using three pictures (Weismer, 1981). The children with language delays performed significantly more poorly than the age-matched group on inferential and literal questions in the verbal task. The children with language delays also performed significantly more poorly on inferential, but not literal, questions in the picture task. In addition, when related literal comprehension questions had been answered correctly, the language delayed group were significantly less likely than the age-matched typically developing group to answer inferential questions correctly (Weismer, 1981). The language delayed children and the younger comprehension-matched children performed similarly for literal and inferential questions across both tasks. Weismer's (1981) study provided the first evidence of poor inferential comprehension in school-aged children with language delays.

Similarly, Bishop and Adams (1992) assessed 61 children with DLD (poor language with average non-verbal IQ) aged 8 to 12 years, and a control group of 10 children aged 5 to 12 years, on literal and inferential comprehension of stories presented either orally or pictorially. The children with DLD performed significantly

more poorly on both literal and inferential comprehension compared to the control children of the same age, with literal comprehension performance higher than inferential comprehension performance (Bishop & Adams, 1992). Interestingly, the significant difference between the DLD and control groups remained after controlling for receptive grammar ability.

In a study of 6 to 10 year old children by Norbury and Bishop (2002), 16 children with DLD, 24 children with pragmatic language disorder (PLI), 10 children with high-functioning autism spectrum disorder (ASD), and 18 typically developing children listened to five stories and answered comprehension questions about each story (two literal questions and four inferential questions). The typically developing children had higher overall comprehension scores than all three clinical groups (DLD, PLI and ASD), but there were no significant differences between the means of the clinical groups. This indicated that, overall, the children with DLD, PLI, and ASD had more difficulty with both literal and inferential comprehension than their typically developing peers (Norbury & Bishop, 2002). In addition, incorrect inferences constituted the highest proportion of errors in the inferences made by the clinical groups (Norbury & Bishop, 2002). The incorrect inferences were generally not relevant to the context of the story, a finding which Norbury and Bishop (2002) noted as supporting weak central coherence as an underlying factor in poor inferential comprehension ability. Difficulty in establishing and maintaining coherence during discourse comprehension may reflect poor integration of the textbase and situation model during discourse comprehension, which allows for coherence to be established and maintained (van Dijk & Kintsch, 1983). The ability of children with DLD to form inferences appropriately may be impacted in this way. There is, however, a lack of knowledge regarding the particular skills which contribute to the situation model and coherence processing in discourse comprehension.

Botting and Adams (2005) assessed semantic and inferential comprehension abilities in 25 children with DLD aged 11 years, 22 children with PLI of the same age, and 113 typically developing children aged 7, 9 and 11 years (age- and language-matched control groups) (Botting & Adams, 2005). The children answered literal and inferential questions (requiring yes/no answers) relating to a story book read aloud. The DLD and PLI groups performed similarly on inferential comprehension, but scored significantly lower than their age-matched peers. In addition, although the DLD and PLI group means for inferencing were lower than those of the younger

control groups (7 and 9 years), the difference was not significant (Botting & Adams, 2005).

Similar results were found by Dodwell and Bavin (2008) in their study of 16 children with DLD aged 6 to 7 years, 25 typically developing age-matched children, and 15 expressive language-matched children aged 4 to 5 years. The participants were assessed on two measures involving narrative recall, narrative generation, and narrative comprehension (one task included 3 literal and 6 inferential questions, and the other included 8 literal and 3 inferential questions). The children with DLD scored significantly more poorly on inferential comprehension than the age-matched children on both tasks (Dodwell & Bavin, 2008). The DLD group performed similarly to the language-matched group on one inferential task but better than the language-matched group on the other inferential task (inferential questions which related to a story they had generated). In addition, the children with DLD performed similarly to both age- and language-matched control groups on literal comprehension. This finding indicated that although younger children with DLD exhibit poor inferential comprehension, they may not exhibit deficits in literal comprehension, contrasting the findings of studies examining slightly older children (Dodwell & Bavin, 2008).

Adams, Clarke and Haynes (2009) also identified inferential comprehension deficits in children with DLD. Their study included 64 children with language disorder aged 6 to 11 years, 64 age- and gender-matched typically developing children, and 64 younger gender- and sentence-comprehension matched typically developing children. The participants looked at a picture which showed a problem, listened to a short story about the picture, and were then asked 11 inferential comprehension questions relating to the picture (inferring cause, emotions, and character motivation). The raw inferential comprehension scores of the children with language disorder were significantly lower than those of the typically developing age-matched group. Although the inferential comprehension scores of the language disordered group were also lower than the sentence-comprehension matched group, the difference was not statistically significant, indicating that sentence comprehension ability influenced inferential comprehension skill (Adams et al., 2009).

Taken together, the results of these studies clearly indicate that school-aged children with DLD present with poor oral inferential comprehension of narrative discourse. This poor performance is evident when compared to typically developing age-matched children, and studies have generally shown similar performance

compared to language-matched peers. There are mixed results regarding literal comprehension, with some studies demonstrating similar performance to age-matched controls and others demonstrating poor performance.

Skills Required for Inferential Comprehension

As a complex, higher level language skill, poor inferential comprehension ability could be attributed to a number of potential contributing factors. In order to achieve inferential comprehension successfully an individual is required to realise that an inference is necessary, draw on a range of language and cognitive skills, as well as relevant background knowledge, and integrate necessary information to form the inference (Cain & Oakhill, 2007b). These processes should be supported by a foundation of well-specified schemas (Bishop, 2014b; van Dijk & Kintsch, 1983; Westby, 2012). As discussed by Bishop (2014b), both bottom-up (e.g. vocabulary) and top-down (e.g. pragmatics) skills influence language comprehension.

Researchers have investigated the relationships between some of these language and cognitive skills and inferential comprehension during reading and oral tasks in typically developing children, adolescents and adults, and adolescents with language disorder.

Karasinski and Weismer (2010) investigated the construction of inferences during oral narrative comprehension in 527 students aged 13, who had typically developing language, low cognition, DLD or non-specific language disorder (NLD). The typically developing language group demonstrated stronger ability to make distant inferences (those requiring linking of information separated by more than four sentences in the story and requiring integration with background knowledge or prediction) than all other groups – low cognition, DLD and NLD (Karasinski & Weismer, 2010). Receptive vocabulary, working memory (a central executive task requiring judgement and verbal recall) and following instructions (syntactic comprehension) predicted a significant amount of individual variance in distant inference ability. Karasinski and Weismer (2010) concluded that syntactic comprehension, working memory, and general world knowledge (reflected by vocabulary) were important skills in inferential comprehension for adolescents. In addition, as the researchers noted, the results demonstrated that inferential comprehension difficulties in children with DLD persist into adolescence (Karasinski & Weismer, 2010).

Silva and Cain (2015) investigated the skills related to inferential and literal narrative comprehension and later reading comprehension in 82 typically developing children aged 4 to 6 years. Assessments included oral inferential and literal comprehension of a wordless narrative picture book, receptive vocabulary and grammar, and verbal memory. After controlling for age and nonverbal IQ, receptive vocabulary was the only significant predictor of oral inferential comprehension ability (Silva & Cain, 2015). Inferential and literal comprehension and receptive grammar were significant predictors of reading comprehension one year following the initial assessments. Additionally, although receptive vocabulary also contributed variance to later reading comprehension, the relationship was mediated by inferential and literal comprehension (Silva & Cain, 2015).

A study of 221 Italian-speaking children aged 4 to 6 years found that receptive vocabulary and measures of verbal intelligence which tapped semantic knowledge – word definitions and identifying similarities – accounted for significant variance in overall literal and inferential comprehension of stories (Florit et al., 2011). Although Silva and Cain's (2015) study did not include measures of semantic knowledge, their receptive vocabulary finding aligned with the results of Florit et al. (2011).

Oral literal and inferential comprehension, and a broad range of language and cognitive abilities, were assessed in 131 typically developing French-speaking children aged 4 to 6 years (Potocki et al., 2013). The assessments included sentence comprehension (judging whether two sentences had a similar meaning), visual working memory (watching a series of pictures and recalling the last picture seen), verbal short term memory (non-word repetition), receptive single word vocabulary, grammatical judgement and correction, and morphological knowledge (judging whether words belonged to the same family). The researchers found that the language and cognitive skills assessed accounted for 44% of the variance in literal and inferential narrative comprehension ability, with significant contributors including working memory, vocabulary, sentence comprehension, grammatical judgement, and morphological knowledge (Potocki et al., 2013).

The findings of Silva and Cain (2015), Florit et al. (2011), and Potocki et al. (2013) indicate that working memory, vocabulary and semantic knowledge, and grammatical comprehension are important for inferential *and* literal narrative comprehension in typically developing 4 to 6 year old children. These skills were also found to be important for inferential comprehension in a mixed group of adolescents

with typically developing language, low cognition, DLD, and non-specific language disorder (Karasinski & Weismer, 2010). Receptive vocabulary appears to be particularly important for oral inferential comprehension in young typically developing children (Silva & Cain, 2015). Taken together, these results indicate that a variety of skills contribute to literal and inferential comprehension in children and adolescents, including adolescents with varying language and cognitive profiles. However, most studies have not considered literal and inferential comprehension separately, nor included a wide range of *both* lower and higher level language and cognitive skills. Additionally, no studies have investigated these skills in relation to young children with DLD, despite oral inferential comprehension being poor in this population.

Oral Comprehension and Reading

A significant amount of research has supported the link between early oral language skills and later reading ability (Nation & Norbury, 2005). The heritability of DLD and strong link with dyslexia have been demonstrated in many studies, which have also shown a significant overlap of oral language and literacy difficulties (Bishop & Snowling, 2004; Gooch et al., 2013). The crucial elements of reading include phonological decoding and comprehension (Vellutino, Fletcher, Snowling, & Scanlon, 2004). As literacy ability builds upon a solid foundation of oral language skills, the ability to comprehend what one is reading depends to a significant extent upon oral language comprehension (Cain & Oakhill, 2007a; Catts, Adlof, & Weismer, 2006; Clarke, Snowling, Truelove, & Hulme, 2010; Hulme & Snowling, 2014; Nash & Heath, 2011; Nation & Norbury, 2005; Oakhill & Cain, 2012; Spencer et al., 2014; van Kleeck & Vander Woude, 2003). Oral language comprehension has a significant, and increasing, influence on reading comprehension from the beginning of its development at around 6 years of age (Language and Reading Research Consortium, 2015).

Pertinent to the research presented in this thesis, a longitudinal study which investigated the reading and language abilities of 240 children aged 5 to 8 years found that children later identified as poor reading comprehenders presented with poor oral language skills at the initial stages of literacy acquisition (Nation et al., 2010). Thus, the researchers concluded that poor oral language skills could not be a result of poor reading comprehension (Nation et al., 2010). Oakhill and Cain (2012) found that oral inferencing ability at 7 to 8 years was a significant predictor of reading

comprehension ability at age 10 to 11 years. Additionally, a recent cross-sectional study of more than 425,000 children from Florida, USA concluded that the difficulties of children classified as having specific reading comprehension disability were *not* specific to reading, but rather, were related to poor oral language skills (Spencer et al., 2014).

Research has demonstrated that text-level comprehension interventions which involve training in the comprehension of *oral* language are more effective than those which focus on written text comprehension (Clarke et al., 2010), and that general oral language intervention at 4 years is effective at supporting later reading comprehension (Fricke, Bowyer-Crane, Haley, Hulme, & Snowling, 2013). Again, such findings highlight that oral language skills underpin reading comprehension ability. In relation to learning and academic attainment, comprehension of written, literate language is an increasingly significant skill as a child progresses through education – particularly after the transition from ‘learning to read’ to ‘reading to learn’ at around 7 years (Ricketts, 2011). As such, it is crucial to foster oral language comprehension in young children in order to support later reading comprehension and, thus, academic achievements (Ricketts, 2011; van Kleeck, 2008).

Summary

It is critical to acknowledge that language comprehension encompasses a vast range of skills (Bishop, 2014b). Researchers have demonstrated that children with DLD show poor oral inferential comprehension, but understanding of the profile of language and cognitive skills which contribute to this ability remains unclear. Past research has demonstrated that a number of language and cognitive skills (including working memory, vocabulary, and grammar) are related to oral and text inferential comprehension abilities in young typically developing children, typically developing adolescents, and adolescents with disordered language or low cognition (Florit et al., 2011; Karasinski & Weismer, 2010; Oakhill et al., 2003; Potocki et al., 2013). Many skills, such as working memory, have also been investigated individually in relation to comprehension in DLD, while combinations of some skills have been investigated in groups of typically developing children. Theoretically, weakness or breakdown in one or a combination of these skills may contribute to poor inferential comprehension. Therefore, the rest of this chapter will discuss the empirical and theoretical evidence for a range of language and cognitive skills hypothesised to be

related to oral inferential comprehension in children with DLD, foregrounding a study which investigated the relationship between these skills and oral inferential comprehension in a group of children with DLD.

Language and Cognitive Skills Contributing to Inferential Comprehension

The following sections explore the language and cognitive skills which have been investigated by researchers in relation to oral inferential comprehension and, where relevant, inferential reading comprehension in typically developing children, children with DLD, and other clinical populations. The theoretical rationale for, and evidence related to, a number of language skills (vocabulary, grammar, and narrative abilities) will be discussed first, followed by a number of cognitive skills (working memory, linguistic processing, inhibition, and theory of mind).

Vocabulary

Vocabulary is a language skill which supports comprehension in a bottom-up way by building meaning through words accessed in the mental lexicon (Bishop, 2014b). In this way, vocabulary is hypothesised to contribute to the textbase representation during comprehension (the online representation of meaning taken from the surface representation) (van Dijk & Kintsch, 1983).

Adequate vocabulary is essential for successful inferential comprehension and, in turn, the ability to infer is necessary to further develop the lexicon. The very nature of learning vocabulary necessitates that children infer the meaning of words (Bishop, 2014b; Deak, 2000). This begins simply with more concrete concepts when fast mapping occurs between a novel phonological form and an object (Chiat, 2001; Gershkoff-Stowe & Hahn, 2007). However, as children begin to learn an increasing number of words requiring abstract lexical elaboration and refinement, the required level of inferencing expands (Chiat, 2001; Deak, 2000; Gershkoff-Stowe & Hahn, 2007; Kucker, McMurray, & Samuelson, 2015). The effectiveness of the initial fast mapping of vocabulary is critical to develop a broad lexicon base for comprehension. However, the slow mapping which follows is also crucial to strengthen this lexicon base over time, ensuring a well-structured vocabulary network is developed which contains comprehensive but refined meanings of words which can be accessed efficiently to support the online process of comprehension (Kucker et al., 2015).

As noted by Baddeley, Gathercole and Papagno (1998), inferencing to learn new vocabulary and learn from context is likely to become increasingly important as a child's language develops. When encountering a novel word during sentence- and discourse-level oral or written communication, children (and adults) draw links between the linguistic input (including phonological, semantic and syntactic cues), the context, and prior knowledge, to infer the meaning of a novel word, and to assist comprehension of the sentence or discourse as a whole (Baddeley, Gathercole, & Papagno, 1998; Chiat, 2001; Deak, 2000; McCutchen & Logan, 2011). Long-term semantic and phonological knowledge, and knowledge of a wide range of word meanings, may be used to assist in refining poorly-stored phonological representations of new words (Baddeley et al., 1998); however, if the stored long-term knowledge is limited then this process will be less effective. In addition, poor long-term linguistic knowledge restricts a child's ability to draw on prior syntactic and/or semantic knowledge in 'bootstrapping' to infer the meaning of novel words (Bishop, 2014b; Chiat, 2001; McCutchen & Logan, 2011).

The research literature demonstrates that children with DLD are generally poor at learning new vocabulary and the features of new vocabulary. The quality of an individual's vocabulary influences the ability to both identify words rapidly and build meaning accurately (Perfetti, 2007; Perfetti & Stafura, 2014). As such, a poorly organised and specified vocabulary may negatively affect language comprehension. Additionally, children with DLD demonstrate poor performance on tasks reflecting the phonological loop (e.g. nonword repetition), which is a significant predictor of fast mapping in vocabulary learning (Alt & Plante, 2006; Alt, Plante, & Creusere, 2004; Bishop, 2014b; Gathercole & Baddeley, 1990; Jackson, Leitao, & Claessen, 2016). This may limit the capacity to increase the size of the lexicon, in turn restricting further learning and literacy development (Baddeley et al., 1998).

Vocabulary has been linked to comprehension abilities in typically developing children and children from a range of clinical populations. Single-word expressive vocabulary was a significant predictor of *overall* story comprehension (literal and inferential questions) in 42, 4 to 5 year old typically developing children, explaining 13% of unique variance (Tompkins, Guo, & Justice, 2013). Combined receptive vocabulary and receptive syntax abilities were also been found to be related to oral inferential comprehension ($r = 0.388$, $p < .05$) in 6 to 10 year old children with DLD, PLI, and high functioning ASD (Norbury & Bishop, 2002).

Currie and Cain (2015) investigated the contributions of working memory and vocabulary (receptive vocabulary and semantic category knowledge) to oral inferential comprehension in a sample of 130 children aged 5 to 10 years (children with special education needs were not included). Across the age groups of participants, vocabulary ability was a significant, unique predictor of local ($\beta = .46-.49$, $p < .01$) and global inferences ($\beta = .48-.59$, $p < .01$) apart from local inferences in 10 year old children ($\beta = .18$, $p > .05$) (Currie & Cain, 2015).

Similar results have been found for reading comprehension, as poor vocabulary has been shown to be predictive of poor reading comprehension ability (Cain & Oakhill, 2006; Spencer et al., 2014). However, reading experiences across varied semantic contexts are also vital to build a rich, robust vocabulary (Nation, 2017). As part of a longitudinal study, 83 typically developing children aged 10 to 11 years were assessed on literal and inferential reading comprehension and measures of vocabulary breadth (receptive vocabulary) and depth (defining words and identifying similarities) (Cain & Oakhill, 2014). Vocabulary breadth and depth predicted significant variance in the ability to make local cohesion inferences (link between propositions), and vocabulary depth was a significant predictor of the ability to make global inferences (using background knowledge to make an inference related to unstated information) (Cain & Oakhill, 2014). Further, overall vocabulary ability in older children (fifth and eighth grade students) predicted significant unique variance in reading comprehension ability ($\beta = .317, .366$, $p < .001$) (McCutchen & Logan, 2011). The combined results of these studies demonstrates the importance of vocabulary to both oral and text inferential comprehension in typically developing children.

In summary, past research has shown that vocabulary growth provides a supportive foundation for the comprehension of both oral and written language. Vocabulary has been shown to contribute to overall story comprehension in typically developing children and older children from mixed clinical populations (DLD, PLI, and ASD), and oral inferential comprehension in young typically developing children (Currie & Cain, 2015; Norbury & Bishop, 2002; Tompkins et al., 2013). However, further research is needed to clearly investigate the relationship between expressive and receptive vocabulary and inferential comprehension in young children with developmental language disorder.

Grammar

Grammar refers to the underlying rules and patterns which are used to organise a language and represent the relationships between words and word units (involving syntax and morphology) in a language: a shared rule system which enables the users of a language to both comprehend and express meaning (Owens, 2008). Grammatical knowledge supports language comprehension in a bottom-up way as the organisation and use of words and word parts (e.g. syntax, inflections, etc) governs meaning (Bishop, 2014b). As such, grammar is hypothesised to influence meaning in the textbase representation during discourse comprehension (van Dijk & Kintsch, 1983).

Delayed and disordered grammatical development is considered to be one of the hallmarks of the expressive and receptive language of many young children with DLD (Bishop, 2014b; Leonard, 2014). It is therefore important when considering outcomes of children with DLD, as expressive syntax ability at age 7 has been shown to be a significant predictor of oral language outcome at age 11 (Botting, Faragher, Simkin, Knox, & Conti-Ramsden, 2001). Many researchers now include receptive-grammar matched groups as the control for language ability in studies of children with DLD, and grammar screens (e.g. brief assessments such as the Grammar and Phonology Screening test) have been shown to be reliable markers of DLD in young children (Gardner, Froud, McClelland, & van der Lely, 2006).

A number of researchers have investigated the influence of receptive grammar ability on the comprehension of sentences in children with DLD (Leonard, 2014). Sentence comprehension difficulties have been shown in the ability to comprehend *complex* sentence structures, with typical performance generally shown for *simple* sentence structures (Montgomery & Evans, 2009). However, few studies have investigated the influence of grammar on discourse comprehension. Bishop and Adams (1992) assessed 61 children with DLD aged 8 to 12 years and found that receptive grammar ability was significantly correlated ($r = .417, p < .01$) with *overall* (literal and inferential) story comprehension (Bishop & Adams, 1992). Similarly, in a mixed profile of clinical groups (DLD, PLI, and high-functioning ASD), Norbury and Bishop (2002) found that *overall* narrative comprehension was significantly correlated to combined receptive vocabulary and receptive grammar abilities ($r = 0.388, p < .05$). However, Norbury and Bishop (2002) also found that specific

inferential comprehension deficits were not attributable to poor vocabulary or grammar, but related to clinical group: behaviours characteristic of ASD were related to poor inferencing.

In terms of typically developing children, a study of French-speaking children aged 4 to 6 years found that expressive and receptive grammatical knowledge, assessed by grammatical correction and judgement tasks, contributed significant variance (2-3% variance explained) to *overall* narrative comprehension ability (Potocki et al., 2013).

In contrast to oral comprehension, some studies have investigated grammar in relation to reading comprehension. A longitudinal study investigating children classified as good and poor *reading* comprehenders, who were first assessed at 7 to 8 years of age, found that the two groups did not differ significantly in their grammatical comprehension, as measured by a standardised test (Cain & Oakhill, 2006). This finding indicated that receptive grammar was not a cause of the difficulties experienced by the poor reading comprehenders (Cain & Oakhill, 2006). Similarly, a longitudinal study of typically developing children found that receptive and expressive grammar (morphological and syntactic) skills at 5 years of age did not contribute significant variance to later reading comprehension ability (Roth, Speece, & Cooper, 2002).

In summary, some studies have shown that receptive grammar is related to literal *and* inferential narrative comprehension in children with DLD and typically developing children (Bishop & Adams, 1992; Norbury & Bishop, 2002; Potocki et al., 2013). Studies investigating reading comprehension have found that receptive and expressive grammar were not significant predictors of reading comprehension skill (Cain & Oakhill, 2006; Roth et al., 2002). Although it is generally accepted that children with DLD have difficulty in the expression and comprehension of grammar, the potential contribution of this difficulty to the oral inferential comprehension of children with DLD is unknown. Given the conflicting findings of past research, and that grammar is hypothesised to influence discourse comprehension, further research investigating the influence of grammar abilities on inferential comprehension in this population is warranted.

Narrative

Narratives provide a majority of middle-class English-speaking children with their first and most frequent exposures to inferencing in oral discourse (van Kleeck, 2008). Narratives are a natural component of language development in the home and in the classroom, and exposure to narratives and narrative ability are a significant predictor of later language outcome, correlated with many skills including vocabulary growth and literal and inferential comprehension (Botting et al., 2001; Boudreau, 2008; Dickinson & Smith, 1994; van Kleeck & Vander Woude, 2003). Exposure to the inferencing skills used in narratives prior to the 'reading to learn' stage of development immerses children in literate language while 'learning to read', supporting their ability to engage in inferencing, and thus learn, in the later years of schooling (van Kleeck, 2006).

Narratives offer an organised, but flexible, structure in which inferencing is commonly an embedded component – a majority of narratives for pre-school and school-aged children inherently lend themselves to making predictions, inferring emotions, and making connections between stated and unstated information related to the text and pictures (Hoffman, 2009). These aspects of inferential comprehension in narrative are imperative for a narrative to be understood as a whole, and the 'gist' to be comprehended appropriately.

The macrostructure of children's narratives in Western cultures is fairly fixed, involving a number of key components (Hoffman, 2009). Exposure to consistent narrative macrostructure allows the formation of schemas, from which children are able to more efficiently process, recall or generate a narrative using a pre-existing schema as a scaffold (Bishop, 2014b; Westby, 2012). Comprehensive schemas support top-down processing – interacting with the situation model – for coherent organisation of the linguistic information in a narrative, allowing for comprehension, generation, and retell (Bishop, 2014b; van Dijk & Kintsch, 1983).

Developing well-organised schemas for narrative is thus very important for later oral and written narrative ability. A longitudinal study of 109, 5 year old Italian-speaking children supported this notion, finding that oral narrative retelling ability (measures of narrative cohesion, coherence and structure) predicted significant variance in later written narrative ability (Pinto, Tarchi, & Bigozzi, 2015). As such, exposure to narrative from a young age builds a strong foundation for narrative

schemas. Without this foundation, generating and processing narrative would be extremely difficult, akin to an adult trying to write or comprehend forms of discourse for which they do not have a stored schema (e.g. such as an individual not in the legal profession reading and trying to understand legal documents!) (van Dijk & Kintsch, 1983).

Children with DLD are known to have deficits in the development of narrative skills, and to be poor at building schemas (Bishop, 2014b). Narrative generation and retells of children with DLD tend to be poorer in macro- and micro-structure than those of their typically developing peers, and research has demonstrated that this problem is persistent (Boudreau, 2008; Dodwell & Bavin, 2008; Fey, Catts, Proctor-Williams, Tomblin, & Zhang, 2004; Kaderavek & Sulzby, 2000). Additionally, narrative comprehension of literal and inferential questions is also weaker in children with DLD than typically developing peers (Bishop & Adams, 1992; Botting & Adams, 2005; Norbury & Bishop, 2002). A significant relationship has been found between narrative comprehension and narrative recall (the number of story components and inferences explicitly stated) in children with DLD, PLI, and high-functioning ASD (Norbury & Bishop, 2002), highlighting the importance of supporting narrative comprehension in order to facilitate expressive narrative development (such as retelling and generation).

Cain (2003) and Cain and Oakhill (1996) grouped children aged 7 to 8 years into: poor reading comprehenders (with age-appropriate reading fluency); adequate reading comprehenders; and a younger group of children who were comprehension age-matched to the poor reading comprehenders. The children with poor reading comprehension generated oral narratives which had poorer structure than both the adequate comprehenders *and* the younger reading comprehension matched group. This indicated that the ability to produce well-structured narratives could not be solely attributed to reading comprehension experience, and thus that either poor narrative ability, and/or the factors causing poor narrative ability, may be a factor in poor reading comprehension (Cain, 2003; Cain & Oakhill, 1996). A later longitudinal study of children aged 7 to 11 years found that knowledge and use of narrative structure was significantly correlated with reading comprehension ability over time, and one of the two tasks (sorting parts of a story in order) predicted unique variance in later reading comprehension above the contributions of other skills such as vocabulary and IQ (Oakhill & Cain, 2012).

Past research has demonstrated a relationship between narrative and comprehension development, however this has not been fully explored in children with DLD. Further research is necessary to investigate this relationship and to evaluate the effect of narrative-based interventions in relation to inferential comprehension skills in DLD (Boudreau, 2008; van Kleeck, 2008).

Working memory

Working memory can be defined as the ability to retain and manipulate various types of information (i.e. phonological, visual) for brief periods of time (seconds) (Baddeley, 2003; Gathercole & Alloway, 2008). In terms of comprehension, working memory functions in a bottom-up way by maintaining the surface representation of language while aspects of syntactic and semantic meaning are accessed (Bishop, 2014b; van Dijk & Kintsch, 1983).

The multi-component subsystem model of working memory proposed by Baddeley and Hitch (1974), and later revised, has been well researched and used widely in the literature, and as such it will be used to discuss the construct of working memory in this research (Alloway, Gathercole, Willis, & Adams, 2004). In the current model, working memory consists of four components: the phonological loop, the visuospatial sketchpad, the episodic buffer, and the central executive. The phonological loop and visuospatial sketchpad hold phonological, and visual and spatial, information (respectively) for very short periods of time (Baddeley & Hitch, 1974). The episodic buffer integrates information from the phonological loop and visuospatial sketchpad with information from long-term memory (Baddeley, 2000). The phonological loop, visuospatial sketchpad, and episodic buffer function under the control of the central executive which manipulates information within the confines of working memory (Baddeley & Hitch, 1974). These components function together to form working memory. This research will focus on the phonological loop (the temporary store of information in phonological short term memory) and the episodic buffer, which have been the focus of research in young children with DLD.

Children with DLD have been shown to have particularly poor ability in the phonological loop component of working memory, which temporarily stores language information (Dollaghan & Campbell, 1998; Gathercole & Baddeley, 1990; Hutchinson, Bavin, Efron, & Sciberras, 2012; Graf Estes, Evans, & Else-Quest, 2007; Montgomery, 2003; Montgomery & Evans, 2009; Petruccelli, Bavin, &

Bretherton, 2012). In addition, research has indicated that children with DLD also present with difficulties in the episodic buffer (Baddeley, 2003; Hutchinson et al., 2012; Petruccelli et al., 2012; Riches, 2012). This is evidenced by extremely poor performance on sentence repetition tasks, which involve the integration of temporary phonological forms with stored syntactic and semantic long-term knowledge for accurate recall (Hutchinson et al., 2012; Petruccelli et al., 2012; Riches, 2012). Phonological loop ability (commonly assessed using non-word repetition tasks), and episodic buffer ability (commonly reflected by sentence repetition tasks), are generally accepted as reliable clinical markers of DLD in children (Montgomery, 2002c; Riches, 2012).

Working memory is extremely important in language acquisition (Gathercole & Baddeley, 1990; Gathercole, Tiffany, Briscoe, & Thorn, 2005). For example, the phonological loop holds novel phonological forms of new sounds and new words intact before conversion to phonological representations in short- and long-term memory stores (Baddeley, 2003). A significant body of research across clinical populations has furthered the evidence of the important role of the phonological loop in language learning and use (Ellmore, Rohlfs, & Khursheed, 2013; Jackson et al., 2016; Leonard et al., 2007; van Daal, Verhoeven, & van Balkom, 2009). If the phonological loop stored inaccurate or incomplete phonological representations, disordered language development would result (Baddeley et al., 1998; Bishop, 2006). Therefore, deficits in working memory may contribute to the development of DLD, and/or may be a result of other underlying processing or language difficulties within the disorder (Montgomery, Magimairaj, & Finney, 2010).

Working memory ability may not only be interpreted in relation to the learning of language, but also its use. In particular, oral language comprehension can be interpreted in terms of working memory contributions (Montgomery, 1996; Montgomery & Evans, 2009). In order to form an inference, an individual must consistently store incoming phonological information in the phonological loop, and integrate this incoming information with relevant past linguistic and semantic long-term knowledge via the episodic buffer. In terms of discourse comprehension, this process reflects the maintenance of the surface representation and establishment of the textbase (van Dijk & Kintsch, 1983). The phonological loop and episodic buffer are therefore hypothesised to support both literal and inferential comprehension.

In support of this hypothesis, Dodwell and Bavin (2008) found that sentence recall, which is often used as a measure of episodic buffer functioning, was a predictor of overall narrative comprehension ability in children with DLD. Additionally, phonological loop ability (measured by word span) was a significant predictor of overall story comprehension in 4 to 6 year old Italian-speaking children (Florit, Roch, Altoè, & Levorato, 2009). In terms of *inferential* comprehension, phonological loop ability (reflected by word and digit recall) explained significant variance in the local and global inferential comprehension of typically developing 5 to 6 year olds in a study by Currie and Cain (2015), however the effect was mediated by vocabulary. The phonological loop measures explained additional variance for global inferences in the typically developing 10 year olds, but not 8 year olds, however again the effect was mediated by vocabulary ability (Currie & Cain, 2015). Phonological loop ability has also been found to be important for reading comprehension, as Cain et al. (2004) found that phonological loop ability (measured by digit recall and sentence span) explained unique variance in the *reading* comprehension of typically developing children aged 8 to 11 years (Cain et al., 2004).

Theoretically, discourse comprehension involves a number of components of working memory functioning in synergy to store, process, retrieve, and buffer information online during communication. While the findings of some studies support the role of the episodic buffer and phonological loop in overall story comprehension in typically developing children and children with DLD (Dodwell & Bavin, 2008; Florit et al., 2009), inferential comprehension in typically developing children (Currie & Cain, 2015), and reading comprehension (Cain et al., 2004), further research is necessary to explore the relationship between these components of working memory and oral inferential comprehension in children with DLD.

Linguistic processing

One prominent account explaining the difficulties underlying developmental language disorder is that of a limitation in processing capacity, which results in an adverse flow-on effect in all aspects of language acquisition and use (Leonard, 2014). Processing involves receiving, moving, and storing information in the brain within the constraints of finite attentional resources (Leonard, 2014; Montgomery, 2002b). The attentional allocation and processing capacity of children with DLD has been shown to be similar to that of younger, language-matched controls (Leclercq,

Majerus, Prigent, & Maillart, 2013). In relation to a processing capacity limitation account, children with DLD may be more restricted (or delayed) in particular areas of processing – such as linguistic processing – compared to other areas of processing – such as visual or spatial (Leclercq et al., 2013).

Linguistic input during discourse is generally rapid and constant, and thus in order to appropriately comprehend and participate in discourse it is essential that processing speed and capacity are adequate to allow for online processing (Montgomery, 2004). Efficient and organised linguistic processing ability is therefore imperative for language learning, as well as use (Leonard et al., 2007). A number of studies have demonstrated that linguistic and non-linguistic processing is slowed in children with DLD aged 6 to 13 years compared to age-matched children (Leclercq et al., 2013; Miller, Kail, Leonard, & Tomblin, 2001; Montgomery, 2002a, 2002b).

French-speaking children with DLD aged 8 to 13 years showed slowed reaction times, compared to age-matched peers, during a sentence comprehension task whilst dual tasking, indicating poorer linguistic processing (Leclercq et al., 2013). However, the children with DLD performed similarly to younger, receptive-grammar matched controls, indicating that processing ability was consistent with language skills. This finding was shown in earlier studies (Montgomery, 2002a), and children with DLD have shown improved sentence comprehension when linguistic input is slowed (Montgomery, 2004). Such findings indicate that speed of processing linguistic information is related to language ability and, therefore, that processing speed may have a significant influence on oral discourse comprehension.

An unconscious conceptual representation of discourse structures, known as schemas, are used to assist in the processing of discourse (van Dijk & Kintsch, 1983). Schemas serve as a frame of reference to organise incoming linguistic information when processing discourse, allowing for effective comprehension (Bishop, 2014b; van Dijk & Kintsch, 1983). Selective and efficient organisation of linguistic information into schemas is necessary to allow for the rapid online process of discourse comprehension (Leonard et al., 2007; Westby, 2012). In terms of narrative comprehension, schemas follow a typical structure (macrostructure), including elements such as setting, complication and resolution. As van Dijk and Kintsch (1983, p. 16) note, an individual will activate a relevant schema as soon as possible from contextual cues, and following this “...the schema may be used as a powerful top-down processing device... and will at the same time provide some

general constraints upon the possible local and global meanings of the textbase.”. Schemas are related to an individual’s ability to comprehend discourse; as van Dijk and Kintsch (1983, p. 251) note “Since comprehending implies finding an appropriate organization for a text, the more possibilities there are for organizing a text, the easier this task should be... schematic superstructures should facilitate comprehension as well as memory for text.”. Situation models are developed from schemas and, in this way, schemas have a significant influence on processing during discourse comprehension (Zwaan & Radvansky, 1998). Poor processing at a young age is likely to detrimentally impact the quality and/or quantity of stored information, resulting in disorganised and/or poorly specified schemas. Efficient and robust schemas are required for online language comprehension: therefore, as a result of slowed or restricted processing, poorly specified schemas would adversely impact ongoing functional language comprehension (Leonard et al., 2007; Westby, 2012).

In addition to this possible developmental impact, poor processing may impact the online process of inferential comprehension. Successful inferential comprehension requires the individual to link information from a variety of sources. The ability to inference successfully therefore dictates that, at one point in time, an individual is accessing and forming links between various types of information, ideally within the constraints of a well-organised schema (van Dijk & Kintsch, 1983). This places a strong load on an individual’s processing capacity – in terms of online processing of linguistic information and efficient access to long-term stored schemas and knowledge (Ellis Weismer & Evans, 2002). Reduced processing capacity and/or speed, reflected in a smaller ‘workplace’ for accessing, retaining and manipulating information quickly during comprehension would have a flow-on effect on all levels of representation (surface, textbase, and situation model). This would result in loss of relevant information (i.e. surface representation and textbase) and, therefore, adversely impact comprehension (Bishop, 2014b; van Dijk & Kintsch, 1983). As such, reduced processing ability may have a detrimental impact on the on-line process of inferential comprehension.

In summary, poor linguistic processing from a young age may inhibit the formation of cohesive and robust schemas, in addition to adversely impacting the online processes of language comprehension. Therefore, if an individual has poor processing ability, as seen in children with DLD, complex tasks such as inferential comprehension may suffer (Leclercq et al., 2013; Montgomery, 2002b). The

relationship between linguistic processing and inferential comprehension in children with DLD has not, to current knowledge, been examined in detail.

Executive Functioning (Inhibition)

Executive functioning involves the higher level cognitive processes which control and evaluate thoughts and actions (Anderson & Reidy, 2012; Carlson, 2005). Executive functions cover a range of related but separable cognitive constructs, including inhibitory control (inhibition), updating (working memory), and shifting (cognitive flexibility) (Anderson & Reidy, 2012; Carlson, 2005; Miyake et al., 2000).

Although assessing executive function in young children has presented a challenge for researchers, and not all measures have been shown to be reliable over time (Willoughby, Wirth, & Blair, 2012), researchers have examined concurrent and longitudinal skills related to executive functions in typically developing children from 3 to 7 years of age. Studies have found that the executive function skills associated with inhibitory control, cognitive flexibility, and working memory are strongly predictive of later academic achievement in maths and reading (Blair & Razza, 2007; Bull, Espy, & Wiebe, 2008; Monette, Bigras, & Guay, 2011). The relationship between these skills and academic achievement provides an indication of a potential relationship with language development. This has been supported by deficits in inhibition demonstrated by English- and Italian-speaking children with poor reading comprehension (Locascio, Mahone, Eason, & Cutting, 2010; Palladino & Ferrari, 2013). Similarly, single word receptive and expressive vocabulary, and comprehension of general knowledge questions, have been shown to be predictive of the executive functions of inhibition and attention shifting in children aged 3 to 5 (Fuhs & Day, 2011). In line with these findings, a study of children aged 10 years with specific reading comprehension difficulties showed that inhibition, planning, and working memory contributed significant variance to inferential *reading* comprehension ability (Potocki, Sanchez, Ecalle, & Magnan, 2015). As oral comprehension underpins reading comprehension, these findings indicate that executive functioning may be important for language comprehension.

Inhibition relates to the deliberate suppression of dominant or automatic responses (Anderson, 2002; Miyake et al., 2000). Inhibition may be important for comprehension, as the ability to suppress irrelevant information impacts the formation of a coherent textbase, and therefore influences comprehension. Such an

idea has been supported by studies which have demonstrated that adults who are less-skilled reading comprehenders are poor at suppressing irrelevant information during reading comprehension (including narratives and figurative language), compared to skilled comprehenders and, as a result of being poor at suppressing irrelevant information, may develop too many mental representations during comprehension (Gernsbacher & Robertson, 1999; Gernsbacher, Robertson, Palladino, & Werner, 2004; Gernsbacher, Varner, & Faust, 1990). Similarly, it could be hypothesised that children with DLD may be able to make relevant connections during comprehension but are poor at inhibiting irrelevant information, thus a disorganised and overloaded textbase may result, negatively impacting successful inferential comprehension (Bishop, 2014b).

Norbury and Bishop (2002) found that the majority of inferential comprehension errors made by children with DLD, PLI and ASD involved making incorrect inferences (i.e. inappropriate or irrelevant). They noted that these errors could be related to difficulty in inhibiting irrelevant information in order to provide the appropriate answer related to the story context. Children with DLD, PLI and ASD may have difficulty integrating relevant information (and inhibiting the integration of irrelevant information) in the textbase during comprehension, which would adversely impact the ability to answer a comprehension question appropriately (irrelevant information may be transferred from the surface representation to the textbase, and/or irrelevant information may be maintained or integrated during interaction with the situation model). In addition, they may have difficulty inhibiting automatic responses to questions, thus providing inappropriate or irrelevant answers to inferential comprehension questions.

In line with this hypothesis, Carlson and Moses (2001) found a significant relationship between inhibition and theory of mind in 3 to 4 year old children. The 107 typically developing participants were assessed on a battery of inhibition and theory of mind tasks. Inhibitory control ability was strongly related to theory of mind performance (Carlson & Moses, 2001). Although the direction of causality was unclear, Carlson and Moses (2001) proposed that the development of inhibitory control facilitates theory of mind development. They hypothesised that inhibition is involved in performance on theory of mind tasks, as children are required to inhibit their pre-learned understanding of themselves and/or current reality to respond correctly (i.e. taking another person's perspective on a false-belief task). This finding

relates to oral inferential comprehension, as similar skills are required for accurate inferential comprehension (i.e. inhibiting your own response to take on the person/character's perspective in order to infer feelings, desires, goals, etc).

The notion that inhibition may be related to inferential comprehension difficulties in children with DLD is supported by research which demonstrates that children with DLD aged 4 to 14 years show poor performance on executive function tasks, in particular, inhibition (Im-Bolter, Johnson, & Pascual-Leone, 2006; Kapa & Plante, 2015; Marton, 2008; Pauls & Archibald, 2016; Wittke, Spaulding, & Schechtman, 2013). Four year old Italian-speaking children with DLD have shown significantly poorer performance than age-matched children on inhibition, shifting, and planning tasks (Roello, Ferretti, Colonnello, & Levi, 2015). Similarly, in slightly older children with DLD aged 7 to 12 years, Im-Bolter et al. (2006) found that the children with DLD performed significantly more poorly than typically developing children on inhibition and updating tasks, but not shifting tasks. Wittke et al. (2013) found a significant relationship between scores on parent- and teacher- rated measures of executive functions (including inhibitory control, flexibility and emergent meta-cognition), and standardised language assessment scores in 3 to 5 year olds with DLD. Such findings indicate a strong relationship between language and inhibition in children with DLD. Conversely, however, on a parent and teacher rated measure of executive functioning, Kuusisto, Nieminen, Helminen & Kleemola (2017) found that 22, 7 to 9 year old Finnish-speaking children with DLD performed significantly more poorly than age- and gender- matched controls on a number of areas including shifting, planning, emotional control, and working memory, but not inhibition.

During the process of successful comprehension the individual must focus on relevant information and suppress irrelevant information. Thus, the ability to inhibit irrelevant information during comprehension may be important for inferential comprehension in children with DLD. The influence of, and relationship between, executive functioning skills (such as inhibition) and oral inferential comprehension ability in children with DLD has not, to current knowledge, been investigated.

Theory of mind

Theory of mind (ToM) refers to the ability to understand that others may have different perspectives to one's own, and to be able to both comprehend and make

predictions about another individual's behaviour and thoughts (Colle, Baron-Cohen, & Hill, 2007; Ford & Milosky, 2008). As such, theory of mind requires inferencing ability (Ford & Milosky, 2003). As a higher level cognitive skill, theory of mind is hypothesised to influence comprehension in a top-down way via the situation model (integrating long-term knowledge with online social cognition processes).

While ToM has traditionally been assessed in young children using false belief tasks (in which the child is required to demonstrate understanding of conflicting mental representations by thinking about another person's differing belief about the contents of a box or the location of an object), more recently, assessments have reflected the variety of skills involved in theory of mind development (Farrar et al., 2009; Hutchins, Prelock, & Bonazinga, 2010; Westby & Robinson, 2014). This wide range of social cognitive understandings includes joint attention, affect recognition, distinctions between appearance and reality, deception, visual perspective-taking, social judgement (interpreting others' mental states and attitudes), and empathy (Hutchins, Prelock, & Bonazinga Bouyeya, 2014). Broadly, these skills can be separated into: thinking and awareness of the thoughts, knowledge, emotions, beliefs, and intentions of other people, and; thinking and awareness of the thoughts, knowledge, emotions, beliefs, and intentions of oneself (Westby & Robinson, 2014).

Typically developing children experience a significant change in their theory of mind development at around the age of 4 years (Colle et al., 2007; Owens, 2010). By this age, typically developing children are able to relate emotions and realise that another individual may have a different perspective to their own (Owens, 2010). Researchers have found that language abilities (primarily syntax and vocabulary) are significantly related to ToM development (Andrés-Roqueta, Adrian, Clemente, & Katsos, 2013; Farrar et al., 2009; Schick, De Villiers, De Villiers, & Hoffmeister, 2007; Wilde Astington & Jenkins, 1999).

Children with DLD show delayed theory of mind development compared to typically developing peers (Farrant, Fletcher, & Maybery, 2006). A group of Spanish-speaking children aged 3 to 7 years with DLD showed theory of mind development which was delayed compared to age-matched peers but at a similar level to language-matched peers (Andrés-Roqueta et al., 2013). Spanoudis (2016) found similar results in a group of 20 Cypriot-Greek-speaking children with DLD aged 9 to 12 years compared to younger language-matched children aged 8 to 10 years. A recent meta-analysis of 17 studies of children aged between 4 and 12 years

supported poor ToM performance in children with DLD compared to typically developing age-matched children (Nilsson & de López, 2016).

Ford and Milosky (2003, 2008) found that young children with DLD have difficulty drawing inferences about emotions in context, results which have been supported by other research (Spackman, Fujiki, & Brinton, 2006). In Ford and Milosky's (2003) first study of 12 children with DLD and 12 typically developing children aged 5 to 6 years, both groups of children were able to identify facial expressions depicting simple emotions (e.g. happy, sad). Following this, however, the participants were presented with short stories and required to show (or tell) the examiner how the character felt. The children with DLD performed significantly more poorly than the typically developing children across story modalities (Ford & Milosky, 2003). This indicated that, although children with DLD could generally label facial expressions depicting emotions, they had significant difficulty with the process of inferring emotions using context – a skill which requires inferential comprehension (Ford & Milosky, 2003).

Similar findings arose from a study investigating the ability of 5 to 12 year old children with ASD (with (+) and without (-) language disorder), DLD, and typically developing peers to identify emotions from facial expressions and tone of voice (Taylor, Maybery, Grayndler, & Whitehouse, 2014). Taylor et al. (2014) found that children with DLD, and those with ASD + language disorder, performed more poorly than both the typically developing group and the group with ASD - language disorder. The children with DLD and ASD + language disorder were poor at identifying both simple and complex emotions, indicating that language ability had an influence on the ability to identify emotions.

A separate study assessed a mixed group of 57 children aged 4 to 9 years who were typically developing or had a diagnosis of DLD or ASD. The children with DLD demonstrated significantly poorer ability than typically developing children in verbal ToM tasks (assessing understanding of other people's thoughts and ideas, intentions, beliefs and figurative language) but performed similarly to the typically developing children on an affect recognition task (choosing photographs depicting the same emotions) (Loukusa, Mäkinen, Kuusikko-Gauffin, Ebeling, & Moilanen, 2014). The results indicated that the children with DLD were able to recognise and match feelings visually, however they struggled with higher level theory of mind tasks which involved verbal skills and using context (Loukusa et al., 2014). The

performance of the children with DLD on verbal theory of mind tasks was related to language performance (word finding ability and grammatical knowledge), further confirming a relationship between language ability and ToM development (Loukusa et al., 2014).

Norbury (2005) compared 94 children aged 8 to 15 years with communication impairment (including DLD, PLI, and high functioning ASD) to 34 age- and non-verbal ability- matched typically developing children. She found that the children with DLD and ASD performed significantly more poorly than typically developing children on semantic knowledge, metaphor (sentence completion), and theory of mind assessments (Norbury, 2005). Norbury (2005) suggested that theory of mind ability is an important contributor to understanding metaphors, a skill which involves inferencing. Understanding of metaphors and similes were also significant predictors of theory of mind performance in a group of Cypriot-Greek-speaking children with DLD aged 9 to 12 years (Spanoudis, 2016).

A significant body of research has demonstrated that children with DLD show delayed theory of mind development, and that their ToM ability is related to language development. A number of theory of mind skills relate directly to inferential comprehension, and therefore delayed ToM development has potential implications for inferential comprehension ability. To current knowledge, no study has investigated the specific relationship between theory of mind ability and inferential comprehension in children with DLD.

Summary of domains contributing to oral inferential comprehension

Oral inferential comprehension is by no means the result of the interplay of one or two areas of language: it is an extremely complex skill which has been found to be related to a number of language and cognitive processes. As noted by Cain & Oakhill (2006, p. 693) in relation to reading comprehension, it is unlikely that one single skill underlies poor comprehension, and “Our understanding of comprehension development may be better advanced by investigation of the interaction between different language and cognitive abilities...”. Discourse comprehension theory indicates that successful comprehension involves the integration of both bottom-up and top-down processes during multilevel processing (surface representation, textbase and situation model) (Bishop, 2014b; van Dijk & Kintsch, 1983). As discussed in this chapter, hypotheses based on theory and

research evidence demonstrate that the skills contributing to oral inferential comprehension in children with DLD may, at the least, include vocabulary, grammar, narrative, working memory, linguistic processing, inhibition, and theory of mind.

A number of studies have investigated a range of language and cognitive skills in relation to reading comprehension ability, and other studies have investigated either one, or a few, skills in relation to overall narrative comprehension in typically developing children or mixed groups of children (such as DLD and ASD). Few studies have included a wide range of language and cognitive measures and specifically investigated *oral* inferential comprehension and, to date, no studies could be found which investigated this in young children with DLD.

Significance

Poor oral language comprehension at a young age underlies the development of poor reading comprehension (Hulme & Snowling, 2014; Hulme & Snowling, 2011; Nation et al., 2010; Nation & Norbury, 2005; Oakhill & Cain, 2012; Spencer et al., 2014). Additionally, interventions for comprehension are typically only provided after reading comprehension issues are apparent and pervasive (van Kleeck, 2006). Given that many children with DLD have difficulty with oral inferential comprehension ability and that this impacts adversely on later reading comprehension, it is critical that they are provided with as much support in oral comprehension skills as possible from a young age. Currently, there is a clear gap in the evidence regarding the particular language and cognitive skills which contribute to *oral* inferential comprehension ability, and the manner in which such skills contribute to this ability, in young children with developmental language disorder.

Therefore, Study One aimed to make a significant contribution to the currently fragmented and, at times, equivocal research base regarding oral inferential comprehension in DLD by investigating the profile of the skills which underpin the skill in this population. Such a profile will provide novel information to support our understanding of discourse comprehension theory in children with DLD. In addition, it will allow for the development of targeted interventions, add to the current theoretical and clinical understanding of oral inferential comprehension in children with DLD, and aid in directing future research in the area.

Chapter 3: Study One

A profile of the cognitive and language skills contributing to oral inferential comprehension ability in children with developmental language disorder.

Chapter Overview

Chapter 2 described developmental language disorder, language comprehension and theories of discourse comprehension, and discussed a key difficulty shown by children with developmental language disorder (DLD): oral inferential comprehension. The literature review of chapter 2 discussed and explored the language and cognitive skills which can be hypothesised to contribute to oral inferential comprehension in children with DLD. This chapter presents a study which investigated whether these language and cognitive skills were significant predictors of oral inferential comprehension of narratives in a population of 5 to 6 year old children with DLD.

Research Rationale

There is a paucity of research and lack of integration of the knowledge base regarding the language and cognitive skills which are drawn on by children with developmental language disorder for oral inferential comprehension. The preceding chapter highlighted that: a) research has consistently shown that most children with DLD show difficulty with oral inferential comprehension; b) a number of language and cognitive skills are hypothesised to contribute to this skill; and, c) to date, no research has investigated which language and cognitive skills may contribute to oral inferential comprehension in children with DLD. As such, there is also a lack of research and evidence to support interventions which target improving inferential comprehension in this population. Therefore, this research aimed to examine the relationship and contribution of a number of language and cognitive skills to oral inferential comprehension of narratives in children with DLD (Study One), and, to utilise the findings of Study One in developing and piloting a targeted oral inferential comprehension intervention for children with DLD (Study Two).

Aims and Hypothesis

Study One examined the relationship between, and degree to which, language and cognitive skills predicted oral inferential comprehension of narratives in children with DLD. The aims of Study One were:

1. To examine which particular language and cognitive skills make a significant contribution to oral inferential comprehension ability in pre-primary aged children with DLD.
2. To develop a comprehensive profile of the language and cognitive skills which contribute to oral inferential comprehension in pre-primary aged children with DLD.

The hypothesis of Study One was: Each language and cognitive skill will predict a significant proportion of unique variance in the oral inferential comprehension scores of children with developmental language disorder.

Methods

Participants

The study participants were recruited from two Language Development Centres (LDCs) in the metropolitan area of Perth, Western Australia. Language Development Centres are specialist language schools which, within the curriculum, provide intensive language-based early intervention to children with developmental language disorders from Kindergarten through to Year 1 (3 to 7 years of age). Application for entry to an LDC requires referral from a speech-language pathologist; this includes standardised language assessment (Clinical Evaluation of Language Fundamentals-Preschool, with scores approximately 1 standard deviation or more below the mean), norm-referenced expressive grammar and narrative retell assessments (the Bus Story and Renfrew Action Picture Test), non-verbal IQ assessment by a registered psychologist, and teacher and parent developmental and behavioural checklists (Renfrew, 1991, 2003; Semel, Wiig, & Secord, 2006). The referrals are processed by speech-language pathologists at the LDC to check that

potential students demonstrate a profile of skills consistent with a diagnosis of developmental language disorder³.

In addition to their placement at a Language Development Centre, the study participants were required to meet the following selection criteria:

1. Hearing within normal limits.
2. Mostly intelligible speech at discourse-level with known context, as confirmed by their class teacher and LDC speech pathologist, to ensure reliability in scoring of assessments requiring expressive language samples.
3. Low average or average/above average non-verbal functioning⁴.
4. Pragmatic skills within the typical range for children with DLD.

Following ethics approval from the Curtin University Human Research Ethics Committee, and the Western Australian Department of Education, the principals at two LDCs were contacted about the study (see Appendix B). The researcher met with each principal individually to discuss the research and obtain consent. Both principals provided consent to participate.

Teacher information letters and consent forms were then sent out to every pre-primary teacher across the two LDCs. Fourteen of the 15 teachers who were contacted provided written consent to participate in the research.

Parent/carer information letters and consent forms were sent out to eligible pre-primary students (aged 4;6 to 5;6, years; months at the beginning of pre-primary) from the 14 classes in Term 2 (April to July), 2014. Eligible pre-primary students ($n = \sim 170$) included those children who the class teacher identified as having mostly intelligible speech at discourse-level with known context.

Participants with parent/carer consent completed a brief initial assessment session with the primary researcher (approximately 5 minutes) in which the researcher explained involvement in the study in a child-friendly manner and gave each potential participant the opportunity to provide informed consent. A hearing screen was also completed in this session, using a Grason-Stadler GSI 39 (Version 3) Pure Tone portable audiometer with headphones in a quiet room. The hearing

³ There have been recent changes relating to the terminology and classification of DLD, and the use of non-verbal IQ criteria for diagnosis (see p.5-6). At the time of this study, entry requirements of Language Development Centres in Western Australia included non-verbal IQ in the average range.

⁴ This study was completed prior to the publication of the CATALISE research (Bishop et al., 2016) and therefore the criteria for specific language impairment of non-verbal IQ (low average or above) and no significant pragmatic difficulties were used as inclusion criteria for the analyses.

screen was conducted with a cut-off level of 25dB at 500, 1000, 2000 and 4000Hz (Doyle, 1998). If the hearing screen was passed, the child was confirmed as a participant and completed the remaining assessment battery with the primary researcher over 4 or 5 short assessment sessions during Term 3 and Term 4 (July to December), 2014.

Seventy-eight consent forms were returned from the parents of pre-primary children who received the information letters (please see Figure 4). All 78 potential participants provided verbal and written consent to participate in the research. One participant failed the hearing screen as a part of the selection process, and did not complete further assessment. An additional participant was excluded following the initial assessment session, as their speech was mostly unintelligible to the researcher at the discourse-level. A sample of 76 participants completed the full assessment battery, consisting of 60 males (79%) and 16 females (21%). The participants' ages ranged from 5;2 to 6;2 at the beginning of the study, with an average age of 5;7. Seventy participants spoke only English at home and 6 participants spoke a language other than English at home. Languages spoken at home by these participants and/or their parents included Fulani, Urdu, Arabic, Vietnamese, Spanish and Tagalog. All had been exposed to English at least since commencing school in kindergarten (i.e. a minimum of 18 months).

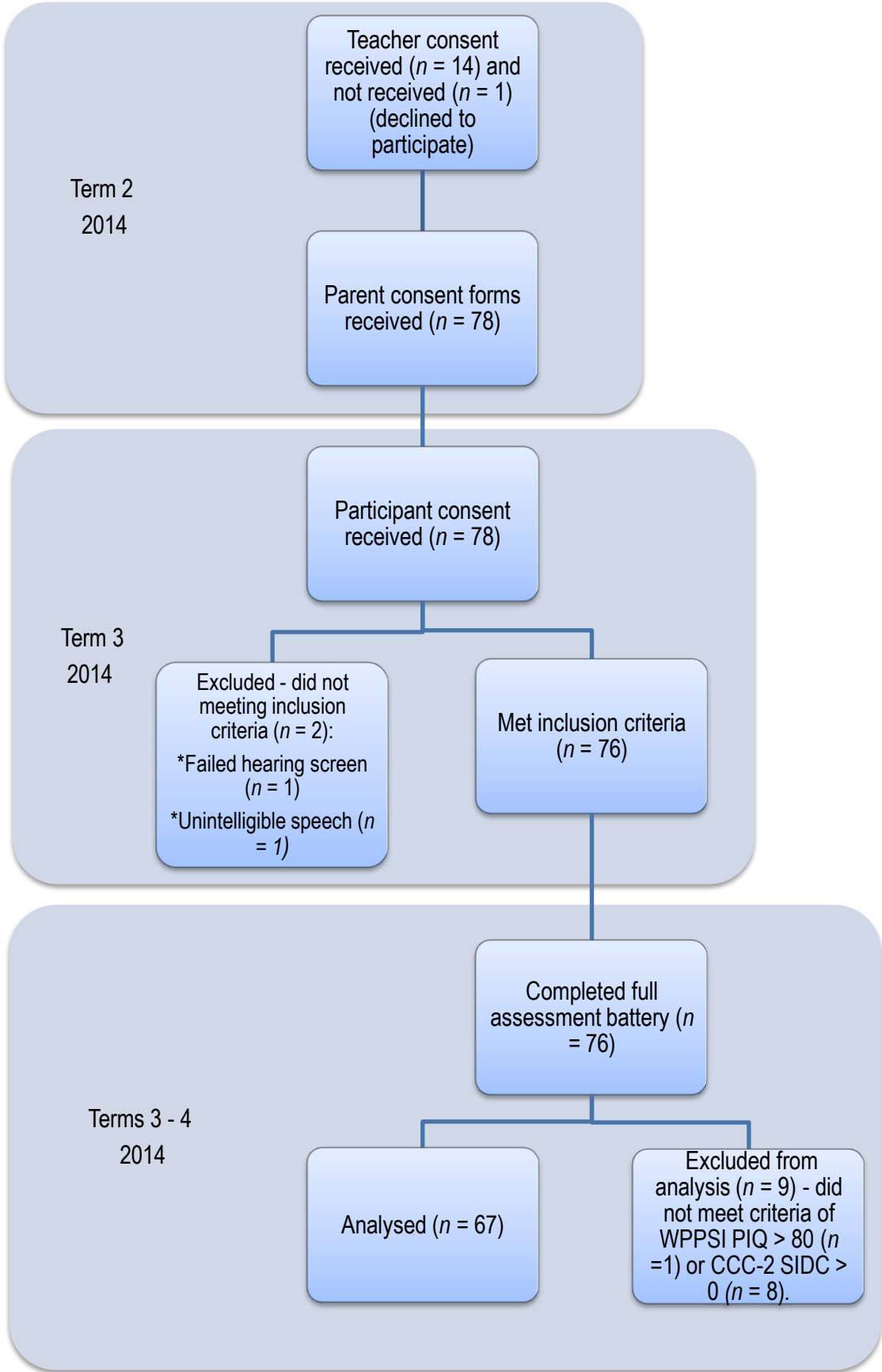


Figure 4. Study One Research Process Flow Chart

Measures

Participants' inferential comprehension of narrative discourse was assessed as the primary outcome measure. The language and cognitive skills chosen for assessment are those identified and discussed in chapter 2. The language and cognitive skills are shown in Table 1 with the assessments administered to assess each area, and order of administration by assessment session.

Table 1: Assessment Battery

| Language / Cognitive Area | Assessment | Session |
|--|---|---------|
| <i>Inferential and literal narrative comprehension</i> | The Squirrel Story Narrative Comprehension Assessment, adapted from the Narrative Comprehension of Picture Books task (Paris & Paris, 2003) | 4 |
| <i>Narrative retell</i> | Squirrel Story Narrative Assessment on iPad (Carey, Leitão, & Allan, 2006) | 4 |
| <i>Expressive single-word vocabulary</i> | Expressive Vocabulary Test – Second Edition (Williams, 2007) | 1 |
| <i>Receptive single-word vocabulary</i> | Peabody Picture Vocabulary Test – Fourth Edition (Dunn & Dunn, 2007) | 1 |
| <i>Expressive grammar</i> | Word Structure subtest of the Clinical Evaluation of Language Fundamentals Preschool – Second Edition (Semel et al., 2006) | 4 |
| <i>Receptive grammar</i> | Test for Reception of Grammar – Second Edition (Bishop, 2003b) | 2 |
| <i>Linguistic processing speed</i> | Rapid Naming subtests of the Comprehensive Test of Phonological Processing (Wagner, Torgesen, & Rashotte, 1999) | 3 |
| <i>Working memory – phonological loop</i> | Phonological Memory subtests of the Comprehensive Test of Phonological Processing (Wagner et al., 1999) | 3 |
| <i>Working memory – episodic buffer</i> | Sentence Imitation subtest of the Test of Language Development – Primary (Third Edition) (Hamill & Newcomer, 1997) | 2 |

Table 1 continued.

| Language / Cognitive Area | Assessment | Session |
|--|---|---------|
| <i>Executive Functions</i> | Bear/dragon task (go/no-go) and grass/snow task (verbal response inhibition) (Carlson, 2005; Reed, Pien, & Rothbart, 1984) | 3 |
| <i>Nonverbal IQ</i> | Core Performance IQ (PIQ) subtests (Picture Concepts, Matrix Reasoning and Block Design) of the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (Wechsler, 2002) | 5 |
| | Teacher Checklists | |
| <i>Theory of Mind</i> | Theory of Mind Inventory (Hutchins, Prelock, & Bonazinga, 2010) | |
| <i>General Language and Pragmatics</i> | Children’s Communication Checklist-Second Edition (Bishop, 2003a) | |

Note. ^aIf a participant had completed the Word Structure subtest of the CELF-Pre 2 in the 6 months prior to assessment, the assessment was not readministered.

^b If a participant had been assessed on the WPPSI in the previous 18 months (i.e. for their referral to the LDC) the assessment was not readministered.

More detailed information about the assessments administered to the participants is listed below. Most of the assessments are well-known standardised assessments which are commonly used by speech-language pathologists in clinical practice and research.

Inferential and literal narrative comprehension: The Narrative Comprehension of Picture Books task (NC task), developed by Paris and Paris (2003), was modified specifically for this research to create an age-appropriate task: The Squirrel Story Narrative Comprehension Assessment (NCA) (see Appendix C). The modified questions were used in conjunction with the Squirrel Story Narrative Assessment on iPad (Carey et al., 2006)⁵. Narrative is commonly used as an assessment and intervention context with this age group and population (Boudreau, 2008).

There are currently few standardised assessments available which measure both literal and inferential oral narrative comprehension, and those which do present

⁵ Please see copyright permissions in Appendix A.

a number of potentially confounding issues such as: the inclusion of a small number of inferential comprehension questions; providing only a total score for inferential and literal comprehension; using single pictures to present an entire story; and, not assessing discourse-level inferential comprehension. The most commonly used assessment, the Test of Narrative Language (Gillam & Pearson, 2004), only assesses overall narrative comprehension and does not separate literal and inferential comprehension. Given that inferential comprehension is the outcome measure of this study, it was necessary for the chosen assessment to separate inferential and literal comprehension and to include a variety of inferential comprehension questions.

The Squirrel Story narrative was chosen due to: its clear story structure; emotions that could be inferred; vocabulary used; and, the perceived engagement of the illustrations on the iPad. Additionally, the app narration was consistent across all participant assessments (supporting reliability) and the app was considered to be easily accessible for clinicians to replicate the NCA in future clinical practice. Furthermore, past research has found that children's ability to generate inferences is related across different types of media (Kendeou, Bohn-Gettler, White, & Van Den Broek, 2008).

The NC task by Paris and Paris (2003) includes both inferential and literal comprehension questions designed for use with wordless picture books and was evaluated in three studies with samples of between 91 and 158 American children aged 5 to 8 years. The studies demonstrated the NC task could be generalised across narratives as there were significant, positive inter-task correlations between different books, appropriate internal consistency ($\alpha = .69$ to $.79$), inter-rater reliability ($r = .97$), and concurrent and predictive validity (Paris & Paris, 2003). The inferential questions in the NC task also align with the types of inferential questions described by van Kleeck (2008).

The NC task questions were adapted by the researcher for use with the Squirrel Story narrative to create The Squirrel Story Narrative Comprehension Assessment (NCA). While Paris and Paris (2003) measured children's comprehension of wordless narratives (ability to comprehend a narrative based on pictures), this study, similar to Tompkins et al. (2013), was interested in measuring children's (oral) comprehension of a narrative they had heard, which is more reflective of typical narrative comprehension in the classroom and home contexts. In

line with Paris and Paris (2003), questions were asked following the story (off-line comprehension) demonstrating the child's ability to process, reason, and reflect on the story as a whole (van den Broek, Tzeng, Risdien, Trabasso, & Basche, 2001). Thus, the protocol for this assessment was based on the story retelling procedure of the Westerveld and Gillon Language Sampling Protocol (Westerveld & Gillon, 2011). The participant watched and listened to The Squirrel Story narrative on iPad using the Australian male voice setting and was then asked comprehension questions (14 inferential questions and 5 literal questions) while looking through the narrative pictures. Following this, the participant listened to the story again and was asked to retell the story using the pictures.

The responses to the comprehension questions and the narrative retell were audio-recorded on the iPad app using the participant's code with no identifying information. A scoring scale (0, 1 or 2 points for each question) was created for the NCA based on the scoring guide developed by Paris and Paris (2003). This provided a total score out of 28 for inferential comprehension and out of 10 for literal comprehension. A pilot study of the task involving 44 typically developing pre-primary aged participants was completed as part of a separate study to confirm and validate the scoring guide of The Squirrel Story NCA and to collect a representative sample of responses from typically developing children of the same age. Please see Appendix H for more details regarding the pilot study. The NCA provided scores of inferential and literal comprehension of narrative, and was completed along with narrative retell over 10 to 15 minutes.

Narrative retell: The Squirrel Story Narrative Assessment on iPad is a criterion-referenced task which assesses the macro- and micro-structure of narrative retell (Carey et al., 2006). The participant watched and listened to The Squirrel Story narrative on iPad and was then asked to retell the story while looking through the narrative pictures (see previous section for full protocol). The assessment was completed following the NCA over 10 to 15 minutes.

The iPad app scoring guidelines for the narrative retell include rating scales for narrative macrostructure and microstructure elements, including story structure, story content, level of language used/syntax, and vocabulary, in addition to observable skills which were not rated for this study (gesture/nonverbal and listening & attention). The retells were transcribed and scored offline for narrative

macrostructure (story structure and story content) and narrative microstructure (level of language used/syntax and vocabulary).

Expressive and receptive single-word vocabulary: The Expressive Vocabulary Test – Second Edition (EVT-2) (Williams, 2007) and The Peabody Picture Vocabulary Test – Fourth Edition (PPVT-4) (Dunn & Dunn, 2007) provided scores of single-word expressive and receptive vocabulary. The participant was shown pictures in a stimulus book and asked to say the word (EVT-2) or select the picture that matched a word said by the examiner (PPVT-4). The EVT-2 and PPVT-4 were co-normed with the same sample of 3,540 Americans aged 2;6 to 90 years. For this study, the scores were combined to reflect overall vocabulary (reflecting storage and access to semantic knowledge). The EVT-2 has appropriate internal consistency reliability ($r = .94$), test-retest reliability ($r = .95$) and appropriate construct validity. The PPVT-4 has appropriate internal consistency reliability ($r = .94$), test-retest reliability ($r = .93$) and appropriate construct validity. The assessments were completed over approximately 20 minutes.

Expressive grammar: The Word Structure subtest of the Clinical Evaluation of Language Fundamentals Preschool – Second Edition, Australian and New Zealand Standardised Edition (CELF-P2) (Semel et al., 2006) was used to assess expressive grammar ability. During this subtest, the participant was asked to complete the end of phrases/sentences stated by the assessor which were related to a picture shown in the stimulus book – the items are designed to elicit certain grammatical forms (e.g. pronouns, irregular past tense, and irregular plurals). The CELF-P2 Australian and New Zealand Standardised Edition was normed on 342 children and demonstrated appropriate internal consistency reliability ($r = .80$ to $.96$) and test-retest reliability (word structure average $r > .80$). The word structure subtest was completed within 5 minutes.

Receptive grammar: The Test for Reception of Grammar – Second Edition (TROG-2) (Bishop, 2003b) was used to assess children's comprehension of grammatical forms by asking children to point to the picture (out of four similar pictures) which best matched a sentence read by the assessor. The TROG-2 was standardised on 792 children aged 4 to 16 years in the United Kingdom, and demonstrated appropriate reliability and validity. The assessment was completed over 10 to 20 minutes.

Linguistic processing speed and working memory (phonological loop):

The Comprehensive Test of Phonological Processing (CTOPP) (Wagner et al., 1999) assessment was used to assess two skills – the phonological loop component of working memory and linguistic processing speed. The CTOPP was normed on a sample of 1,656 Americans aged 4 to 24 years. The composite scores demonstrated appropriate internal consistency ($\alpha > .8$), test-retest reliability ($r = .78$ to $.95$), inter-rater reliability ($r = .98$) and criterion and construct validity. Two subtests (memory for digits and non-word repetition) were administered to each participant to gain a phonological memory composite score (reflecting the phonological loop), and two subtests (rapid colour naming and rapid object naming) were administered to gain a rapid naming composite score (reflecting linguistic processing speed).

For the phonological memory subtests, the participant watched an iPad video of an alien puppet and was required to repeat back strings of digits of increasing length, and then nonsense words of increasing complexity. The puppet video was pre-recorded by the primary researcher with a break of 3 to 6 seconds between each subtest item (longer breaks as the items increased in length). The video ensured that every child observed and heard the same recorded subtest, increasing the reliability of the assessment. Additionally, the puppet supported participant engagement during the subtests. The phonological memory subtests were audio-recorded with a Voice memos app using the participant's code (no identifying information). For the rapid naming subtests, the participant was timed using a stop-watch and asked to name rows of pictures as quickly as possible (rows of colours followed by rows of common objects). The four subtests took approximately 20 minutes to administer.

Working memory (episodic buffer): The sentence imitation subtest of the Test of Language Development – Primary (Third Edition) (TOLD-P3) (Hamill & Newcomer, 1997) was used to gain a score reflecting the functioning of the episodic buffer component of working memory (as it interacts with the phonological loop and long-term linguistic knowledge). The participant was asked to repeat back sentences of increasing length and complexity. The subtest was audio-recorded with a Voice memos app using the participant's code (no identifying information). The TOLD-P3 was standardised on 1,519 American children aged 4 to 9 years, demonstrating acceptable internal consistency ($\alpha > .80$), test-retest reliability ($r > .80$), inter-rater reliability ($r = .99$), and content, criterion, and construct validity. The subtest took approximately 2 to 5 minutes to administer.

Inhibition (executive functioning): The bear/dragon task (Carlson, 2005; Reed et al., 1984) and grass/snow task (Carlson, 2005; Carlson & Moses, 2001) were administered to participants as measures of inhibitory control. To current knowledge, there are few standardised or norm-referenced assessments for executive functioning in young children (Anderson & Reidy, 2012; Willoughby et al., 2012). As such, the bear/dragon and grass/snow tasks were selected as they are commonly used measures of inhibition in research with young children, are engaging, quick to administer, and relatively simple to explain to children (Anderson & Reidy, 2012; Benson, Sabbagh, Carlson, & Zelazo, 2013; Carlson, 2005; Carlson & Moses, 2001; Kraybill & Bell, 2013; Reed et al., 1984).

The tasks were administered following the procedure described by Carlson (2005). In the bear/dragon task, the participant followed simple one-step action instructions (e.g. 'shake your head', 'touch your knee') given by a 'nice' bear puppet (a dog puppet was used in this research), and ignored instructions given by a 'naughty' dragon puppet. An iPad video with the dog and dragon puppets was pre-recorded by the researcher, with a break of approximately 4 to 5 seconds between each instruction. The participant was provided with four trial items (with feedback) on the iPad video prior to completing the ten test items. The items were scored on a scale of 0, 1 or 2 points as a total score out of 20 – for the dog's instructions (0 – did not move, 1 – other movement, 2 – completed action correctly) and for the dragon's instructions (0 – completed action, 1 – other movement, 2 – did not move) (Carlson, 2005; Gooch, Thompson, Nash, Snowling, & Hulme, 2016).

In the grass/snow task, the participant was asked to point to a white card when they heard the word 'grass' and a green card when they heard the word 'snow'. Each participant was provided with two trial items (with feedback) prior to the ten test items. The grass/snow task items were scored on a scale of 0, 1 or 2 points as total score out of 20 – for grass (0 – pointed to green/no response, 1 – self-corrected, 2 – pointed to white) and for snow (0 – pointed to white/no response, 1 – self-corrected, 2 – pointed to green). These two inhibition tasks were completed over 5 to 10 minutes. See Appendix E for the task instructions and assessment forms.

Nonverbal IQ: The core Performance IQ subtests (Block Design, Matrix Reasoning, and Picture Concepts) of the Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI-3) (Wechsler, 2002) were used as a measure of non-verbal intelligence. In the Block Design subtest, the participant was timed while

copying increasingly complex constructs of blocks, first those built by the examiner and then those shown in a stimulus book. In the Matrix Reasoning subtest, the participant was asked to find and point to the picture that was missing from a matrix of pictures. In the Picture Concepts subtest, the participant selected a picture from two to three rows of pictures to form a group which shared a common feature. The researcher was provided with training and supervision in the administration and scoring of the WPPSI-3 by a registered psychologist at Curtin University prior to completing this assessment with participants. The WPPSI-3 has appropriate validity and reliability, with internal consistency reliability for the Performance IQ composite score across age groups between $r = .89 - .95$.

More detailed information about the checklists given to participants' teachers is listed below.

Theory of Mind: The Theory of Mind Inventory (ToMI) (Hutchins et al., 2010) assessment was used to provide a score reflecting theory of mind development. The ToMI is a 42-item checklist of theory of mind skills which uses a scale ranging from 'definitely not' to 'definitely'. It was completed by each participant's teacher in the fourth term of the school year. The checklist took approximately 10 to 15 minutes to complete. Preliminary norms for the ToMI were completed with 124 typically developing children aged 2 to 12 years from five American states. The ToMI demonstrated appropriate test-retest reliability ($r = .89$), internal consistency ($\alpha = .98$) and criterion-related validity (Hutchins, Prelock, & Bonazinga Bouyea, 2014; Hutchins, Prelock, & Bonazinga, 2012).

The ToMI was selected for a number of reasons: few norm-referenced or standardised theory of mind assessments exist, the commonly used theory of mind assessment tasks (such as the Sally-and-Anne test) tend to only assess one aspect of theory of mind (false belief), and performance on these tasks can be significantly influenced by language ability (van Buijsen, Hendriks, Ketelaars, & Verhoeven, 2011). As a teacher checklist, the ToMI did not require the child to complete further assessment or rely on language skills to understand and complete tasks (Hutchins et al., 2014; Siegal & Beattie, 1991; van Buijsen et al., 2011). Additionally, the ToMI included items reflecting a broad range of theory of mind development over three general levels of typical developmental progression (early, basic and advanced) which are presented in a mixed format. The early skills include affect recognition, intentionality, social referencing, and sharing attention (e.g. "My child understands

that when people frown, they feel differently than when they smile.”). The basic skills represented include false beliefs, visual perspective-taking, mental state term comprehension, and physiologically-based and emotion-based behaviours (e.g. “My child understands that when someone says they are afraid of the dark, they will not want to go into a dark room.”). The advanced skills include empathy, sarcasm, complex social judgement, and second order understanding of beliefs and emotions (e.g. “My child understands that people often have thoughts about other peoples’ feelings.”). Therefore, the ToMI was selected as a comprehensive measure of theory of mind, providing a broad reflection of overall theory of mind development (Hutchins et al., 2014).

General Language and Pragmatics: The Children’s Communication Checklist-Second Edition (CCC-2) (Bishop, 2003a) is a screening assessment which evaluates language, speech, and pragmatic skill development and was completed by each participant’s teacher in approximately 10 minutes. The CCC-2 provides scores reflecting whether a child may have communication and/or pragmatic difficulties. The scores provided include a Social Interaction Deviance Composite (SIDC), a measure of pragmatic skills; and, a General Communication Composite (GCC), a measure of communication (and language) skills. A SIDC above 0 indicates that a child’s difficulty is primarily in the language, rather than pragmatic, domain of communication. A GCC score below 55 indicates that a child has language difficulties (poor language content and structure). The CCC-2 was standardised on 542 children in the United Kingdom and 115 children in Australia aged 6, 9, and 12 years. Internal consistency was generally acceptable but varied across the checklist areas ($r = .66 - .80$) and inter-rater reliability was acceptable but varied slightly between parents and professionals. Three studies confirmed the validity of the CCC-2 as a screening tool for communication disorders (Bishop, 2003a).

Procedures

Data collection took place in a quiet room at the Language Development Centres during normal school hours. The researcher arranged the most suitable times for assessment with pre-primary class teachers. Each participant completed the battery of assessments over four or five individual assessment sessions with the researcher in the same order (see Table 1). Each session lasted 10 to 20 minutes (including breaks, as needed), and the total assessment time for each participant

was approximately 60 to 90 minutes. Participants were provided with a small reward at the end of each assessment session (e.g. a sticker). All assessments were administered and scored following the instructions in each respective manual of the standardised assessments or according to published author guidelines.

The two teacher checklists (CCC-2 and ToMI) were discussed with and given to the participants' classroom teachers by the researcher at the beginning of Term 4, 2014, and were returned completed by the end of Term 4, 2014. The teachers were provided with opportunities to discuss and ask questions about the checklists. The researcher scored the completed CCC-2s using the standardised scoring software provided with the assessment and scored the ToMIs using the online scoring software provided by the authors (<http://www.theoryofmindinventory.com/>) (see Appendix F for a sample report).

Inter-rater reliability was calculated using the intra-class correlation (ICC) on 10% of the assessment sample scored by a speech-language pathologist who was not involved in the research. The ICCs are reported in Table 2. All measures demonstrated appropriate reliability (ICCs > .75) (Portney & Watkins, 2000).

Table 2: Inter-rater Reliability of Measures

| Measure | ICC |
|------------------------------|------|
| Narrative macrostructure | .974 |
| Narrative microstructure | .983 |
| Literal comprehension | .979 |
| Inferential comprehension | .961 |
| CELF-P2 word structure | 1.00 |
| EVT-2 and PPVT-4 | 1.00 |
| TROG | 1.00 |
| CTOPP – phonological memory | .981 |
| CTOPP – rapid naming | 1.00 |
| TOLD -P3 –sentence imitation | 1.00 |
| ToMI teacher checklist | 1.00 |

Analysis Plan and Rationale

Analyses, using SPSS Version 22, were conducted in six stages as outlined below.

Stage 1: Participants who did not meet the selection criteria were removed from the sample and descriptive statistics were calculated.

Stage 2: The assumptions underlying parametric correlational analysis were tested. These assumptions included linearity, homoscedasticity, normality, and independence.

Stage 3: A power analysis was conducted to determine whether the sample size of 67 was sufficiently large to detect 'moderate' relationships between inferential comprehension and each of the language and cognitive variables.

Stage 4: Bivariate correlational analyses were conducted to test the significance of the relationships between the language and cognitive variables. The statistic used to estimate the correlations was selected on the basis of the Stage 2 results.

Stage 5: Theoretically, age, gender and language/s spoken could potentially confound the relationships between inferential comprehension and the language and cognitive variables. This stage of the analysis thus tested whether age, gender and language/s spoken were confounders in the analyses.

Stage 6: Twelve bivariate regression models (one for each of the language and cognitive variables) were tested in order to identify the language and cognitive variables which were significant predictors of inferential comprehension. Multiple regression models were initially tested in order to control for the shared variance among the language and cognitive variables. Multiple regression models were also tested for the composite language and cognitive variables generated by a Principal Components Analysis. However, the multiple regression models were compromised by suppressor effects brought about by the predictor variables (the language and cognitive skills) being more highly correlated with each other than with the dependent variable (inferential comprehension). For several of the multiple regression models, suppressor effects produced significant relationships between inferential comprehension and particular language and cognitive variables after controlling for other language and cognitive variables, even when there were no bivariate relationships between the variables to begin with. The suppressor effects

are purely statistical anomalies and, as such, are uninterpretable within the theoretical framework of this thesis. As such, the statistics for the compromised multiple regression models and the Principal Components Analysis are reported in Appendix G. The bivariate regression models are reported under the Stage 6 heading below.

Results

Stage 1: Descriptive statistics

Of the total sample size ($n = 76$), 8 participants were excluded based on a negative Social Interaction Deviance Composite and a General Communication Composite score below 55 on the CCC-2. This indicated that these participants' primary difficulty was in the pragmatic domain of communication (i.e., communicative profile indicative of pragmatic language impairment or autism spectrum disorder) (Bishop, 2003a). One participant was excluded due to a Performance IQ standard score on the WPPSI below 80 ($PIQ = 72$) indicating borderline nonverbal functioning, and therefore not meeting participant selection criteria of low average or average/above average nonverbal functioning⁶.

Of the remaining 67 participants included for analysis, 51 were males (76%) and 16 were females (24%). This reflects a slightly higher male to female ratio than that found in the general population of children with language disorder (59% male, 41% female) (Tomblin et al., 1997). The mean age of participants at the commencement of assessment in Term 3, 2014 was 5;7, ranging from 5;2 to 6;2 ($SD = 3.62$ months).

The means and standard deviations of the language and cognitive measures are provided in Table 3. The group means for the standardised assessments EVT-2, PPVT-4, and CTOPP – Rapid Naming were in the typical range, within one standard deviation of the reported standardised mean ($M = 100$, $SD = 15$). The group means for the TROG-2, TOLD-P3 – Sentence Imitation and CTOPP – Phonological Memory were one to two standard deviations below the reported standardised mean. The group mean for the CELF-P2 Word Structure ($M = 10$, $SD = 3$) was just within one standard deviation of the mean.

⁶ N.B. WPPSI-III Performance IQ standard scores of 70 – 79 indicate borderline functioning; 80 – 89 indicates low average functioning; 90 – 109 indicates average functioning.

As the Narrative Comprehension Assessment questions for The Squirrel Story narrative were created for this research, comprehensive normative data for the comprehension questions are not available. However, the comprehension questions were piloted in a separate reference study (please see Appendix H). The typically developing pre-primary aged children ($n = 40$) in the pilot study demonstrated higher scores for both inferential ($M = 15$) and literal ($M = 5.8$) comprehension than the DLD group in this study ($M = 12.51$ and 4.37 , respectively).

The Squirrel Story Manual contains guidelines for average narrative retell macrostructure and microstructure scores for typically developing children (aged 5 – 5;9): 4.8 for macrostructure elements and 4.3 for microstructure elements (Carey et al., 2006). Both the macrostructure and microstructure means were higher than the DLD group means in this study ($M = 3.40$ and 2.66 , respectively).

The inhibition tasks and scoring were modified for this study based on the descriptions by Carlson (2005), and as such there are no norms available for comparison. However, the means were very close to the maximum possible score (20), suggesting a ceiling effect on both tasks.

The DLD group mean for the Theory of Mind Inventory composite scores ($M = 12.51$) was lower than the preliminary norm means of 15.53 (5 – 6 years) and 15.8 (6 – 7 years) from a sample of 124 typically developing children aged 2 to 12 years (Hutchins et al., 2014). The DLD group means, however, were higher than the preliminary norms of 8.8 and 10.8 reported for the same age bands of children diagnosed with ASD (a sample of 135 children aged 3 to 17 years).

Table 3: Means, Standard Deviations and Ranges of Measures ($n = 67$)

| Measure | Mean | Standard Deviation | Range |
|--|----------|--------------------|----------|
| Inferential comprehension | 12.51* | 3.44 | 4 – 19 |
| Literal comprehension | 4.37* | 1.35 | 1 – 7 |
| Narrative retell – macrostructure | 3.40* | 1.19 | 1 – 6 |
| Narrative retell – microstructure | 2.66* | 1.03 | 1 – 5 |
| CELF-P2 Word Structure - expressive grammar | 7.28** | 2.75 | 1 – 14 |
| TROG-2 - receptive grammar | 81.97** | 12.32 | 60 – 107 |
| EVT-2 and PPVT-4 – combined vocabulary | 98.85** | 8.43 | 80 – 118 |
| CTOPP – phonological loop | 84.78** | 7.65 | 64 – 106 |
| CTOPP – rapid naming | 92.97** | 13.84 | 61 – 127 |
| TOLD-P3 Sentence Imitation – episodic buffer | 5.69** | 2.46 | 1 – 12 |
| ToMI – theory of mind | 12.51** | 3.18 | 4 – 18 |
| Inhibition – Dragon/Dog | 18.94* | 1.92 | 9 – 20 |
| Inhibition – Grass/Snow | 17.01* | 3.32 | 3 – 20 |
| WPPSI – Performance IQ | 100.69** | 12.66 | 81 – 145 |

Note. * = assessment raw scores; ** = assessment standard scores.

Stage 2: Assumption testing

The assumptions underlying parametric correlational analysis were tested: linearity, homoscedasticity, normality, and independence. None of the 12 bivariate scatterplots between inferential comprehension and the language and cognitive variables showed a curvilinear (cone-like) pattern, indicating that the assumptions of

linearity and homoscedasticity had been met. The scatterplots for the executive function tasks, however, showed clear violations of normality. Due to the normality violations, Spearman's rho was chosen to test the significance of the relationship between inferential comprehension and each of the language and cognitive variables. Spearman's rho is a non-parametric measure of association and, as such, does not assume normality.

The mean inferential comprehension scores differed significantly between participants from the two Language Development Centres, indicating intra-centre dependency in the data (i.e., a violation of the independence assumption). The intra-class correlation (ICC), a measure of dependency, was significant ($ICC = .017$, $p = .007$). Any non-zero ICC can inflate the Type I error rate (Donner & Klar, 1996; Killip, Mahfoud, & Pearce, 2004) and, as such, intra-centre dependency was controlled in the Stage 6 bivariate regression analyses. The difference between the two LDCs may have been related to the interventions programs run at the centres and/or socio-economic factors. Although catchment areas for both LDCs included areas of socio-economic disadvantage, the catchment area for one of the LDCs included two of the five most socio-economically disadvantaged areas in Perth (Australian Bureau of Statistics, 2013).

Stage 3: Power analysis.

A power analysis was conducted to determine whether the sample size of 67 was sufficiently large to detect 'moderate' relationships between inferential comprehension and each of the language and cognitive variables. At an adjusted alpha-level of .004 (Bonferroni correction), 67 participants provided sufficient power for an 80% chance of detecting a 'moderate' relationship ($f^2 = .22$) between inferential comprehension and each of the language and cognitive variables.

Stage 4: Bivariate correlational analyses using Spearman's rho

The linear relationships among the language and cognitive measures were evaluated across the participants with bivariate Spearman correlation coefficients. As displayed in Table 4, significant, medium to strong correlations were found between many of the language and cognitive measures.

Table 4: Spearman's Rho Correlations among Language and Cognitive Measures

| Variable | 1. Narrative retell macro-structure | 2. Narrative retell micro-structure | 3. Literal comprehension | 4. Inferential comprehension | 5. CELF-P2 word structure – expressive grammar | 6. EVT-2 & PPVT-4 – vocabulary | 7. TROG-2 – receptive grammar | 8. CTOPP-Phonological loop | 9. CTOPP Rapid naming – linguistic processing | 10. TOLD-P3 Sentence imitation – episodic buffer | 11. Inhibition – Dog / Dragon | 12. Inhibition – Grass / Snow | 13. Theory of Mind Inventory |
|----------|-------------------------------------|-------------------------------------|--------------------------|------------------------------|--|--------------------------------|-------------------------------|----------------------------|---|--|-------------------------------|-------------------------------|------------------------------|
| 1. | - | .854*** | .613*** | .410*** | .297* | .191 | .148 | .104 | .056 | .196 | .161 | .185 | .208 |
| 2. | | - | .468*** | .332** | .326** | .239 | .245* | .162 | .066 | .289* | .246* | .260* | .213 |
| 3. | | | - | .339** | .449*** | .311** | .297* | .156 | .088 | .304* | .167 | .213 | .239 |
| 4. | | | | - | .264* | .245* | .180 | -.136 | .032 | .133 | .156 | .213 | .312** |
| 5. | | | | | - | .450*** | .473*** | .331** | .055 | .588*** | .194 | .176 | .340** |
| 6. | | | | | | - | .487*** | .296* | .235 | .412*** | .125 | .149 | .378** |
| 7. | | | | | | | - | .285* | .206 | .433*** | .213 | .258* | .185 |
| 8. | | | | | | | | - | .170 | .401*** | .149 | .134 | -.076 |
| 9. | | | | | | | | | - | .150 | -.006 | .008 | .215 |
| 10. | | | | | | | | | | - | .172 | .137 | .232 |
| 11. | | | | | | | | | | | - | .274* | .119 |
| 12. | | | | | | | | | | | | - | .147 |

Note. * = significance at .05 level, ** = significance at .01 level, *** = significance at <.001 level.

Stage 5: Testing for potentially confounding covariates

Theoretically, age, gender, and language/s spoken had the potential to confound the relationships between inferential comprehension and the language and cognitive variables. Age, gender, and language were ruled out as potentially confounding covariates because participants were the same age, there was no gender difference in terms of inferential comprehension ($t[65] = 0.405, p = .687$), or inferential comprehension difference between participants who did or did not speak a language other than English at home ($t[65] = .118, p = .906$),.

Stage 6: Bivariate relationships between inferential comprehension and the language and cognitive variables

Bivariate regression models were tested for each of the 12 language and cognitive variables in order to identify variables which were significant predictors of inferential comprehension. A Bonferroni correction was made to adjust the alpha level to a more conservative level due to the number of regressions conducted, $\alpha = .004 (.05/12)$. Eta-squared was used as an estimate of the strength of the association between each predictor and inferential comprehension score. The results are reported in Table 5.

Narrative macrostructure and microstructure, literal comprehension, vocabulary, and theory of mind were significant predictors of inferential comprehension scores. In descending order, the percentage of variance in inferential comprehension scores accounted for by the significant individual predictors included: 18.3% narrative retell (macrostructure), 14.6% narrative retell (microstructure), 12.6% theory of mind, 10.8% literal comprehension, and 5.5% vocabulary. The expressive and receptive grammar, phonological loop, episodic buffer, linguistic processing, and inhibition measures did not predict significant individual variance in inferential comprehension scores.

Table 5: Relationships between Inferential Comprehension and Each Predictor in the Regression Analyses

| Predictor | Inferential comprehension | | | |
|---------------------------------------|---------------------------------------|----------------|----------|--------|
| | Unstandardised Regression coefficient | 95% CI | η^2 | p |
| Narrative macrostructure | 1.121 | 0.490, 1.751 | .183 | .001* |
| Narrative microstructure | 1.145 | 1.033, 1.257 | .146 | <.001* |
| Literal comprehension | 0.704 | 0.388, 1.021 | .108 | <.001* |
| Expressive grammar | 0.231 | -0.205, 0.666 | .049 | .294 |
| Receptive grammar | 0.040 | -0.011, 0.092 | .040 | .124 |
| Vocabulary | 0.093 | 0.040, 0.147 | .055 | .001* |
| Phonological loop | -0.065 | -0.119, -0.011 | .017 | .018 |
| Linguistic processing (rapid naming) | -0.002 | -0.046, 0.042 | <.001 | .934 |
| Episodic buffer (sentence repetition) | 0.120 | -0.085, 0.325 | .020 | .245 |
| Inhibition – dog/dragon | 0.032 | -0.188, 0.251 | .005 | .773 |
| Inhibition – grass/snow | -0.006 | -0.209, 0.197 | .001 | .955 |
| Theory of mind | 0.320 | 0.177, 0.464 | .126 | <.001* |

Note. $p < .004$ is denoted with an asterisk ().*

Discussion

There is currently a lack of knowledge regarding the skills which children with DLD draw on to make oral inferences, and a comprehensive understanding of the skills which contribute to this ability is necessary in order to develop more targeted and effective interventions. As such, the aims of Study One were to examine which particular language and cognitive skills made a significant contribution to inferential comprehension ability in children with DLD in order to develop a comprehensive profile of those skills. The variety of language and cognitive measures included in the study were identified as potentially important predictors of inferential comprehension based on discourse comprehension theory and past research literature.

The study's hypothesis was not fully confirmed as, individually, a mixed profile of language and cognitive skills predicted unique variance in oral inferential comprehension scores. The findings will be discussed in relation to the research literature examining typically developing and language disordered populations, discourse comprehension theory, and clinical implications. The overall profile of skills shown to be significant will be discussed first, followed by a discussion of the individual skills which contributed significant variance to inferential comprehension, and those skills which did not contribute significant variance. The limitations of the study will then be addressed.

Profile of skills contributing to oral inferential comprehension

This study has identified the language and cognitive skills which contributed significant individual variance to inferential comprehension ability of narratives in a group of 5 to 6 year old children with DLD (see Figure 5). Both language (narrative retell, literal comprehension, and vocabulary) and cognitive (theory of mind) skills emerged as significant predictors. The profile of skills included narrative retelling ability (macrostructure and microstructure), literal comprehension of narrative, theory of mind, and overall vocabulary. Individually, each of these skills explained between 5.5 to 18.3% of significant variance in oral inferential comprehension ability. This finding indicates that a number of skills contribute to inferential comprehension in young children with DLD and, as such, interventions to improve inferential comprehension in this population should focus on this variety of language and

cognitive skills. The identified skills may be important intervention targets to support, and improve, oral inferential comprehension in young children with DLD.

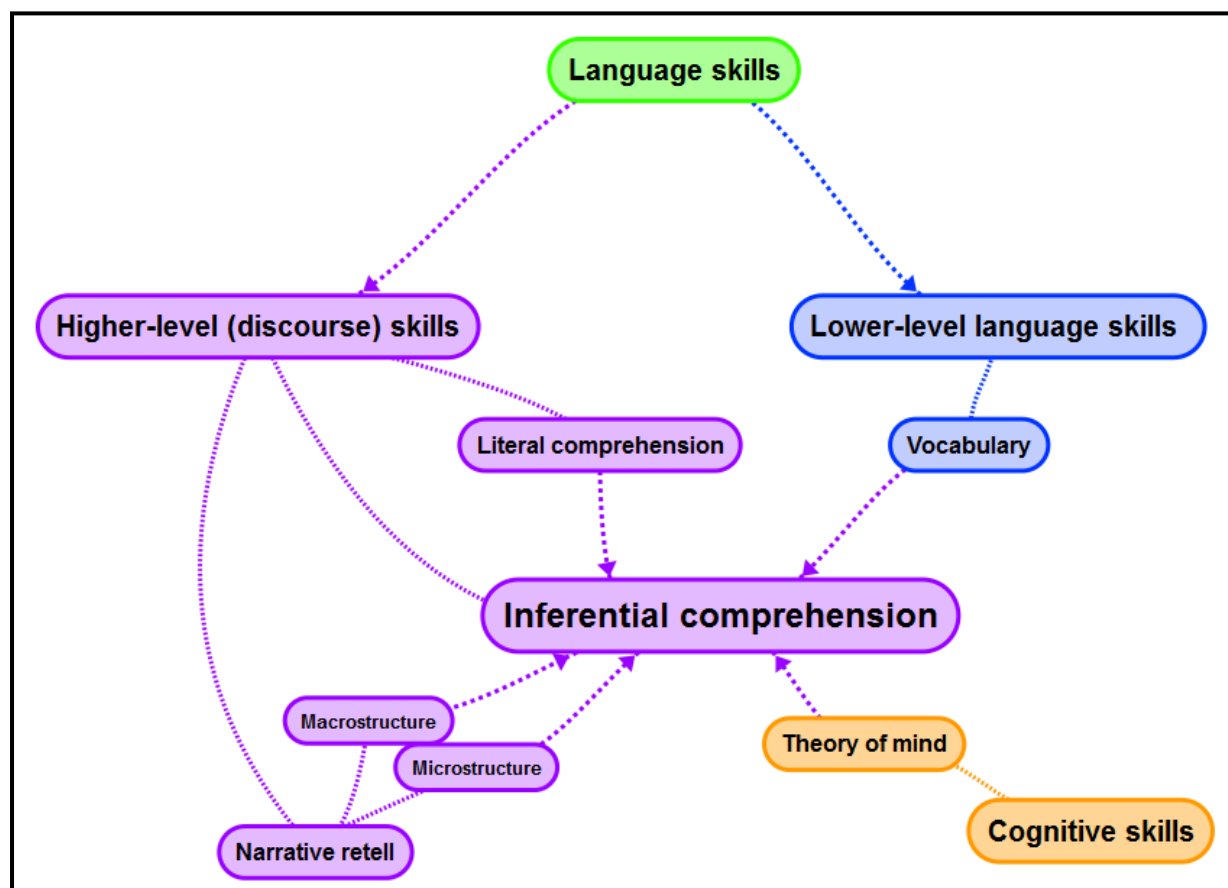


Figure 5. Profile of skills contributing to inferential comprehension in children with DLD.

According to van Dijk and Kintsch's (1983) model, discourse comprehension involves integrated, multilevel processing with contributions from bottom-up and top-down processes. The current findings align with this model, as both bottom-up and top-down language and cognitive skills were significant predictors of oral inferential comprehension.

From a bottom-up perspective, vocabulary supports inferential comprehension by helping to build meaning (Bishop, 2014b). Strong vocabulary abilities support the development of an accurate textbase during comprehension, thus allowing the successful drawing of inferences (van Dijk & Kintsch, 1983).

Additionally, discourse-level skills function in a top-down way to support inferential comprehension. The discourse-level skills of narrative retell (macrostructure and microstructure) and literal comprehension are heavily reliant on schemas. Situation models are developed from schemas, and it is hypothesised that

successful inferential comprehension is reliant on interaction between the textbase and situation model (Graesser et al., 1997; van Dijk & Kintsch, 1983). As such, knowledge of schematic structures for discourse, as reflected by narrative retelling ability and literal comprehension, support inferential comprehension. The findings illustrate a cohesive relationship between discourse-level skills, indicating that strong foundations in narrative retelling and literal comprehension support inferential comprehension ability.

This study also found that theory of mind, a cognitive skill, supports inferential comprehension. This may occur in a top-down way as stored knowledge of, and online, social cognition processes may contribute to the development of situation models; thus supporting inferential comprehension. As van Dijk and Kintsch (1983, p. 83) note, "...the hearer makes assumptions... This information may be drawn from episodic memory already established... or be inferred from the representation of the actual social context and communicative situation".

The profile created by this study exhibits some similarities and some differences compared to profiles of young typically developing children. In particular, recent studies have examined the language and cognitive skills which significantly predict oral narrative comprehension abilities in Italian-, Finnish-, French-, and English- speaking children of a similar age to this study. Florit et al. (2011) found that receptive vocabulary and verbal intelligence (measured by word definitions and identifying similarities) accounted for significant variance in the overall story comprehension abilities of 221, typically developing 4 to 6 year old Italian-speaking children. In their longitudinal study of 130 Finnish-speaking children aged 4 to 6 years, Lepola et al. (2012) found that expressive vocabulary (definitions) and sentence repetition (episodic buffer component of working memory) were significantly related to inference-making abilities. The primary outcome measure in the Lepola et al. (2012) study was narrative listening comprehension, reflected by a combination of narrative retelling ability and overall story comprehension. In keeping with the findings of the study reported here, Lepola et al. (2012) found that overall narrative retelling and comprehension skills were significantly related to discourse-level inference-making skills. Potocki et al. (2013) found that significant predictors of overall narrative comprehension in 131 French-speaking 4 to 6 year old children included working memory (central executive), receptive vocabulary, sentence comprehension (judgement of similar meaning), and grammatical and morphological

knowledge (Potocki et al., 2013). Silva and Cain (2015) specifically investigated oral inferential and literal narrative comprehension in 82, 4 to 6 year old typically developing children, and assessed verbal memory (phonological loop), receptive vocabulary, and receptive grammar. Receptive vocabulary was the only significant individual predictor of inferential narrative comprehension (Silva & Cain, 2015). Neither working memory nor grammar were significant individual predictors of inferential comprehension, which parallels the findings of this study.

However, in contrast to the findings of both Silva and Cain (2015) and this study, as reported above, Potocki et al. (2013) found that working memory and grammar skills were predictors of narrative comprehension in typically developing children, while Lepola et al. (2012) also found working memory to be a predictor. These findings may indicate that children with DLD draw on a different profile of language and cognitive skills to some typically developing children. However, the languages of those studies (French and Finnish) also differed to the language (English) used by Silva and Cain (2015) and the study reported here. As such, the language/s spoken by children may also influence the skills drawn on for inferential comprehension, although this requires investigation.

Additionally, poor working memory and grammar are hallmarks of DLD, and the participants in this study showed relatively poor performance (approximately one to two standard deviations below the mean) on the working memory measures (phonological loop and episodic buffer) and the grammar measures (expressive and receptive). In contrast, single-word vocabulary, which emerged as a significant predictor in this study, was within the typical range and very close to the reported standardised mean. Therefore, in terms of language and cognitive skills which contribute in a bottom-up way, it is possible that children with DLD draw on relative language strengths (i.e. vocabulary) to support inferential comprehension, rather than areas of their language and cognitive profile which are relatively weak (i.e. working memory and grammar).

In a study of sentence processing, Pizzioli and Schelstraete (2013) found that 8 to 12 year old French-speaking children with DLD demonstrated thematic integration deficits. Their study showed that although the children with DLD utilised world knowledge, syntactic, and semantic information in the comprehension of simple sentences, they did not integrate these to form an accurate representation of the sentence (Pizzioli & Schelstraete, 2013). This difficulty in integrating language

and cognitive information may have a compounded impact at discourse level, when significantly greater integration of information (i.e. text base and situation model) is required for effective comprehension (van Dijk & Kintsch, 1983). As such, difficulty integrating information at the discourse level may result in children with DLD not drawing on weaker skills, such as grammar, to the same extent as some typically developing children.

The profile of skills identified by this study reflects those skills important for inferential comprehension in one group of 5 to 6 year old children with DLD. This profile of skills may change over time. Similar to Potocki et al. (2013) and Lepola et al. (2012), Karasinski and Weismer (2010) found that receptive vocabulary, receptive grammar, and working memory (central executive and phonological loop) were significant individual predictors of oral inferential comprehension in a mixed group of adolescents (typically developing, low cognition, DLD or non-specific language disorder). Thus, perhaps as weaker language and cognitive skills (such as grammar and working memory) develop over time, a changing profile of skills contribute to inferential comprehension in children with DLD. Again, this highlights an area for future investigation through a longitudinal study.

It is important to note that the results reported here reflect the type of inferences assessed in this study, i.e. those drawn at discourse-level in the context of a narrative. These types of inferences are integral to oral discourse comprehension in the classroom, and for later reading comprehension. However, different types of inferences, such as text-connecting inferences at sentence and paragraph-level, may draw on a different profile of language and cognitive abilities.

The following sections will discuss, in greater detail, each of the individual language and cognitive skills investigated in this study. Skills identified as significant predictors of inferential comprehension will be discussed first, followed by those which were not significant.

Skills which contributed significantly to oral inferential comprehension

Narrative retell

Both the individual narrative retell measures (macrostructure and microstructure) were significant individual predictors of inferential comprehension. Individually, narrative retell macrostructure explained 18.3%, and microstructure

explained 14.6%, of the variance in oral inferential comprehension scores. The measures each showed significant, positive, and medium to large correlations with inferential comprehension scores (macrostructure $r^s = .410$, $p < .001$; microstructure $r^s = .332$, $p < .01$).

Narrative retelling (a combination of macrostructure and microstructure) is a discourse-level skill which reflects how well an individual is able to store, process, and recall a story. Narrative macrostructure reflects the organisation of a narrative, which is usually based on the story grammar (i.e. sequencing of the event structure, cause and effect). Narrative microstructure involves the language used within a narrative (e.g., sentence structures and conjunctions, vocabulary – adjectives and cognitive verbs, etc). Narrative retelling ability therefore reflects the internalisation of a narrative. As such, it was expected that narrative macrostructure and microstructure would be significant predictors of inferential comprehension.

Minimal research exists which has examined this relationship, however Norbury and Bishop (2002) found that story *recall* (scored by number of propositions recalled and inferences explicitly stated in story retell) and story comprehension were significantly related in a group of children with DLD, PLI, and high-functioning ASD. However, the task description and scoring reflected a high demand on memory and inferential comprehension, rather than the macrostructure or microstructure of the retell. Norbury and Bishop (2002) noted that narrative comprehension supports narrative retell by allowing the listener to construct a more stable representation of the story, thus reflecting the situation model (van Dijk & Kintsch, 1983). The results of this study add to this and indicate that narrative retelling ability also supports inferential narrative comprehension.

In terms of van Dijk and Kintsch's (1983) discourse comprehension theory, this finding highlights the importance of higher level narrative discourse skills for inferential comprehension. Inferences are thought to be drawn via comparison between the textbase and situation model during discourse comprehension (Graesser et al., 1994 ; van Dijk & Kintsch, 1983). The situation models used during discourse comprehension are developed from schemas (van Dijk & Kintsch, 1983) and, therefore, the robustness of schemas provide a foundation for inferential comprehension. Strong narrative retelling skills reflect internalisation of the organisation and language of a narrative and, as such, the structure and quality of the schemas available to an individual. In order to retell a narrative accurately and

coherently, the individual must draw on the best corresponding schema available as a scaffold to support recall. In this way, narrative retelling provides a strong foundation to support successful inferential comprehension.

Dodwell and Bavin (2008) found that children with DLD showed better inferential comprehension of stories they had generated themselves, compared to those they had not, which is consistent with this interpretation. Their results indicated that underlying, internalised story knowledge and structure (as reflected by narrative generation) supported inferential comprehension. In other words, the schema drawn on to generate a story supported inferential comprehension of that story (Dodwell & Bavin, 2008). As such, the availability of robust schemas for narrative retelling and generation are important to support inferential comprehension.

The finding that narrative retelling is a significant predictor of inferential comprehension in children with DLD is clinically relevant in terms of intervention. Interventions which include focus on narrative retelling ability may better support the development of inferential comprehension in this population.

Literal comprehension

As expected, literal comprehension was a significant predictor of inferential comprehension, explaining 10.8% of individual variance in inferential comprehension scores. The literal comprehension measure showed a significant, positive, and medium to large correlation with inferential comprehension scores ($r^s = .339, p < .01$).

Literal comprehension involves remembering and recalling information which has been explicitly stated. This base of recalled information is therefore an important foundation from which inferences can be drawn. Although literal and inferential comprehension reflect separate skills, few studies have considered them separately or investigated the relationship between them.

Both bottom-up and top-down processes may contribute to successful literal comprehension of narratives. Literal comprehension is thought to rely heavily on working memory to recall information via the surface representation and textbase. This provides a foundation to support inferential comprehension processes, such as drawing a link between stated (literal comprehension) and unstated information to form an inference. Accurate literal comprehension is also thought to draw on the situation model (i.e. utilising long-term knowledge to support the textbase representation). For example, it may be easier to maintain the textbase

representation for literal recall if it 'fits' with the situation model being drawn on. The robustness of the situation model relies upon the schemas available as a structure to organise the discourse. In this way, the bottom-up and top-down processes contributing to literal comprehension may act to support inferential comprehension.

This study's finding was supported by Barnes et al. (1996), who found that literal comprehension in a group of 51 typically developing children aged 6 to 15 years was a significant predictor of the ability to make coherence inferences (Barnes et al., 1996). However, Barnes et al. (1996) found that literal comprehension was not a significant predictor of the ability to make elaborative inferences. They hypothesised that coherence inferences (which are required to maintain understanding) are highly integrated with working memory in remembering information to maintain an understanding of the text, and therefore may be more related to literal comprehension which also relies on memory by recalling information.

Hua and Keenan (2014) assessed 39 poor-oral comprehenders and 39 controls, aged 8 to 18 years, and found that text memory (memory for the premises related to questions) significantly contributed to inferential comprehension ability and accounted for group differences in comprehension ability. Although the participants were older, as text memory is the basis of literal comprehension, the findings support those of this study in demonstrating that literal comprehension (as reflected by recall of important premises in a text) is important for inferential comprehension (Hua & Keenan, 2014).

Inferential and literal narrative comprehension and narrative retell are discourse-level skills. In summary, the current findings highlight the importance of considering discourse-level skills in an integrated way, both theoretically and clinically. Theoretically, the finding points to the integral nature of discourse schemas in underlying these skills and their role in supporting inferential comprehension. Clinically, the findings indicate that targeting a variety of discourse-level skills (i.e. narrative retell and literal comprehension) in intervention will support the development of inferential comprehension.

Theory of mind

Theory of mind ability was a significant individual predictor of inferential comprehension ability, explaining 12.6% of the variance in inferential comprehension

scores. Theory of mind scores showed a significant, positive and medium correlation with inferential comprehension scores ($r^s = .312, p < .01$). To current knowledge, this is the first study which has investigated the specific relationship between theory of mind and oral inferential comprehension in children with DLD.

Theory of mind is the ability to understand that another individual's perspective may be different to one's own. Therefore, it is not surprising that ToM was significantly related to inferential comprehension of discourse, as conversation and narrative forms of communication are based upon on the experiences of people and characters. A number of the types of inferential questions commonly used for narrative comprehension assessment relate clearly to aspects of ToM development, such as understanding character emotions and actions (e.g. "How do you think the character is feeling? Why?", "why do you think the character decided to...?"). Using theory of mind ability to understand or infer character motivations and fears would allow an individual to form a better understanding of cause-effect relationships, make predictions, and comprehend the 'gist' of a discourse. This understanding and reasoning reflected by theory of mind development may support the development of situation models. Situation models reflect personalised experiences and stored knowledge related to a text, thus an individual's theory of mind development, as based on experience, may be reflected in the situation model, in turn supporting inferential comprehension (van Dijk & Kintsch, 1983). As such, the variety and quality of experiences a child has in interacting with others and being exposed to contexts which facilitate theory of mind development (such as family discussions about thoughts and feelings, and narratives which explore the character's mental states), the better able they will be to integrate this knowledge to support inferential comprehension (Bishop, 2014b; Westby & Robinson, 2014).

This finding both supports and advances previous studies which have demonstrated a relationship between language development and ToM, and which have shown that children with DLD demonstrate delayed theory of mind development (Andrés-Roqueta et al., 2013; Farrar et al., 2009; Ford & Milosky, 2003; Ford & Milosky, 2008; Nilsson & de López, 2016; Norbury, 2005; Spanoudis, 2016; Taylor et al., 2014; Wilde Astington & Jenkins, 1999). The findings are also consistent with those of Ford and Milosky (2003, 2008) and Loukusa et al. (2014), who found that, while children with DLD may be able to recognise and match simple

emotions visually, they demonstrate poor performance on higher level emotion tasks which involve using context.

This study found a specific, significant relationship between theory of mind and inferential comprehension, and showed that ToM was a significant individual predictor of discourse-level inferential comprehension in the group of young children with DLD. Given the overlap of many of the skills required for ToM and inferential comprehension, there may be a reciprocal relationship in the development of these complex skills. Also, given that past research has found that children with DLD show delayed theory of mind development, it may be an important early intervention target in this population to support pragmatic skills and social-emotional development. In addition, the clinical implication of this study's finding is that intervention targeting theory of mind may support the development of inferential comprehension in children with DLD.

Vocabulary

Overall single-word (receptive and expressive) vocabulary ability was a significant individual predictor of inferential comprehension ability, explaining 5.5% of the variance in inferential comprehension scores. Vocabulary showed a significant, positive and small to medium correlation with inferential comprehension scores ($r^s = .245, p < .05$).

A number of studies have investigated the influence of receptive vocabulary on comprehension in children, but few have focused on expressive vocabulary. This study included both expressive and receptive vocabulary to reflect overall vocabulary in terms of both use and understanding. Vocabulary supports discourse comprehension in a bottom-up way by building meaning in the textbase (Bishop, 2014b; van Dijk & Kintsch, 1983). Poor vocabulary knowledge would hinder the ability to develop an accurate textbase and gain meaning from language, therefore adversely impacting comprehension and the ability to draw inferences via interaction between the textbase and situation model.

Interestingly, the participants' overall vocabulary mean score ($M = 98.85$) demonstrated that, as a whole, vocabulary ability was within the average range of the typically developing standardisation population ($M = 100, SD = 15$). This contrasts past research which has demonstrated that many children with DLD show ongoing poor vocabulary ability (Hick, Joseph, Conti-Ramsden, & Serratrice, 2002;

McGregor, Oleson, Bahnsen, & Duff, 2013; Rice & Hoffman, 2015). However, this study assessed children who were receiving intensive language support and, in addition, did not have a control group of age-matched typically developing children in the Western Australian population to compare vocabulary means.

The findings of this study align with a number of other studies which have demonstrated that receptive vocabulary contributes significant variance to *overall* story comprehension and reading comprehension ability in typically developing children (Cain & Oakhill, 2014; Currie & Cain, 2015; Florit et al., 2009; Florit et al., 2011; Potocki et al., 2013; Silva & Cain, 2015). Tompkins et al. (2013) found that expressive, but not receptive, vocabulary was a significant predictor of *overall* story comprehension in typically developing 4 to 5 year old children. Although Norbury and Bishop (2002) found a significant correlation between receptive vocabulary and *overall* story comprehension in children with DLD, PLI and ASD aged 6 to 10 years, they found that specific inferential comprehension deficits were not attributable to poor vocabulary.

As mentioned, few studies have considered the skills of literal and inferential comprehension separately. However, supporting the finding of this study, Silva and Cain (2015) found that receptive vocabulary was the only significant predictor of oral inferential comprehension, and literal comprehension, of a narrative in typically developing English-speaking children aged 4 to 6 years. However, Florit et al. (2011) found that receptive vocabulary accounted for individual differences in literal, but not inferential, comprehension in 4 to 6 year old Italian-speaking children. Florit et al. (2011) noted that typically developing young children may draw on receptive vocabulary skills to a greater extent during literal comprehension. However, verbal intelligence (vocabulary depth, reflected by word definitions and identifying similarities) was a significant predictor of both inferential and literal comprehension, indicating that *quality* of vocabulary knowledge may be important for inferencing (Florit et al., 2011).

Similar to Florit et al. (2001), a number of studies have included measures of vocabulary *breadth* (vocabulary size) and *depth* (knowledge about vocabulary, tapping deeper semantic knowledge), which this study did not. Currie and Cain (2015) looked into the influence of vocabulary and working memory on the local and global coherence inference generation of 130, 5 to 10 year old children. Vocabulary breadth and depth (assessed with a word associations task tapping semantic

categories) explained significant variance in local and global coherence inferencing of the typically developing children aged 6 and 8 years, but did not explain significant variance for the 10 year olds (Currie & Cain, 2015). The vocabulary tasks were not separated, so the individual contributions of the vocabulary breadth versus the depth tasks to inferencing were not reported.

Other studies have found that vocabulary depth, but not breadth, is a significant predictor of comprehension (Cain & Oakhill, 2014; Lepola et al., 2012; Ouellette, 2006; Roth et al., 2002). As these studies tend to focus on reading comprehension and, therefore, tend to include older participants, the quality of the knowledge about vocabulary (depth) may be increasingly important for comprehension as children grow older, while the importance of vocabulary size (breadth) may reduce. Additionally, longitudinal research has found that vocabulary depth is significantly poorer in children with DLD than typically developing peers, so this skill may be important to assess in future research (McGregor et al., 2013).

However, the relationship between vocabulary development and inferential comprehension is also likely to be reciprocal. One study recruited 504 second grade (7 year old) students and found that reading comprehension at the beginning of the school year accounted for 47% of the variation in vocabulary at the end of the school year, whereas vocabulary accounted for 34% of the variation in reading comprehension over the same time period (Eldredge, Quinn, & Butterfield, 1990). Supporting vocabulary development may thus support comprehension, and vice versa.

This study found that overall single-word vocabulary (breadth) was a significant predictor of oral inferential comprehension ability in a group of 5 to 6 year old children with DLD. As such, vocabulary skills may be an important intervention target to support oral inferential comprehension in this population. Given the past findings regarding depth of vocabulary knowledge, it would be useful for future research to include measures of vocabulary depth to investigate whether the quality of stored vocabulary knowledge is important for inferential comprehension. Additionally, vocabulary depth may become increasingly important as vocabulary breadth development slows, so future research should investigate vocabulary depth over time in children with DLD.

Skills which did not contribute significantly to oral inferential comprehension

Expressive and receptive grammar

While it is well known that one of the primary hallmarks of children with DLD is disordered expressive and receptive grammar development (Leonard, 2014), in this study, neither measure of expressive or receptive grammar was a significant individual predictor of inferential comprehension score. The expressive grammar measure showed a significant, small to medium correlation ($r^s = .264$, $p < .05$) with inferential comprehension, while receptive grammar showed a non-significant, small correlation ($r^s = .180$, $p > .05$). Grammar is thought to contribute to comprehension in a bottom-up way by influencing the meaning representation in the textbase (van Dijk & Kintsch, 1983). While language comprehension undoubtedly requires grammatical skills, the results of this study indicate that grammar was not a key individual contributor to inferential comprehension of narratives in this group of children with DLD. In a clinical sense, this indicates that expressive and receptive grammar at the word- and sentence- level, while important intervention targets to support the language development of children with DLD (Ebbels, 2014), are unlikely to be important intervention targets to improve discourse-level inferential comprehension. It is important to note that the narrative microstructure measure reflected sentence structures and conjunctions (among other areas of language use), indicating that discourse-level grammar ability may be important for inferencing.

The findings of a recent study by Silva and Cain (2015) align with this study. Silva and Cain (2015) found that receptive grammar was not a significant predictor of inferential comprehension of a wordless picture book in typically developing 4 to 6 year old children. Receptive grammar was measured using the same assessment as that used in this study (TROG-2), and the age of the participants closely matched this study, however the participants were typically developing. In line with the findings of Silva and Cain (2015), and those of this study, studies investigating reading comprehension have found that grammar skills do not differentiate between children classified as good and poor reading comprehenders, nor contribute significant variance to later reading comprehension (Cain & Oakhill, 2006; Roth et al., 2002).

Contrasting these findings, however, Bishop and Adams (1992) found that *overall* story comprehension (inferential and literal) was significantly correlated with receptive grammar in 61 children with DLD aged 8 to 12 years, which was also assessed using the TROG. The specific relationship between receptive grammar and inferential comprehension scores was not reported. However, after controlling for receptive grammar scores Bishop and Adams (1992) found that, while the difference in scores was reduced between the DLD group and typically developing control group, the DLD participants' comprehension remained significantly poorer. This indicated that receptive grammar ability was not a primary contributor to the poor literal and inferential comprehension demonstrated by the DLD group. Similarly, while Norbury and Bishop (2002) found a significant correlation between receptive grammar and story comprehension in children with DLD, PLI, and ASD, they also found that the specific inferential comprehension deficits shown by the participants were not attributable to poor grammar.

Potocki et al. (2013) found that expressive and receptive grammar skills contributed a significant 3% of variance to *overall* oral narrative comprehension in 4 to 6 year old, typically developing French-speaking children. Additionally, Potocki et al. (2013) found that grammar ability (as measured by a grammatical correction task) was a main difference between children with poor inferential comprehension and those with average comprehension. Grammatical *correction* is a metalinguistic skill, and as such involves higher level processing than most expressive and receptive grammar assessments. Potocki et al. (2013) suggested that grammar abilities may be important for inferencing ability in typically developing children, which contrasts the finding of Silva and Cain (2015) with typically developing children and this study's finding with a population of children with DLD.

It is possible that the syntactic structure of the comprehension questions used may have had an impact on the extent to which receptive grammar would impact inferential comprehension (i.e. the more complex syntax used to word an inferential comprehension question, the more a child will be required to draw on their receptive grammar ability in order to answer the question appropriately). The inferential question types used in this study were drawn from prior research, and aimed to use simple and familiar sentence structures to increase the likelihood of the participants appropriately understanding the question (Paris & Paris, 2003). Additionally, the scoring of the responses to inferential comprehension questions in this study was

weighted towards the *content* of the answers (i.e. whether the answer was semantically appropriate in responding to the question), rather than correct expressive grammar. As inferential comprehension was the primary outcome measure, it was pertinent to ensure scoring reflected *comprehension* ability as much as possible. If the questions involved more complex grammar or if the scoring had reflected a stronger reliance on grammatical accuracy, it is possible that word- and sentence-level grammar may have been significant predictors of inferential comprehension. This aligns with the reasoning of early research looking into levels of teacher-child discussion by Blank et al. (1978a, p.38), "In evaluating the responses, it is important to keep in mind that the structure, complexity of length of the child's response is not the central issue. Rather, it is the appropriateness of the response relative to the demand."

Although there was a significant correlation between expressive grammar and inferential comprehension, this study found that neither expressive nor receptive grammar ability contributed significant individual variance to oral inferential comprehension of narratives in a group of young children with DLD. While studies including older children with DLD have found a significant correlation between receptive grammar and *overall* narrative comprehension, they have demonstrated that the poor inferential comprehension shown by the children with DLD was not attributable to grammar (Bishop & Adams, 1992; Norbury & Bishop, 2002). Studies of young typically developing children have found mixed results as to whether expressive and/or receptive grammar contribute significant variance to narrative comprehension ability (Potocki et al., 2013; Silva & Cain, 2015), and neither expressive nor receptive grammar have been found to contribute significant variance to good/poor reading comprehension or to later reading comprehension in typically developing children (Cain & Oakhill, 2006; Roth et al., 2002). The findings of this study therefore align with those including older children with DLD, some studies of younger typically developing children, and those investigating reading comprehension. Although grammar contributes to language comprehension, the results indicate that neither expressive nor receptive grammar ability contribute significant unique variance to oral inferential comprehension of narratives in young children with DLD. The findings have clinical implications in terms of selecting targets for intervention, and raises the issue of considering working on grammar above the

sentence-level (Gillam, Gillam, & Reece, 2012), to support oral inferential comprehension of narratives in this population.

Working memory – phonological loop

This study found that phonological loop ability did not contribute significant variance to inferential comprehension. The correlation coefficient of the phonological loop and inferential comprehension scores was negative, small, and non-significant ($r^s = -.136$, $p > .05$). While phonological loop performance is generally poor in children with DLD and was just over one standard deviation below the mean for this study's participants ($M = 84.78$), the finding indicates that poor phonological loop ability was not a key individual contributor to oral inferential comprehension ability in the group of participants with DLD.

While phonological loop ability is hypothesised to contribute directly to the surface representation during language comprehension, its influence on inferential comprehension in children with DLD was unknown. Strong phonological loop abilities would indicate that an individual has greater capacity to store linguistic information in working memory (which is retained for only a few seconds, unless refreshed via subvocal rehearsal). Hypothetically, better phonological loop abilities would have a positive impact on comprehension overall, as over short periods of time the individual would be able to hold, and thus recall, more verbal information. However, inferential comprehension involves linking information, and as such requires more than just recall. Thus, a less important factor in inferential comprehension may be how long (and how accurately) phonological information is held in working memory. As such, and given the current findings, phonological loop ability may contribute more directly to literal comprehension, which draws more heavily on recall of information via linguistic information in the surface representation.

Previous research findings are equivocal as to whether working memory ability is significantly related to inferential comprehension in typically developing children. Consistent with the findings of this study, Silva and Cain (2015) found that phonological memory (as reflected by digit repetition) was not a significant predictor of inferential comprehension of a wordless picture book in 82 typically developing 4 to 6 year old children. Similarly, Potocki et al. (2013) assessed 131 typically developing French-speaking children aged 4 to 6 years and found that a phonological loop task (non-word repetition) did not account for significant variance

in overall narrative listening comprehension (a mixture of literal and inferential questions which required a yes/no response) (Potocki et al., 2013). Interestingly, a separate working memory task (updating) which involved the participants watching and naming a series of pictures, and then recalling the last or second last picture seen, accounted for the most significant amount of variance (24%) in story comprehension (Potocki et al., 2013). Theoretically, the updating task would draw on both the phonological loop to recall the verbal information (picture names) and the central executive component of working memory (involved in storage and manipulation of information) to hold and retrieve the last or second last picture name (Baddeley, 2003). Potocki et al. (2013) found that a key difference between the children with poor inferential comprehension and those with average comprehension was the working memory task requiring updating, indicating that the central executive component of working memory may be important for inferential comprehension in typically developing children. Additionally, Potocki et al. (2013) found that one of the key differences between children with both poor literal and inferential comprehension, and those with average literal but poor inferential comprehension, was a phonological loop task (non-word repetition). This finding indicated that phonological loop performance may have contributed to poor literal, but not inferential, comprehension in young typically developing French-speaking children.

More recently, Currie and Cain (2015) found that, although simple working memory (measured by word and digit repetition) was related to oral inference generation, neither simple nor complex working memory tasks (reflecting the phonological loop and central executive) contributed unique variance to the generation of local or global coherence inferences in 130 typically developing children aged 5 to 10 years (Currie & Cain, 2015).

Other studies have found that central executive tasks contribute significant variance to overall story comprehension (literal and inferential questions) in typically developing English-speaking children aged 6 to 11 years (Montgomery, Polunenko, & Marinellie, 2009; Pike, Barnes, & Barron, 2010) and typically developing Italian-speaking children aged 4 to 6 years (Florit et al., 2009). Although phonological loop performance was related to story comprehension in these studies, it was only shown to contribute significant variance in the study by Florit et al. (2009). Additionally, while central executive ability predicted reading skills (including overall

comprehension) in 60 Hebrew-speaking children aged 6 years, neither phonological loop nor episodic buffer tasks predicted reading comprehension (Nevo & Bar-Kochva, 2015). Cutting and Scarborough (2006) also found that phonological loop and episodic buffer measures did not contribute significant variance to overall reading comprehension in 97 English-speaking children aged 7 to 16 years.

The study reported here did not include a measure of the central executive component of working memory, as it was considered that young children with DLD would not fully understand the assessment task demands (commonly, backwards digit recall and listening span tasks). Other researchers have found the task demands of central executive assessments to be too complex for typically developing children aged 6 years and under (Currie & Cain, 2015; Gathercole, Pickering, Ambridge, & Wearing, 2004). However, given the findings of studies which have included measures of the central executive, it would be pertinent for future research to include a measure of the central executive (in slightly older children with DLD) to gain a comprehensive understanding of the relationship between all working memory components and inferential comprehension.

There are mixed findings as to whether phonological loop ability contributes significant variance to inferential comprehension in typically developing children, however, phonological loop ability may be important for literal comprehension. A number of studies have shown that central executive performance is significantly related to overall story comprehension.

To current knowledge, this study presents the first investigation of the relationship between the phonological loop and oral inferential comprehension ability at discourse-level in young children with DLD. While most children with DLD demonstrate significantly poor phonological loop ability (Montgomery et al., 2010), confirmed by the scores of the participants in this study, this study found that the phonological loop component of working memory did not contribute significant individual variance to inferential comprehension ability in the group of children with DLD. The link between working memory and discourse-level comprehension (both inferential and literal) in DLD requires further exploration, and future research should aim to include tasks assessing the central executive component.

Working memory – episodic buffer

The episodic buffer measure (sentence repetition) did not contribute significant individual variance to inferential comprehension scores. The small, non-significant correlation coefficient ($r^s = .133$, $p > .05$) indicated a weak relationship between the episodic buffer and inferential comprehension ability.

The episodic buffer is involved in integrating information from the phonological loop and visuo-spatial sketchpad with stored long-term knowledge. Due to the interaction with long-term knowledge, it was hypothesised that episodic buffer ability would contribute to inferential comprehension of children with DLD. However, this relationship was not found. It could be hypothesised that the episodic buffer may be more related to word- and sentence-level skills (bottom-up use of grammar and semantics), rather than the higher level skill of discourse comprehension. This idea is supported by the correlations between the episodic buffer measure and vocabulary ($r^s = .412$, $p < .001$) and expressive and receptive grammar ($r^s = .588$, $.433$, $p < .001$, respectively).

Although sentence repetition is commonly used to reflect episodic buffer functioning, there is also ongoing discussion regarding the episodic buffer component of working memory and the tasks used to assess it (Alloway et al., 2004; Henry, 2010). As such, minimal research exists which has investigated the influence of the episodic buffer component of working memory on inferential comprehension ability.

Episodic buffer ability has been found to be related to sentence comprehension (syntax) in typically developing children aged 4 to 6 years (Boyle, Lindell, & Kidd, 2013). Nevo and Bar-Kochva (2015) investigated the longitudinal relationship between working memory (the central executive, phonological loop, visuo-spatial sketchpad, and episodic buffer) and reading abilities in 60 Hebrew-speaking children, from 6 years of age. The episodic buffer was assessed using sentence span and recall, and reading comprehension was assessed using true/false statements related to two texts. The central executive tasks predicted all reading skills in grade one, and the visuo-spatial sketchpad tasks predicted reading comprehension in two of the later grades (Nevo & Bar-Kochva, 2015). However, consistent with the findings of this study, neither the episodic buffer nor the phonological loop tasks were significant predictors of later reading comprehension.

Similarly, Cutting & Scarborough (2006) assessed 97 typically developing English-speaking children aged 7 to 16 years ($M = 9;7$) on a wide range of language and cognitive assessments, including measures of the phonological loop and episodic buffer (non-word and digit repetition, sentence span, and story recall). Reading comprehension was assessed using multiple choice and open-ended questions (literal and inferential) on three different standardised reading comprehension assessments. The working memory measures did not contribute significant variance to reading comprehension scores (Cutting & Scarborough, 2006).

Episodic buffer functioning has been shown to be related to syntactic comprehension, but not reading comprehension (involving literal and inferential questions). As mentioned, children with DLD tend to show poor performance on episodic buffer tasks. However, this study demonstrated that the episodic buffer measure did not contribute significant variance to inferential comprehension in pre-primary aged children with DLD. Further research is required to clarify the contributions of the episodic buffer to discourse-level comprehension in this population.

Linguistic processing (rapid naming)

The rapid naming measure was not a significant individual predictor of inferential comprehension ability, which was supported by the very weak, non-significant correlation ($r^s = .032$, $p > .05$). The rapid naming measure reflected linguistic processing speed, in terms of retrieval speed of target linguistic material (how quickly a child could name a series of well-known colours and objects). Oral language comprehension is an online task, as the listener must process language in real time for comprehension to be successful, and as such linguistic processing has an influence on language comprehension (Montgomery, 2002b). However, while rapid naming requires the retrieval of well-learned material, comprehension requires more than simply accessing such material. Lower-level processes such as vocabulary are drawn on for individual word meanings, but higher-level processes and structures, such as situation models, are used to support the individual to accurately and efficiently understand the coherent whole during discourse comprehension (Bishop, 2014b; van Dijk & Kintsch, 1983).

Research has shown that rapid automatic naming is one of the strongest predictors of later reading ability (Catts, Gillispie, Leonard, Kail, & Miller, 2002;

Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997). Some studies have demonstrated that children with DLD show poor performance on rapid automatic naming tasks (Coady, 2013; Lahey & Edwards, 1996). However, contrasting these findings, the mean of the rapid naming task for the DLD participants in this study was within the typical range, although the standard deviation was large ($M = 92.97$, $SD = 13.84$). To current knowledge, this is the first study to investigate the link between rapid automatic naming and inferential comprehension in children with DLD.

Lahey and Edwards (2001) found that rapid naming, along with other processing measures (including reaction times), was not significantly related to language disorder severity (as measured by standardised expressive and receptive language assessments) in 66 children with DLD aged 4 to 9 years. Although inferential comprehension was not assessed, the finding aligns with this study in that there was not a direct relationship between rapid naming and general language ability.

The findings of slower linguistic and non-linguistic processing speed (reflected by reaction times) have contributed to theories proposing a generalised limitation in processing capacity to account for some of the language difficulties experienced by children with DLD (Kail, 1994; Leonard, 2014; Montgomery, 2002a). While reaction times reflect more general processing ability than rapid naming, rapid naming can be considered a complex measure of (linguistic) processing speed in terms of the task requirements (left to right sequential scanning, perceptual encoding, lexical search, motor planning and execution) (Lahey, Edwards, & Munson, 2001). Montgomery et al. (2009) evaluated processing speed, measured by auditory-visual reaction times, in 67 typically developing children aged 6 to 11 years to investigate its influence with phonological short-term memory and attentional resource capacity/allocation on oral narrative comprehension ability. The processing speed task accounted for a significant 5.2% of variance in overall story comprehension ability (literal and inferential questions), which indicated that processing speed had a significant influence on overall narrative comprehension ability in the group of older typically developing children. Thus, future research should include more general processing measures (such as reaction time tasks) in investigation of inferential comprehension in children with DLD.

To date, no prior research has investigated the association between linguistic processing speed and inferential comprehension in children with DLD. This study

demonstrated that linguistic processing, as measured by rapid naming, was not a significant individual predictor of inferential comprehension in young children with DLD. Future research would benefit from investigating this relationship further, including using a variety of different processing tasks.

Inhibition (executive functions)

The inhibition tasks (dog/dragon and grass/snow tasks) were not significant individual predictors of inferential comprehension ability, supported by the weak, non-significant correlations ($r^s = .156, .213, p > .05$, respectively). The bear/dragon task (dog/dragon in this study), a go/no-go measure, is a simpler type of inhibition task where the child is required to respond to the target stimuli (the dog's instructions) but inhibit themselves from responding to non-target stimuli (the dragon's instructions). In addition, the child must listen and respond to linguistic stimuli (verbal instructions). Therefore, language processing is involved in the task as the child must, under the monitoring of inhibitory control, comprehend and follow the given instructions for the target stimuli.

The grass/snow task is a complex response inhibition task. During the grass/snow task the child is required to learn and employ a new rule, which conflicts with their existing, established knowledge (Anderson & Reidy, 2012). Thus, they must inhibit the dominant, learnt response to the stimuli in order to respond correctly during the task, requiring consistent and significant monitoring by inhibitory control (i.e. point to the white card when you hear grass and the green card when you hear snow).

The more complex nature of the grass/snow task was supported by the task means (both scored out of 20), as there was a higher mean score and less variability in scores for the dog/dragon task ($M = 18.94, SD = 1.92, \text{range} = 9-20$) than the response inhibition task ($M = 17.01, SD = 3.32, \text{range} = 3-20$). However, although the tasks and scoring used in this research were modified from previous research of executive functions assessment tasks for young children, they are not standardised assessments and ceiling effects were noted as many children scored at or very close to ceiling for both tasks. As such, the validity of the tasks is questionable, and these results must be interpreted with caution. The issue of establishing reliable measurements of executive function skills is ongoing, as a recent study of 1,123 families showed strong measurement invariance of executive functions

assessments, including inhibitory control tasks similar to those used in this study, completed with the participating children at 3, 4 and 5 years of age (Willoughby et al., 2012).

A number of studies have demonstrated that children with DLD exhibit deficits in inhibitory control (in addition to other areas of executive functions, such as updating and planning) compared to typically developing peers (Im-Bolter et al., 2006; Marton, 2008; Pauls & Archibald, 2016; Roello et al., 2015; Wittke et al., 2013). However, not all studies have confirmed these findings, as 31 Hungarian-speaking children with DLD aged 7 years performed similarly to 31 age- and nonverbal IQ-matched typically developing children on inhibition and updating tasks (Lukacs, Ladanyi, Fazekas, & Kemeny, 2016). In addition, the development of inhibition (and attention shifting) was *predicted* by general language skills (expressive and receptive vocabulary, and general knowledge) in 132 children aged 3 to 5 years from low income families (Fuhs & Day, 2011). Thus, although most studies have found poor inhibitory control in children with DLD, contrasting results exist and the nature of the relationship between language skills and inhibition is unclear (i.e. language skills may have a greater influence on the development of inhibition, than vice versa).

It is pertinent to consider that inhibition relates to the *deliberate* suppression of automatic responses (Anderson, 2002; Miyake et al., 2000). Studies of adults have found that less-skilled reading comprehenders are poor at suppressing irrelevant information during reading comprehension and, as a result, may develop too many mental representations during comprehension (Gernsbacher & Robertson, 1999; Gernsbacher et al., 2004; Gernsbacher et al., 1990). Suppression of irrelevant information is important to form a coherent textbase, and allow for inferencing. There may be differences between oral and reading comprehension, as reading comprehension (particularly in adults) may be more goal-driven than oral comprehension and, therefore, more deliberate. During oral narrative comprehension, children are generally not explicitly reminded to inhibit irrelevant information, and therefore children may not be engaging in 'deliberate' inhibition. This aligns with research investigating children with poor reading comprehension, who have been shown to demonstrate poor inhibition (Locascio et al., 2010; Palladino & Ferrari, 2013), and for whom inhibition, among other executive functions skills, contributes significant variance to inferential *reading* comprehension (Potocki

et al., 2015). Future research could investigate differences in oral and reading comprehension, particularly in terms of goal-directed comprehension. Additionally, future research would benefit from investigating developmental changes in inhibition and oral inferential comprehension, including the nature of the relationship and how it may change over time (Roello et al., 2015).

To current knowledge, this is the first investigation of the specific relationship between executive functioning and oral inferential comprehension in children with DLD. As past research has demonstrated a significant relationship between executive functioning and general language abilities in children with DLD, it was hypothesised that inhibition may be a significant contributor to inferential comprehension ability (Wittke et al., 2013). This study has demonstrated that, in a group of young children with DLD, inhibition was not a significant predictor of oral inferential comprehension. However, the assessment tasks used demonstrated ceiling effects, so the results should be interpreted with caution. Further research is required to provide evidence-based, reliable measures of executive functions in young children (Willoughby et al., 2012). In addition, future research should further explore the relationship between inferential comprehension and a wider range of executive function abilities in children with DLD. In particular, it would be pertinent to assess the executive function skill of planning, which has been shown to be related to inferential *reading* comprehension in older children with reading comprehension difficulty (Potocki et al., 2015).

Limitations

There are a number of limitations to this study. Firstly, narrative comprehension and narrative retell measures were assessed using a task which was not standardised. However, the comprehension assessment was adapted based on research by Paris and Paris (2003) (see Measures), and included a range of inferential comprehension questions to assess discourse-level understanding in the narrative context (reflecting the classroom context), therefore aligning with the aims of the study and allowing for practical interpretation of the results. Additionally, the NCA was piloted on a small sample of typically developing children ($n = 4$) and in a larger pilot study (see Appendix H), which provided some norm-referencing to ensure that the scoring was based on the responses of typically developing children

of the same age as the participants in this study. Additionally, inter-rater reliability ensured that scoring judgements met reliability standards.

Secondly, it would have been useful to include additional assessment tasks reflecting a wider variety of skills. The selection of tasks for the assessment battery was restricted due to analytical limitations, assessment time limitations with participants, the complexity of requirements for some assessments, and the available literature at the time of planning the study. A measure assessing the depth of vocabulary knowledge, rather than just the breadth of vocabulary, would have been valuable given the findings of recent research (Cain & Oakhill, 2014). Also, given the findings of past studies, it would have been advantageous to include a measure assessing the central executive component of working memory (Montgomery et al., 2009; Nevo & Bar-Kochva, 2015; Potocki et al., 2013). In addition, there is debate regarding the use of sentence repetition to assess the episodic buffer component of working memory (Alloway et al., 2004; Henry, 2010; Klem, et al., 2015; Kuusisto, Nieminen, Helminen & Kleemola, 2017; Moll, Hulme, Nag, & Snowling, 2013).

Thirdly, the executive functions tasks used in this study were not standardised, and the results of both tasks demonstrated ceiling effects. As such, the results must be interpreted with caution. As discussed in the executive functions section, further research is required to ensure valid and reliable assessments of executive functions for young children. Future research should include assessments measuring other areas of executive functioning, particularly switching (Im-Bolter et al., 2006; Marton, 2008; Pauls & Archibald, 2016; Roello et al., 2015; Wittke et al., 2013).

Fourthly, while the sample size for the study was large considering the DLD research literature, a larger sample size would have better powered the analyses. Additionally, statistical issues (suppressor effects) hindered the ability to interpret the results of multiple regressions and, thus, develop an integrated profile of language and cognitive skills. Hopefully future research will be able to address these issues.

Finally, this study did not include a typically developing group of children for comparison nor investigate different age groups of children with DLD. Including a group of typically developing children would have been useful to enable a comprehensive profile of the skills used for inferential comprehension for comparison to the profile of children with DLD. However, the aim of the study was to investigate

inferential comprehension in young children with developmental language disorder, as it is a skill in which they show significant difficulty. Including different age groups of children with DLD would also provide useful information on how the profile of skills which are important for inferential comprehension may change over time. It would therefore be beneficial for future research to include typically developing and DLD populations, and to include a wider age range of participants with DLD.

Study One Conclusion

This study has provided the first comprehensive profile of the language and cognitive skills which contribute significantly to oral inferential comprehension in young children with DLD, a skill in which children with DLD perform particularly poorly and which is extremely important for success in both oral communication and later reading comprehension. The results demonstrated that significant individual variance in inferential comprehension in the cohort of young children with DLD was predicted by a combination of language and cognitive skills. Of the language and cognitive skills assessed, the best predictors of inferential comprehension in pre-primary aged children included: narrative retelling ability (macrostructure and microstructure), literal comprehension of narrative, theory of mind, and overall vocabulary. The findings support the idea that successful inferential comprehension requires effective integration of a variety of language and cognitive abilities. In particular, discourse-level skills (narrative retelling and literal comprehension) predicted the greatest individual variance in inferential comprehension.

This profile has significant implications for the development and evaluation of interventions aiming to improve inferential comprehension in this population. The results indicate that intervention should target a variety of skills, including those at the discourse-level. Providing intervention which also targets the skills underlying inferential comprehension may be more effective than those which focus solely on inferential comprehension itself. Thus, the profile provides an evidence-base for the creation of targeted inferential comprehension interventions for children with DLD. The results and clinical implications of the profile were used for the second study of this research to create, and trial, an inferential comprehension intervention with pre-primary aged children with DLD. This will be discussed in the next chapters.

Chapter 4: Study Two Literature Review

Chapter Overview

Chapter 3 presented a study which identified the language and cognitive skills which significantly contributed to oral inferential comprehension of narratives in 5 to 6 year old children with DLD. This chapter reviews evidence for interventions targeting literal and inferential language comprehension. The results of Study One (presented in chapter 3) are then combined with the findings of the literature review in this chapter to develop and trial an intervention targeting oral inferential comprehension (Study Two), which is the focus of chapter 5.

Interventions for Children with Developmental Language Disorder

There is increasing evidence regarding the effectiveness of language interventions for children with DLD, such as those targeting phonological awareness, semantics, vocabulary, syntax, and narrative retelling (Boudreau, 2008; Law, Garrett, & Nye, 2004). Two large randomised controlled trials of school-based oral language interventions (targeting narrative, vocabulary, listening skills, and phonological awareness) completed over 20 to 30 weeks with 4 year old children with weak oral language showed gains across oral language skills which were maintained 6 months following intervention (Bowyer-Crane et al., 2008; Fricke et al., 2013). These findings demonstrate that a range of oral language areas can be targeted effectively in interventions for young children with language difficulties.

However, thus far, the evidence base for interventions targeting language comprehension is small, and has had less research focus than those targeting areas of expressive language (Botting, 2008; Law et al., 2004; Nelson, Nygren, Walker, & Panoscha, 2006; van Kleeck, 2008). There is a paucity of research which has investigated the effect of interventions designed to improve comprehension in general and, in particular, interventions which target oral inferential comprehension (Law et al., 2004; Paris & Paris, 2007; van Kleeck, 2008).

This chapter will review the research evidence for interventions that target literal and inferential language comprehension, both directly and indirectly. The majority of research has investigated interventions for *reading* comprehension, highlighting the link between oral and written comprehension. While reading

comprehension interventions do not themselves specifically target oral language, most focus on or include oral language skills within the intervention approach or strategies, and many reading comprehension interventions indirectly target both literal and inferential language comprehension. Therefore, this chapter will begin with an overview of reading comprehension interventions which used strategies directly related to inferencing and/or which aimed to improve inferential comprehension. This will be followed by an overview of intervention studies which have targeted oral narrative and theory of mind – areas related to inferential comprehension – in children with DLD and in different populations. Finally, two studies to date that have specifically aimed to improve oral inferential comprehension in young children with DLD will be discussed in detail. Where applicable, the level of evidence in accordance with the National Health and Medical Research Council evidence hierarchy (NHMRC, 2009) is reported for each intervention study⁷. The intervention research presented in this chapter will then, in combination with the findings of Study One, inform the background and intervention principles of Study Two.

Reading Comprehension Interventions

Reading comprehension development, difficulties, and interventions have received greater research focus than oral language comprehension. In the ‘simple view of reading’, introduced by Gough and Tunmer (1986), proficient reading ability is said to be the product of both phonological decoding *and* language comprehension. As such, reading difficulties will arise if a child has difficulty with decoding and/or oral comprehension (Gough & Tunmer, 1986). The integral nature of oral comprehension to reading ability has been studied for decades (Bentin, Deutsch, & Liberman, 1990; Cain & Oakhill, 2006; Cain et al., 2004; Hulme & Snowling, 2011; Nation et al., 2010; Nation & Norbury, 2005; Oakhill & Cain, 2012; Roth et al., 2002; Spencer et al., 2014). In particular, poor inferential comprehension has been shown to be a key differentiator between good and poor reading comprehension ability, with a potential causal relationship (Cain & Oakhill, 1999; Oakhill, 1984).

⁷ NHMRC Evidence Hierarchy for intervention studies includes level I – a systematic review of level II studies; level II – a randomised controlled trial; level III-1 – a pseudo-randomised controlled trial; level III-2 – a comparative study with concurrent controls; level III-3 – a comparative study without concurrent controls, and; level IV – a case series with either post-test or pre-test/post-test outcomes.

A cross-sectional study of over 425,000 children, and a separate longitudinal study of 242 children, demonstrated that most children with poor reading comprehension present with underlying oral language difficulties (Nation et al., 2010; Spencer et al., 2014). In addition, oral inferencing ability at 7 to 8 years of age has been found to be a significant predictor of reading comprehension at 10 to 11 years of age (Oakhill & Cain, 2012). Findings such as these highlight the need to address oral language skills in interventions to improve reading comprehension, and indicate that addressing oral language difficulties at an earlier age may support later reading comprehension.

It is therefore of critical importance to identify oral language comprehension difficulties in young children prior to the emergence of any reading comprehension difficulties (Cain & Oakhill, 2007b; van Kleeck, 2008). Ongoing language comprehension difficulties not only impact communication and learning in oral language, but have a significant and adverse impact on learning through reading; and adequate reading comprehension is vital once children reach the 'reading to learn' phase (Ricketts, 2011).

Reading comprehension interventions in typically developing and 'poor' readers

Reciprocal teaching has been the focus of many reading comprehension interventions, and the strategies of reciprocal teaching were introduced and evaluated in two seminal studies (level III-2) reported by Palinscar and Brown (1984). Reciprocal teaching involves naturalistic discussion between a teacher and student/s about a text with the clear goal of gaining meaning from the text, using strategies which promote both comprehension monitoring and comprehension of the text itself. These include summarising (self-review of understanding of the text), questioning (concentrating on main ideas and understanding), clarifying (critically evaluating), and making predictions (drawing and testing inferences) (Palinscar & Brown, 1984). Twenty-four grade 7 students (12 years of age) who had adequate reading fluency but poor reading comprehension participated in the first intervention study in pairs. The participants were divided into four groups: one group received reciprocal teaching intervention; one group received locating information intervention (answering questions with the teacher guiding them on how to find the information

needed to answer questions); and two control groups (one of which read and answered comprehension questions and the other received no intervention). The reciprocal training group improved significantly on daily comprehension assessments compared to the three other groups. In addition, three months following the intervention study most of the reciprocal training group participants had made significant gains on a standardised reading comprehension assessment. A follow up study of a separate group of 21 students showed the same pattern of results for reciprocal teaching intervention (Palinscar & Brown, 1984). While it was unclear whether the participants were randomly allocated to groups, the inclusion of control groups and maintenance assessment increased the strength of evidence provided by these studies.

More recently, an intervention study (level III-1) found long-term, generalised reading comprehension improvements (including prediction, which reflects inferential comprehension) following traditional reciprocal teaching in 210 German-speaking children from grades 3 to 6 of schooling (Spörer, Brunstein, & Kieschke, 2009). Two schools were assigned to either the control condition (teaching as usual) or the intervention condition. The students at the school receiving intervention were randomly assigned to one of three interventions (all of which involved some reciprocal teaching strategies). While all intervention groups showed improvements on non-standardised reading comprehension assessments compared to the control group at post-intervention and maintenance, only the students who received traditional reciprocal teaching in small groups showed significant improvement on a standardised reading comprehension assessment at maintenance (3 months following the interventions). These findings provide strong support for traditional reciprocal teaching intervention in terms of providing long-term, generalised improvements in reading comprehension across a range of students.

A research review of 16 studies (including both published and unpublished studies which used quantitative methodology) focusing on reciprocal teaching to improve reading comprehension found that improvement on standardised reading assessments yielded a small to medium median effect size of .32, with assessments which had been designed by the researchers yielding a large median effect size of .88 (Rosenshine & Meister, 1994). Although literal and inferential reading comprehension were not assessed separately in the studies, the findings indicate the utility of this approach to improving overall reading comprehension. However,

Rosenshine and Meister (1994) reported that the methodological quality of the studies varied (e.g. poor description or implementation of intervention/s).

A number of reading comprehension interventions have focused specifically on improving inferencing. However, an issue with the majority of these studies is that reading comprehension is assessed as a complete construct, with the impact on inferential comprehension not specifically measured. Yuill and Oakhill (1988) (level III-1) evaluated three different interventions in 38 good and poor reading comprehenders aged 7 to 8 years. Fourteen children received inference skills training, 12 children received comprehension exercises, and 12 children received rapid decoding practice. The participants in each skill group (good and poor comprehenders) were randomly allocated to the interventions and received the intervention in small groups of three to five children, for seven, 30 minute sessions over four weeks. The inference training involved lexical inferences (looking for clue words), generating 'wh' questions and prediction (sentences missing in the text) (Yuill & Oakhill, 1988). The comprehension exercises intervention involved shared reading of texts followed by comprehension questions, in which the teacher corrected responses which were incorrect but provided minimal feedback. The rapid decoding intervention involved repeated practice of reading word lists. The results showed that the less skilled comprehenders benefited more from all interventions than the skilled comprehenders, who showed little improvement (however as 'skilled' comprehenders they did not necessarily need or have far to improve). The participants who undertook the inference training showed significantly greater reading comprehension improvement than those given the rapid decoding intervention, and improved more than those given the comprehension exercise intervention, although the difference was not significant. This study indicated that a fairly short intervention focused on comprehension skills significantly improved the reading comprehension of poor comprehenders compared to a control intervention, but had minimal effect on skilled comprehenders (Yuill & Oakhill, 1988).

Based on the Yuill and Oakhill (1988) research, McGee and Johnson (2003) (level III-1) recruited 20 skilled and less-skilled reading comprehenders aged 6 to 9 years who were randomly allocated to an inference training group and a control group. In keeping with the previous findings, the less skilled reading comprehenders demonstrated significantly greater increases in reading comprehension ability than the skilled comprehenders, and improved significantly more than the less skilled

comprehenders who received the control comprehension training (McGee & Johnson, 2003). Given that these studies included random allocation and control groups, these findings provide strong support for the use of inference training intervention for poor readers.

The following paragraphs discuss the few studies which have specifically measured inferential comprehension of texts as an outcome. Three reading comprehension interventions and a control condition were compared in a large study (level III-1) of 101 grade 5 students (10 years of age) (Dewitz, Carr, & Patberg, 1987). The interventions included cloze-procedures with self-monitoring of comprehension; a structured overview group in which a hierarchical overview of the topics to learn was presented visually, reviewed and discussed each day; a combined cloze-procedures and structured overview group; and a control group (usual classroom instruction) (Dewitz et al., 1987). Inferential questioning was used in all of the treatment groups. The treatments took place in the students' usual social studies class, for three weekly, 40 minute sessions over 8 weeks of schooling. Three of the four classes were randomly assigned to a treatment group or the control group. The cloze-procedure group and the combined group showed significantly higher inferential and literal reading comprehension scores post-intervention than the structured overview and control groups. Given that this study included a range of interventions and a control group, it provides strong evidence identifying that training students to integrate text information with background knowledge (via cloze procedures, self-monitoring, and visual supports) improved both inferential and literal comprehension of written texts (Dewitz et al., 1987).

Johnson-Glenberg (2000) (level III-2) also measured the impact of intervention on inferential reading comprehension. Johnson-Glenberg (2000) compared two reading comprehension interventions: reciprocal teaching (summarisation, clarification, prediction, and generating questions), with visualising-verbalising. Fifty-nine grade 3 to 5 students who presented with adequate decoding but poor reading or listening comprehension took part in the study. They were assigned to small groups of participants in the same school grade, and the small groups were alternately allocated to the two interventions. The participants receiving the interventions ($n = 45$) took part in approximately 28, 30 minute sessions over ten weeks. The control students ($n = 14$), who were recruited from separate schools, completed pre- and post- assessments only (however they received 3 hours of

comprehension training following the study). While both intervention groups performed higher than the untreated control group on inferential comprehension of texts (the means were very similar) post-intervention, only the visualising-verbalising group performed significantly higher (reciprocal teaching $M = 7.06$; visualising-verbalising $M = 7.16$; control $M = 5.31$) (Johnson-Glenberg, 2000). The reciprocal teaching group demonstrated larger average gain in inferential comprehension than the visualising-verbalising group, and showed significantly higher literal comprehension of texts (Johnson-Glenberg, 2000). Although only visualising-verbalising was significant in the analyses, the results indicated that both interventions improved inferential reading comprehension, and that reciprocal teaching was more effective at improving literal reading comprehension.

Elbro and Buch-Iversen (2013) (level III-1) measured inferential comprehension of expository texts following an intervention which aimed to use background knowledge for inferencing. The intervention focused on gap-filling inferences, which involve the reader/listener supplying necessary information to fill a 'gap' in the provided information (Elbro & Buch-Iversen, 2013). Participants included 236, 11 year old Norwegian-speaking children from six schools, who participated in inference training or a control training (teaching as usual). The intervention and control conditions were randomly allocated by school. For the inference condition, the participants' usual teachers implemented the intervention over eight, 30 minute sessions. The intervention sessions focused on short expository texts with questions which requiring gap-filling inferences. Graphic-organisers with missing information were used to teach the participants how to fill the 'gaps' in information from expository texts and to answer questions using background knowledge. The participants' ability to make gap-filling inferences was assessed on short expository texts created by the researchers, and general reading comprehension ability was also assessed. Compared to the control group, the inferencing intervention group demonstrated a significant increase in their ability to make gap-filling inferences and in overall reading comprehension, which was maintained 5 weeks after the intervention (Elbro & Buch-Iversen, 2013). Although teacher effects were not controlled, the use of control groups and the large sample size strengthen the study's results, providing support for relatively short training provided by teachers in mainstream schooling, focused on using graphic organisers and background knowledge to make gap-filling inferences.

Similar results were also demonstrated in a study (level III-1) comparing three types of questioning interventions in 246 English-speaking students aged 9 years with mixed reading abilities (poor, average, and good) (McMaster et al., 2012). Two interventions focused on inferential questions (causal inferences or linking to prior knowledge/information) and one intervention focused on literal questions ('wh' questions including who, what, where and when). Good and poor readers were paired together, and teachers provided the allocated intervention for 20 to 30 minute sessions over 9 weeks. All participants made significant gains from pre- to post-intervention on story recall, however story comprehension was not measured (McMaster et al., 2012). The researchers found two subgroups of poor reading comprehenders. The first group (who produced more invalid inferences) benefited more from the causal questioning intervention, whereas the second group (who paraphrased more) benefited more from the questioning requiring linking of background knowledge (McMaster et al., 2012). Thus, in contrast to the findings of earlier studies, but supporting the finding of Elbro and Buch-Iversen (2013), McMaster et al. (2012) found that children with both good and poor reading abilities benefited from reading comprehension intervention consisting of different types of questioning, as measured by their ability to recall stories. As this study did not include a measure of comprehension, the specific impact of the interventions on reading comprehension cannot be clearly determined.

The relationship between the comprehension of oral and written language, highlighted in the simple view of reading (Gough & Tunmer, 1986), has been further supported by the findings of reading comprehension interventions that also target oral language comprehension. Clarke, Snowling, Truelove, and Hulme (2010) (level II) evaluated three interventions to improve reading comprehension in a randomised controlled trial with a sample of 84 children aged 8 to 9 years. The participants presented with a specific reading comprehension deficit, with at least a one standard deviation discrepancy between standardised reading fluency and reading comprehension scores (Clarke et al., 2010). The participants were randomised to either a waitlist-control group or one of three intervention groups. The text-comprehension training used written texts, focusing on four components: meta-cognitive strategies, reciprocal teaching, inferencing, and written narrative. The oral language training targeted only spoken language, and focused on four components: vocabulary, reciprocal teaching, figurative language, and spoken narrative. The

combined text-comprehension and oral language training integrated the components of both interventions. The participants received 20 weeks of intervention, with three 30 minute sessions per week (two paired sessions and one individual session) run by a trained education assistant. Compared to the waitlist control groups, all three intervention groups showed significant post-intervention increases in reading comprehension scores. The increases were maintained when assessed 11 months following the intervention, and the oral language training group had continued to make significant gains in reading comprehension. Given that the study was a randomised controlled trial, the results provide strong support illustrating that both text and oral-language based comprehension interventions can improve reading comprehension in children with specific reading comprehension difficulty. Pertinently, the ongoing reading comprehension improvement experienced by the children who received the oral language training indicated that oral language ability is a critical underlying factor affecting reading comprehension ability which should be targeted in intervention (Clarke et al., 2010).

Reading comprehension interventions in developmental language disorder

Although many children with DLD experience difficulty with reading comprehension, few studies have investigated the effectiveness of reading comprehension interventions in the DLD population. However, Wright, Mitchell, O'Donoghue, Cowhey, and Kearney (2015) (level IV) investigated reading comprehension intervention for adolescents with DLD and mixed cognitive profiles over two studies using pre- to post-intervention case series design with control assessment tasks. The female participants in both studies were aged between 12 to 14 years and took part in two 1 hour intervention sessions a week for four weeks at their school. The intervention consisted of a number of strategies from reading comprehension interventions, including: activating prior knowledge, generating questions, making predictions, summarising, organising information graphically, and attending to contextual clues to gain word meanings (Wright et al., 2015). In both studies, the students demonstrated significant pre- to post- intervention gains on a standardised reading comprehension assessment. In the second study (Wright et al., 2015), significant improvement on curriculum-relevant texts was also demonstrated.

The results indicated that a fairly brief intervention delivered in mainstream schooling for adolescents with language disorders and mixed cognitive profiles delivered significant reading comprehension gains. However, as the study did not employ a control group, the gains cannot be clearly attributed to the intervention.

Summary of reading comprehension interventions

A recent meta-analysis of reading interventions for poor readers from grade 4 to grade 12 evaluated 82 reading intervention studies published between 1980 and 2011 which used experimental or quasi-experimental treatment comparison, or multiple treatment comparison research designs (Scammacca, Roberts, Vaughn, & Stuebing, 2015). The mean effect size across all reading comprehension measures was 0.45, which indicated a positive, moderate impact of reading comprehension interventions for poor readers. The results of the meta-analysis indicated that the strategies used in reading comprehension interventions are effective at improving *general* reading comprehension ability (Scammacca et al., 2015).

A number of common themes emerge from synthesis of the studies investigating reading comprehension interventions (see Table 6). In particular, reading comprehension interventions can be broadly separated into those which teach children how to look for clues in a text, and those which promote thinking about texts (Oakhill, Cain, & Elbro, 2015). Although many reading comprehension intervention studies have focused on strategies to support inferential comprehension of texts and have reported significant, positive effects on overall reading comprehension, few have specifically measured the effect of such interventions on inferential comprehension. Those studies which have included measures of inferencing have shown significant improvement in inferential comprehension of texts (Dewitz et al., 1987; Elbro & Buch-Iversen, 2013; Johnson-Glenberg, 2000). In addition, reading comprehension intervention studies have generally focused on poor/good comprehenders, or participants from mainstream schools, with few focusing specifically on children with language disorders.

Overall, the studies examining reading comprehension interventions demonstrate that a number of the strategies used in such interventions are effective at improving overall reading comprehension, particularly in children and adolescents who present with poor reading ability. In addition, while at present there is no research with younger children, Wright et al's., (2015) studies showed that reading

comprehension could be improved in adolescents with language disorder. The research demonstrating that poor oral language skills underlie poor reading comprehension supports the key role of oral language comprehension in reading comprehension (Hulme & Snowling, 2014; Hulme & Snowling, 2011; Nation et al., 2010; Nation & Norbury, 2005; Oakhill & Cain, 2012; Spencer et al., 2014). Past research has also shown that young children with DLD are at high risk for later reading difficulties (Catts, Fey, Tomblin, & Zhang, 2002). As noted by van Kleeck (2006), strategic inferencing is generally only taught to children after they commence learning to read, and often only when reading comprehension difficulties arise. It is critical, however, that inferential comprehension skills are first fostered in the oral language of children with poor inferential comprehension to not only support their oral language, but also their later literacy development (Ricketts, 2011; van Kleeck, 2008). Further research is clearly necessary to investigate interventions to improve oral language comprehension in young children with DLD in order to support later reading comprehension.

Table 6: Common Strategies in Reading Comprehension Interventions

| Intervention Strategy | Study/ies |
|---|-----------------------------|
| Answering questions – literal (e.g. who, what, where, etc) and inferential (e.g. causal, linking to prior knowledge, etc) | Clarke et al. (2010) |
| | Dewitz et al. (1987) |
| | Elbro & Buch-Iversen (2013) |
| | McGee & Johnson (2003) |
| | McMaster et al., (2012) |
| | Yuill & Oakhill (1988) |
| Generating questions – related to main ideas in the text | Clarke et al. (2010) |
| | Johnson-Glenberg (2000) |
| | McGee & Johnson (2003) |
| | Palinscar & Brown (1984) |
| | Spörer et al. (2009) |
| | Wright et al. (2015) |
| | Yuill & Joscelyne (1988) |

Table 6 continued.

| | |
|---|---|
| Prediction | Clarke et al. (2010) Johnson-Glenberg (2000) McGee & Johnson (2003) Palinscar & Brown (1984) Spörer et al. (2009) Wright et al. (2015) Yuill & Oakhill (1988) |
| Graphic organisers | Dewitz et al. (1987) Elbro & Buch-Iversen (2013) Wright et al. (2015) |
| Explicit teaching to looking for clues (for important vocabulary or word meanings) | Clarke et al. (2010) McGee & Johnson (2003) Wright et al. (2015) Yuill & Joscelyne (1988) |
| Explicit teaching of inference types – basic (e.g. cohesive inferences) and complex (e.g. bridging and evaluative inferences) | Clarke et al. (2010) |
| Cloze-procedures (gap-filling) | Dewitz et al. (1987) Elbro & Buch-Iversen (2013) |
| Self-monitoring – summarising / clarifying (self-review of understanding of the text) | Clarke et al. (2010) Dewitz et al. (1987) Palinscar & Brown (1984) Spörer et al. (2009) Wright et al. (2015) |
| Meta-cognitive strategies (re-reading, visualising, thinking aloud, and self-explanations) | Clarke et al. (2010) (visualising) Johnson-Glenberg (2000) |
| Activating prior knowledge | Clarke et al. (2010) Wright et al. (2015) |

Table 6 continued.

| | |
|--|----------------------|
| Written and oral narrative structures and production | Clarke et al. (2010) |
| Vocabulary and figurative language instruction | Clarke et al. (2010) |

Narrative-based Interventions

The link between narrative ability and both oral and reading comprehension in different populations of children has been clearly demonstrated (Cain, 2003; Cain & Oakhill, 1996; Lepola et al., 2012; Norbury & Bishop, 2002; Oakhill & Cain, 2012; Wagner, Sahlén, & Nettelbladt, 1999). In Study One of this research, individual discourse-level skills (including narrative macrostructure and microstructure) were shown to be significant predictors of inferential comprehension in 5 to 6 year old children with DLD. Similarly, past research has shown a link between narrative retell and generation, and language comprehension, in children with DLD (Dodwell & Bavin, 2008; Norbury & Bishop, 2002; Wagner et al., 1999). A number of studies have used book-sharing as a narrative context for language intervention, particularly to develop vocabulary skills, and others have focused on narrative macrostructure and/or microstructure to improve narrative retelling and generation (Acosta, Moreno, & Axpe, 2012; Colmar, 2014; Green & Klecan-Aker, 2012; Hickman, Pollard-Durodola, & Vaughn, 2004; Petersen, 2011; Spencer, Kajian, Petersen, & Bilyk, 2013; Tsybina & Eriks-Brophy, 2010; Verhallen & Bus, 2010).

Narratives are a common context for language interventions in speech-language pathology with young children and school-aged children (Hoffman, 2009; Kaderavek & Justice, 2002). In addition, narratives reflect a naturalistic communication context at the discourse-level, providing a more functional environment which supports generalisation to everyday communication (Hoffman, 2009; Kaderavek & Justice, 2002; Paris & Paris, 2007).

As with most other areas of language intervention, narrative-based interventions have typically focused on expressive language (narrative retelling), with few studies specifically targeting or measuring narrative comprehension. The following sections will provide a brief overview of narrative intervention studies which have directly or indirectly targeted comprehension in the following populations:

children with typically developing language, those at-risk, and those with DLD or learning difficulties.

Typically developing and 'at-risk' children

A meta-analysis of 18 studies (both published and unpublished) from 1983 to 2012 examined the effect of adults' inferential book-sharing strategies as a narrative intervention context with young children (Dunst, Williams, Trivette, Simkus, & Hamby, 2012). A majority of the included studies focused on typically developing children, with a smaller number including at-risk children and two studies including children with communication impairments. The interventions were provided by either parents or teachers, and a range of standardised and non-standardised assessments were used to measure outcomes across expressive language, receptive language, and literacy. A medium mean effect size was found for expressive language outcomes and a small effect was found for receptive language and literacy outcomes (Dunst et al., 2012). Some inferential strategies were reported to be more effective than others for expressive and receptive language outcomes, such as asking open-ended questions, relating the story to a child's personal experiences, asking the child to make predictions, and providing or asking for de-contextualised explanations of a story. Overall, the meta-analysis indicated that parent or teacher-lead book-sharing using inferential comprehension strategies within a narrative context has a positive impact on the development of young children's expressive and receptive language, and literacy (Dunst et al., 2012). However, similar to other research, receptive language skills demonstrated less improvement from these interventions than expressive language (Law et al., 2004).

Some studies have specifically investigated the influence of narrative interventions on comprehension in typically developing children. Morrow (1985) (level III-1) included 82 children aged 5 years and investigated a narrative retelling intervention in which students were guided to retell narratives through the use of questions related to macrostructure elements. This was compared to a control intervention in which students were asked to draw a picture of the story. Participants from two classrooms were randomly allocated to the intervention or control intervention groups. The participants completed weekly individual intervention sessions over 8 weeks. Compared to the control group, the narrative retelling group made significant gains on both narrative comprehension (assessed by literal and

inferential questions) and narrative retell (macrostructure and microstructure) measures (Morrow, 1985). Given that a control intervention was used and that the random allocation of participants controlled for teaching effects, these findings provide strong support for the use of repeated narrative retelling practice to improve both narrative retelling and comprehension in young typically developing children.

Similarly, Strouse, O'Doherty, and Troseth (2013) (level III-1) found significant differences in story comprehension across intervention groups following a parent-led questioning intervention watching storybook videos. Parents of 81, typically developing 3 year old children took part in the study, and were assigned to one of four interventions: dialogic questioning (pausing and asking questions), directed attention (pausing and commenting), dialogic actress (questions asked on the video), and control (video as usual). The parents in the dialogic questioning group were trained using the dialogic reading questioning strategies introduced by Whitehurst et al. (1988), which were adapted by Strouse et al. (2013) for use with storybook videos. Dialogic strategies include asking open-ended questions over repeated readings of stories (and decreasing the number of questions that can be answered by pointing), responding to the child's answers, particularly by expanding on what they have said, and linking story components to personal experiences (Strouse, O'Doherty, & Troseth, 2013; Whitehurst et al., 1988). Over four weeks the parents were asked to follow the intervention instructions and show their child one of four videos three to five times a week. Following the intervention period, the children in the dialogic reading group obtained story comprehension scores (assessed by literal and inferential questions related to a video) which were significantly higher than the children in the directed attention and control groups, and higher (but non-significant) scores than the children in the dialogic actress group (Strouse et al., 2013). All of the children showed significant improvement in story-specific vocabulary following the interventions, and on a standardised expressive vocabulary measure the two parent-interaction groups (dialogic strategies and directed attention) showed significant pre- to post-intervention improvement. The results indicated that parent interaction during book-sharing (via videos) was related to expressive vocabulary growth and, critically, that interaction in the form of questioning and response led to better story comprehension in typically developing 3 year old children (Strouse et al., 2013).

Other studies have shown language benefits following parent-based book-sharing interventions. Peterson, Jesso, and McCabe (1999) (level II) found that

parent book-sharing training had a positive influence on the receptive vocabulary development of 20, 3 year old children from low income families. The families were randomly assigned to the intervention group or a control group who received no intervention. Parents in the intervention group were trained in book-sharing strategies (similar to dialogic strategies). Compared to the control group, the children of trained parents demonstrated significant receptive vocabulary gains 12 months after the intervention, and also showed significantly higher narrative retelling ability 36 months after the intervention (narrative length and information included) (Peterson, Jesso, & McCabe, 1999). This study provides strong evidence supporting the use of book-sharing strategies to improve vocabulary and narrative development in young children. Similarly, other studies have demonstrated that individual and small group dialogic book-sharing interventions improve narrative retelling ability and expressive vocabulary in 4 to 6 year old typically developing children, and children from low income homes, as compared to children in control groups (Lever & Sénéchal, 2011; Zevenbergen, Whitehurst, & Zevenbergen, 2003). However, these studies did not specifically evaluate the impact of intervention on comprehension.

Spencer Kelley, Goldstein, Spencer, and Sherman (2015) (level II) conducted an efficacy study of an automated storybook intervention designed to improve vocabulary and comprehension in young children. Eighteen 4 year old children from low income families who attended one of three pre-kindergarten classrooms were randomly allocated to participate in either the intervention or waitlist-control group. On standardised measures, the participants had low average vocabulary and overall language ability. The 14 week intervention, Story Friends, was a small group intervention with brief audio-recorded instructional lessons embedded in 13 narratives (animal characters experiencing common childhood events). The intervention included a plain version of each book (narration only), and an interactive version embedded with the instructional lessons during which children were encouraged to respond to the narrator. The instructional lessons targeted vocabulary (basic concept vocabulary and higher level but high utility vocabulary) and comprehension questions (three inferential questions per book focusing on emotions, character actions, prediction or linking to personal experiences) (Spencer Kelley et al., 2015). Using headphones, participants listened to the plain version of each story once and the instructional version three times in small groups. The participants in the intervention group showed greater gains on targeted vocabulary

than the control group. In addition, the participants in the intervention group demonstrated significantly greater improvement in inferential comprehension of narratives than the control group, with no difference demonstrated on literal comprehension questions. Although the study included a relatively small sample size, the results indicate that automated, interactive storybook intervention focusing on vocabulary and comprehension can improve targeted vocabulary and inferential comprehension in young at-risk children from low income families (Spencer Kelley et al., 2015).

Paris and Paris (2007) (level III-1) investigated the impact of narrative instruction on comprehension in slightly older children in the classroom context. The 123 participants from six classrooms at one school were aged 6 to 7 years and classrooms were allocated to either the narrative strategy instruction (NSI) group or the comparison group. The NSI group had more participants with greater academic needs and from poor socio-economic backgrounds than the comparison group. The comparison group received a similar amount of instruction in non-narrative activities (poetry). The NSI, an oral approach, was based on principles of effective reading comprehension interventions with modifications for younger children, including visual supports. Participants received 10, 45 minute whole-class intervention sessions over 5 weeks with a researcher. The intervention included: teaching of narrative macrostructure (story grammar); strategies to support inferences about feelings, thoughts, and desires; other inferences including predictions and character dialogue; and, strategies to support retelling stories in a sequenced way. The NSI took place across oral and written modalities, including wordless picture books, and focused on meta-cognitive discussion, meaningful activities, and adult think-alouds (Paris & Paris, 2007). The NSI group showed significantly greater improvement on inferential and literal comprehension of wordless picture books (no oral narrative heard), with improvements generalising to oral inferential and literal narrative comprehension and narrative retelling ability. Paris and Paris (2007) found that the intervention benefits were similar across participants, regardless of their pre-intervention literacy and language abilities. Thus, a narrative-based classroom intervention focusing on narrative macrostructure and retelling, and inferential comprehension, significantly benefited inferential and literal narrative comprehension in 6 to 7 year old children with a variety of abilities and backgrounds (Paris & Paris, 2007). As this study

specifically measured inferential comprehension of narratives, it provides strong support for the impact of oral narrative intervention on inferential comprehension.

Pesco and Devlin (2014) (level II) evaluated an explicit instruction narrative intervention with 30, 5 to 6 year old French-speaking children. The children were randomly allocated to a comparison group or the explicit instruction intervention, which involved explicit instruction of story grammar elements, causal relationships between events, character's internal states (emotions and thoughts), and prediction. This was supported by explanation, modelling, practice, feedback, and visual supports (e.g. story grammar icons). The comparison group received an intervention which involved listening to a story and then linking the story to personal experiences (the researcher acknowledged children's contributions without elaborating) (Pesco & Devlin, 2014). Both groups received five, 30 minute sessions over three weeks. The children completed a narrative assessment involving a wordless picture book with which they generated a story and were then asked comprehension questions. While the groups were equivalent pre-intervention, the children who received the explicit instruction group scored significantly higher on narrative retelling following the intervention. However, there was no significant difference between the groups on overall story comprehension, indicating that the intervention did not significantly improve comprehension. However, Pesco and Devlin (2014) noted that the comprehension questions (related to a story the child generated using the wordless picture book) may have placed a heavy demand on the child to answer questions without a model, and that scoring of the comprehension questions relied more heavily on recall of information (i.e. literal comprehension) than the retelling task (which reflected more of an understanding of the story gist). Additionally, the results may have been confounded as both of the interventions used strategies which may have supported comprehension.

A number of studies have demonstrated that teachers' shared book-reading, and particularly the type of questioning used by teachers, has a positive impact on expressive and receptive vocabulary growth in young children (Blewitt, Rump, Shealy, & Cook, 2009; Gonzalez et al., 2014; Hargrave & Sénéchal, 2000; Mol, Bus, & de Jong, 2009; Whitehurst et al., 1994; Zucker, Cabell, Justice, Pentimonti, & Kaderavek, 2013). However, one study did not find a significant relationship between teachers' questioning during shared book reading and students' vocabulary outcomes when initial vocabulary abilities were controlled (Zucker, Justice, Piasta, &

Kaderavek, 2010), and a meta-analysis identified difficulty replicating results of such interventions in natural classroom settings (Mol et al., 2009). Zucker et al. (2013) found that, in 3 to 5 year olds, extra-textual discussion before, during, and after shared reading was a significant predictor of both short-term and longitudinal vocabulary and literacy outcomes, with a trend towards significance for reading comprehension ($p = .04$). Extra-textual discussion around book-sharing included: definitions (vocabulary), inferential questions (including comparing, predicting, and explaining), and literacy (print conventions, phonological awareness, and letter-sound links) (Zucker et al., 2013).

In summary, past research has shown that narrative interventions for typically developing and/or 'at-risk' children, particularly those from low income backgrounds, can improve narrative comprehension, narrative retelling, and vocabulary. The main features of narrative interventions include dialogic strategies (by parents and/or teachers), and narrative retelling. Although few studies have specifically targeted or measured comprehension as an outcome, the results of some recent studies show promising results from applying these strategies to improve narrative comprehension (Paris & Paris, 2007; Spencer Kelley et al., 2015; Strouse et al., 2013).

Developmental language disorder

Children with DLD show difficulty with narrative development, and a number of intervention studies have focused directly on improving narrative skills in this population. Similar to the typically developing population, a majority of these intervention studies focus on expressive narrative skills. Those studies focusing on expressive narrative, such as through narrative retelling instruction and book-sharing, have found improvements in the macro- and micro-structure of narrative retelling ability in children with DLD, although some methodological limitations have been reported (Acosta et al., 2012; Bellon-Harn, Byers, & Lappi, 2014; Gillam & Gillam, 2016; Green & Klecan-Aker, 2012; Petersen, 2011; Swanson, Fey, Mills, & Hood, 2005).

Past research has found that young children with delayed language development are exposed to less abstract language use by parents during book-sharing than typically developing children of the same age (van Kleeck & Vander Woude, 2003). In addition, later higher level language gains in typically developing children have been shown to be related to the frequency of parental abstract

language use at the discourse-level (van Kleeck, Gillam, Hamilton, & McGrath, 1997). Therefore, it is pertinent for research to evaluate interventions in the narrative context, such as book-sharing, for children with DLD.

Colmar (2014) (level III-2) investigated the impact of parent book-sharing (using strategies based on milieu teaching and dialogic reading) on the general language and vocabulary skills of 4 to 5 year old children with DLD. Twenty-three children with DLD (who scored more than two standard deviations below the mean on a standardised language assessment) and 13 children with typically developing language were recruited. Participants were recruited from preschools in disadvantaged areas and those with language disorder were allocated to groups based on preschool (intervention or control group). Similar to the results of studies in typically developing and 'at-risk' children, the language disordered children who received the parent-based intervention demonstrated significantly greater improvement, and significantly higher scores, on standardised receptive vocabulary and overall (expressive and receptive) language measures following the intervention compared to children in two control groups (language delayed, and typically developing language) (Colmar, 2014).

Gillam, Gillam, and Reece (2012) (level II) compared contextualised language intervention (CLI) and de-contextualised language intervention (DLI). The CLI was a narrative-based intervention including retelling, vocabulary, grammar, and comprehension (literal and inferential questions asked after the story). The DLI involved grammar activities focused on vocabulary, syntax, and social language. Twenty-four children with DLD aged 6 to 8 years were randomly allocated to the CLI or DLI interventions and took part in small group (3 to 4 students) intervention sessions with a speech-language pathologist for 50-minutes, three times a week over 6 weeks. A control group of 8 children with DLD did not receive intervention. Post-intervention, the CLI group performed significantly better on the Test of Narrative Language (TNL) (Gillam & Pearson, 2004) than the control group on overall narrative comprehension (a combination of literal and inferential questions), narrative retell microstructure (not macrostructure), sentence repetition, and sentence structure measures. There was no significant difference between the DLI group and the control group on narrative comprehension, narrative macrostructure, and sentence repetition measures, but the DLI group performed significantly better than the control group on narrative microstructure and sentence structure measures

(Gillam et al., 2012). These results demonstrated that a narrative-based intervention focusing on narrative retelling, vocabulary, grammar, and comprehension was effective at improving both narrative expression and comprehension. However, due to the measure of narrative comprehension used (which combined literal and inferential comprehension), the specific impact on inferential comprehension cannot be clearly determined.

Similar results were found by Spencer, Kajjan, Petersen and Bilyk (2013) in a non-experimental single-subject study (level III-3) which evaluated the effect of an individual narrative retell intervention on five children aged 4 years from low income homes who presented with significantly delayed language abilities (Spencer et al., 2013). Four of the five children spoke Spanish as their first language, and three of the children were triplets. The participants received 24 individual intervention sessions over 12 to 16 weeks, in which a narrative program based around 12 stories was repeated. The structure of each session involved: modelling of a short five picture story, practice retelling the story with and without story grammar icons and pictures, story generation related to the story, and retelling practice. The participants demonstrated improvements on narrative retelling, narrative comprehension (five literal and one inferential question), and personal narrative generation (Spencer et al., 2013). Given the small sample size and lack of control group, this study provided preliminary evidence indicating that expressive narrative intervention focused on narrative retelling may improve narrative comprehension skills in young children with significantly delayed language ability.

Overall, studies investigating narrative and book-sharing interventions for children with DLD have demonstrated positive results on general measures of both expressive and receptive language, as well as measures of narrative macrostructure and microstructure. Few studies have specifically targeted and evaluated the impact on narrative comprehension in children with DLD, although the studies that included a measure of, or focused on, narrative comprehension have found promising results (Gillam et al., 2012; Spencer et al., 2013).

Learning difficulties

A study by Westerveld and Gillon (2008) (level III-1) is one of few narrative intervention studies to assess narrative comprehension as an outcome. Ten children aged 7 to 9 years with ongoing reading difficulties (reading fluency and reading

comprehension) and oral narrative difficulties (comprehension and production) participated in a six week intervention. The intervention involved 12, one hour sessions in groups of five children. A non-equivalent pre-test-post-test design was used in which one group was randomly assigned to immediate intervention and the other group was assigned to delayed intervention. An untreated control group of typically developing children with average reading ability, listening comprehension, and nonverbal IQ were used for comparison. The intervention aimed to improve the participants' knowledge of story structure by teaching the children to identify story grammar elements, retell parts of stories including particular story grammar elements, and by practising giving other children feedback on their narrative retelling. The principles of the intervention included using narratives with well-defined story structure, developing meta-narrative awareness, and using scaffolding techniques and graphic organisers (Westerveld & Gillon, 2008).

Two narrative comprehension tasks were included in the study: comprehension questions assessing story structure, and the TNL (Gillam & Pearson, 2004), a standardised narrative comprehension measure. Following the first intervention period, the first group demonstrated significant oral narrative comprehension improvement on both tasks compared to the second group, who had not yet received intervention. Following both intervention periods, the children with reading difficulties scored significantly higher than the untreated control group on the story structure comprehension questions, with no significant difference between the groups on the TNL. These results indicated that the narrative comprehension and retelling skills of participants in the intervention groups had improved to the level of the typically developing control group, who had performed significantly higher on pre-intervention measures. There was no significant change in reading comprehension scores post-intervention, indicating that the oral narrative comprehension gains had not transferred to reading comprehension ability (Westerveld & Gillon, 2008). Although this study included a small sample size, the results and strength of the study design clearly support the use of small group intervention focused on narrative structure – including strategies such as meta-narrative awareness, scaffolding, and graphic organisers – to promote narrative comprehension, and retell, in children with reading and listening comprehension difficulties.

Summary of narrative-based interventions

As discussed, few studies have directly focused on or measured inferential narrative comprehension, particularly in younger children. Despite this, a number of common strategies in narrative interventions have shown positive effects on narrative comprehension and retelling ability in young children (shown in Table 7).

Table 7: Common Strategies in Narrative-based Interventions

| Intervention Strategy | Study/ies |
|---|-------------------------------|
| Dialogic book-sharing | Colmar (2014) |
| | Dunst et al. (2012) |
| | Lever & Sénéchal (2011) |
| | Peterson et al. (1999) |
| | Strouse et al. (2013) |
| | Whitehurst et al. (1994) |
| | Zevenbergen et al. (2003) |
| | Zucker et al. (2013) |
| Open-ended and/or specific questioning (including predictions) | Colmar (2014) |
| | Dunst et al. (2012) |
| | Gillam et al. (2012) |
| | Morrow (1985) |
| | Pesco & Devlin (2014) |
| | Spencer Kelley et al. (2015) |
| | Strouse et al. (2013) |
| | Zucker et al. (2013) |
| Repeated reading | Gillam, Gillam & Reece (2012) |
| | Spencer et al. (2013) |
| | Spencer Kelley et al. (2015) |
| | Strouse et al. (2013) |

Table 7 continued.

| | |
|--|---|
| Narrative retelling and/or generation | Gillam et al. (2012) Morrow (1985) Spencer et al. (2013) Westerveld & Gillon (2008) |
| Relating to personal experiences | Dunst et al. (2012) Gillam et al. (2012) Spencer Kelley et al. (2015) Strouse et al. (2013) |
| Visual supports / graphic organisers | Boulineau et al. (2004) Paris and Paris (2007) Pesco & Devlin (2014) Spencer et al. (2013) Westerveld & Gillon (2008) |
| Vocabulary instruction | Gillam et al. (2012) Spencer Kelley et al. (2015) Zucker et al. (2013) |
| Scaffolding | Paris and Paris (2007) Westerveld & Gillon (2008) |
| Meta-cognitive discussion / meta-narrative awareness | Paris and Paris (2007) Westerveld & Gillon (2008) |
| Explicit strategies instruction | Paris and Paris (2007) Pesco & Devlin (2014) |

Theory of Mind Interventions

Theory of mind encompasses a range of skills which develop over time, beginning in early childhood. The development of theory of mind has been closely linked to language development (Andrés-Roqueta et al., 2013; Farrar et al., 2009; Norbury, 2005; Schick et al., 2007; Wilde Astington & Jenkins, 1999). Study One of

this research demonstrated that theory of mind ability in young children with DLD is a significant predictor of inferential comprehension ability. A small range of studies have investigated interventions to improve theory of mind, with most investigating children and adolescents with autism spectrum disorder. This section will briefly review the evidence for theory of mind interventions related to inferential comprehension.

A review of theory of mind interventions for individuals with ASD evaluated 22 randomised controlled trials which focused on theory of mind and related skills (Fletcher-Watson, McConnell, Manola, & McConachie, 2014). The intervention studies were grouped into four main targets which included: emotion recognition, joint attention and social communication, imitation, and theory of mind itself. Positive effects were found across intervention areas, however the evidence quality was rated as very low due to poor methodology, and in addition there was minimal reported evidence for generalisation and maintenance of skills (Fletcher-Watson et al., 2014). A more recent meta-analysis identified 45 intervention studies targeting theory of mind, with the majority of studies including typically developing children or children with ASD (Hofmann et al., 2016). All studies included a control group and pre- and post-intervention ToM measures. The intervention studies, many of which used a narrative context, targeted a range of ToM skills including perspective taking, mental states, appearance-reality, perception and desire, false belief, sociodramatic play, and sentential complements. Theory of mind was assessed using one or more measures of false belief, appearance-reality, or combined theory of mind batteries. Hofmann et al. (2016) found a large average effect size, indicating that theory of mind interventions were effective at improving children's theory of mind skills, however the effect size was significantly moderated by length of sessions and intervention period.

Theory of mind interventions of particular interest in relation to inferential comprehension include narrative-based interventions and those targeting emotion recognition. Guajardo and Watson (2002) (level III-2) evaluated a theory of mind intervention using narratives with 3 to 4 year old children over two studies which differed in their findings. Following pre-intervention assessment, the children were assigned to either the intervention group or an untreated control group matched on age and assessment (language and ToM) scores. The intervention included 12 to 15 book-sharing sessions of 10 to 15 minutes each over 5 weeks. The participants were

engaged in discussion related to the book which focused on theory of mind concepts (thoughts, actions and beliefs in terms of false beliefs, deception, and appearance-reality). In the first study children with mixed theory of mind skills received intervention in groups and were compared to a control group who did not receive intervention. The first study found no significant improvement in the theory of mind skills of the intervention group compared to the control group. However, the participants in the second study presented with low theory of mind skills (below a cut-off) and received individual intervention. These participants demonstrated significant pre- to post-intervention improvement in theory of mind scores compared to the control group (Guajardo & Watson, 2002). The inclusion of control groups in these studies strengthened the findings, indicating that theory of mind intervention was only effective for young children who presented with poor ToM skills.

Dodd, Ocampo, and Kennedy (2011) (level II) used narratives to promote the theory of mind skill of perspective-taking in 18 children with ASD aged 9 to 12 years. The participants were recruited from two schools, and were randomly assigned to the two intervention groups at each of the school sites to control for teaching effects. Half of the participants at each school received a perspective-taking narrative intervention which focused on completing story grammar marker character maps (what is known/what can be inferred about the character), using open-ended and inferential questions, and discussion about character emotions and cognitive states of mind. The other half of the participants received a more traditional narrative intervention which focused on macrostructure (organising story maps), microstructure (connectors and vocabulary not related to emotions or states of mind), and narrative retelling. The intervention groups participated in three weekly small group intervention sessions for 30 minutes over 6 weeks. The participants who received the perspective-taking narrative intervention showed greater growth in perspective taking ability and mental state verb use as reflected by narrative retells (Dodd, Ocampo, & Kennedy, 2011). The results of these studies indicated that narrative may be an effective way to support theory of mind skill development in children with ASD, and also in otherwise typically developing children with poor theory of mind development.

Taumoepeau and Reese (2013) (level III-1) investigated the influence of parent language training on their child's theory of mind development. The longitudinal study included 102 families with 19 month old infants who were followed

to 4 years of age. Mother-child pairs matched for maternal education level, maternal language (elaborative questioning), and child vocabulary were randomly assigned to either the intervention group or the no-training group. The mothers of children in the parent-intervention group received training in elaborative reminiscing, which involved having conversations about past events with their child using open-ended questions. Children with low expressive vocabulary at a young age who were exposed to increased elaborative talk about the past had better theory of mind skills at age 3;8 than the children who had low expressive vocabulary and were not exposed to increased elaborative talk (Taumoepeau & Reese, 2013). The results (from the battery of tasks completed at 3;8) indicated that the relationship between language and theory of mind was dependent on whether mothers had received training. Thus, given that the two groups were closely matched on a number of variables and randomly assigned, the results provide strong support for the role of elaborative talk about past events in theory of mind development (Taumoepeau & Reese, 2013).

A number of studies have also demonstrated that language use in narratives and during book-sharing is related to theory of mind development. A profiling study found that 7 year old children with ASD referenced character emotions significantly less during story telling than typically developing children, and that use of emotions in narratives was significantly related to theory of mind ability (Siller, Swanson, Serlin, & Teachworth, 2014). Slaughter, Peterson, and Mackintosh (2007) explored the relationship between the type of parental language used during book-sharing and theory of mind development in typically developing children and children with ASD. In 3 to 6 year old typically developing children, mother's talk about *cognition* (explanatory, causal, and contrastive) during book-sharing was significantly correlated with theory of mind ability. A slightly differing finding emerged in 4 to 9 year old children with ASD, as mothers' talk about *emotions* was significantly correlated with theory of mind ability (Slaughter, Peterson, & Mackintosh, 2007). These results indicate that certain types of language used during book-sharing – particularly higher level language discussions related to cognition and emotion – are related to, and may support the development of, theory of mind skills in typically developing children and children with ASD.

Summary of theory of mind interventions

Previous research has demonstrated that children with DLD tend to show delayed theory of mind development, in particular recognition of emotions in context (Ford & Milosky, 2003; Ford & Milosky, 2008; Spackman et al., 2006). To date, no intervention studies could be found which targeted theory of mind skills in children with DLD, although researchers have highlighted the importance of facilitating theory of mind development in intervention with this population (Ford & Milosky, 2003; Ford & Milosky, 2008; Spackman et al., 2006; Westby & Robinson, 2014). In particular, Westby and Robinson (2014) discuss the importance of, and strategies to, evaluate and target theory of mind in interventions to support both social-emotional development and communication skills.

In summary, findings from research including participants with ASD and typically developing children have demonstrated that some theory of mind skills can be improved through training, however generalisation and maintenance of skills have not been consistently shown (Fletcher-Watson et al., 2014; Williams, Gray, & Tonge, 2012). Past studies have shown positive results for narrative-based interventions targeting theory of mind skills (see Table 8), but studies have generally not included narrative comprehension as an outcome measure (Dodd et al., 2011; Guajardo & Watson, 2002). Given past results and the findings of Study One in this research, targeting theory of mind skills in the context of narrative-based intervention can be hypothesised to assist the development of inferential comprehension in children with DLD.

Table 8: Common Strategies in Theory of Mind Interventions related to Inferential Comprehension

| Intervention Strategy | Study/ies |
|---|--|
| Book-sharing | Guajardo & Watson (2002) Westby & Robinson (2014) |
| Discussion related to theory of mind concepts (e.g. character emotions, beliefs, thoughts, & actions) | Dodd et al. (2011) Guajardo & Watson (2002) Westby & Robinson (2014) |
| Narrative story grammar | Dodd et al. (2011) |

Table 8 continued.

| | |
|---------------------------------------|---|
| Open-ended questions | Dodd et al. (2011) Taumoepeau & Reese (2013) |
| Parent elaborative talk (past events) | Taumoepeau & Reese (2013) |

Inferential Comprehension Interventions

To date, two intervention studies have been identified which have specifically focused on improving and measuring oral inferential comprehension in *young* children with DLD. These intervention studies targeted inferential comprehension using book-sharing (Desmarais et al., 2013; van Kleeck et al., 2006). These studies will be discussed in detail as they further informed the design of the intervention study reported in chapter 5.

A book-sharing intervention by van Kleeck, Vander Woude and Hammett (2006) (level III-1) aimed to improve the oral literal and inferential language comprehension of 3 to 5 year old children with language disorders from low socio-economic backgrounds. The intervention focused on dialogic book-sharing using natural interaction strategies such as questioning, modelling answers, cloze sentences, and expansions (van Kleeck et al., 2006). The inferencing modelled by adults during book-sharing in the study reflected the skills which children would need to use independently during later reading comprehension (van Kleeck et al., 2006).

Thirty children with language disorders, as measured by poor expressive language ability but average nonverbal cognitive ability, were included in the intervention study. The participants completed a standardised receptive vocabulary assessment (the Peabody Picture Vocabulary Test, Third Edition), and a language assessment, the Preschool Language Assessment Instrument (PLAI) (Blank et al., 1978b; Dunn & Dunn, 1997). The PLAI is based on the perceptual-language distance levels of questioning introduced by Blank, Rose and Berlin (1978a). Level I and level II questioning reflect literal language (e.g. 'what is this?') and levels III and IV reflect inferential language (e.g. 'what will happen if...?') (Blank et al., 1978a). The PLAI was scored as per the original assessment guidelines using a four-point scale (3-fully adequate, 2-acceptable, 1-ambiguous and 0-inadequate). The scores from responses to level I and level II questions were combined to reflect literal

comprehension, and the scores from level III and level IV questions were combined to reflect inferential comprehension (van Kleeck et al., 2006).

The 30 participants were randomly assigned to either a treatment or control group. Both groups continued to receive the usual preschool program at their school (HeadStart program), however the participants in the treatment group also received two individual 15 minute intervention sessions a week over 8 weeks, conducted by trained undergraduate and graduate research assistants. Two books were read repeatedly during the intervention, and each book had three sets of 25 scripted questions (including scripted answers and some scripted prompts). Approximately 70% of the questions reflected literal comprehension and 30% reflected inferential comprehension. If the participant did not respond adequately to a question the research assistant provided a scripted initial prompt, followed by modelling ('thinking aloud') the appropriate response in a natural way if the child did not respond appropriately after the initial prompt (van Kleeck et al., 2006).

The treatment group, but not the control group, showed a statistically significant increase in receptive vocabulary scores from pre- to post-intervention. This finding indicated that the book-sharing intervention had a positive influence on receptive vocabulary development (van Kleeck et al., 2006). The treatment group, but not the control group, also showed a statistically significant increase in literal and inferential comprehension scores between pre- to post-intervention as measured by the PLAI, with a large effect ($\omega^2 = .13$). The control group's inferential scores also increased, however the difference was not statistically significant ($p = .06$). Thus, following an eight week individual scripted book-sharing intervention, children with DLD showed significant improvements in receptive vocabulary, and both literal and inferential comprehension (van Kleeck et al., 2006).

The study's limitations were addressed by van Kleeck et al. (2006), and included: lack of maintenance testing, blind research assistants, and a control intervention for participants in the control group. The latter presents a significant issue in terms of clearly attributing the results to the content of the intervention. In summary, although this study provides important initial evidence to support the use of book-sharing intervention for oral inferential language comprehension in children with DLD, additional research is required to address the study's limitations and replicate the results.

Extending the study by van Kleeck et al. (2006), Desmarais, Nadeau, Trudeau, Filiatrault-Veilleux and Maxes-Fournier (2013) (level III-3) aimed to improve the inferential comprehension ability of 4 to 6 year old children with developmental language disorder. The study recruited 16 French-speaking participants who presented with significantly low scores on normed language assessments. Participant exclusion criteria included intellectual impairment, poor speech intelligibility, or significant behavioural difficulties. The participants completed four assessments: two pre-intervention assessments to establish a baseline (weeks 1 and 6), a post-intervention assessment (week 16) and, in order to address a limitation identified by van Kleeck et al. (2006), a maintenance assessment 6 weeks after the post-intervention assessment (week 22).

The assessments included narrative comprehension questions during shared reading of two different story-books, which were developed in an earlier pilot study (as cited in Desmarais et al., 2013), and the second edition of the PLAI (Blank, Rose, & Berlin, 2003). One narrative was used for the first baseline assessment and the post-intervention assessment, and the other narrative was used for the second (week 6) baseline assessment and the maintenance assessment (week 22). The comprehension questions created for each book were based on those described by van Kleeck et al. (2006), and included 10 inferential and 10 referential (literal) comprehension questions. Participants' answers were scored using the four-point response scale in the PLAI-II (Blank et al., 2003).

The participants took part in 10 weekly individual intervention sessions with their usual speech-language pathologist. The first 15 to 20 minutes of each session focused on the dialogic book-sharing intervention using scripted questions, followed by usual intervention activities. Two scripts were developed for ten narratives, and each script included 16 questions (8 literal and 8 inferential). The speech-language pathologist chose five out of the ten books to use with each participant. Each narrative was used for two consecutive intervention sessions. During the intervention sessions, speech-language pathologists provided scaffolded prompts to assist the participant to provide the expected response to a question. The three stages of scaffolding included: rephrasing the questions (aiming to use a simpler syntactic structure), followed by providing a semantic prompt, and finally providing a phonemic prompt. The question was repeated immediately after the expected response was

provided following scaffolding, and a second time during reading of the narrative in the next session.

Although there was a statistically significant increase in the participants' inferential comprehension scores over the four assessment points, the two narrative assessments used were not comparable. To combat this issue, scores collected using the same narrative were compared (i.e. second baseline assessment and maintenance assessment). This comparison showed improvement in scores over time, however as non-treatment phases were included, the improvement could not be interpreted as clearly demonstrating a treatment effect. There was a statistically significant increase in scores on the PLAI, indicating that general inferential comprehension skills had improved from pre- to post-intervention (Desmarais et al., 2013). However, as there was no baseline for the PLAI, the change could not be clearly attributed to the intervention. Desmarais et al. (2013) analysed the quality of the comprehension question responses given by participants and found that most of the participants produced better quality responses following the intervention, supporting the intervention findings.

Although these results are promising, Desmarais et al.'s (2013) study presented a number of limitations including the lack of a control group and non-equivalent narrative comprehension measures. Using narrative comprehension assessments provided information which was more reflective of the intervention content and focus, however the non-equivalent narrative comprehension tasks confounded a clear interpretation of the study's results. In addition, although using different speech-language pathologists for the intervention supported the external validity of the study, it may have reduced the study's internal validity. The selection of 5 out of 10 possible narratives for the intervention sessions provided participants with exposure to different narratives in quasi random sequences, potentially providing quite varied intervention experiences. As suggested by Desmarais et al. (2013) and indicated by the study's limitations, further research is required to investigate valid and reliable narrative-based inferential comprehension assessments, in addition to replicating similar inferential comprehension interventions for children with DLD using larger sample sizes, control groups, and equivalent measures.

One other study by Joffe, Cain and Marić (2007) investigated mental imagery training in *older* children with DLD and, as such, will not be discussed in detail. Joffe

et al. (2007) aimed to improve comprehension of short stories in 9 children with DLD aged 9 years, who were compared to 16 age-matched untreated typically developing controls. The intervention involved five, 30 minute sessions over three weeks with the DLD participants using visual cues (drawings), with the aim 'to think in pictures' (Joffe et al. 2007). The literal, but not inferential, comprehension of both groups improved significantly from pre-intervention to post-intervention. The significant interaction between group and assessment time demonstrated that the DLD group showed significantly greater improvement than the control group. The results indicated that five short group sessions of mental imagery training resulted in significant *literal* comprehension improvement in 9 year old children with DLD. However, the use of a treated control group of children with DLD would have strengthened the results of this study in terms of clearly attributing improvements to the intervention.

Summary of inferential comprehension interventions

To current knowledge, the studies by van Kleeck et al. (2006) and Desmarais et al. (2013) are the only intervention studies which have specifically investigated improving *oral* inferential comprehension in young children with DLD. Although these initial findings show promise and a number of common strategies were used in the interventions (see Table 9), each study has presented limitations which have highlighted the need for replication and further research. The limitations presented by the two studies have included: lack of a control group receiving intervention, no maintenance follow-up, poor internal validity, non-equivalent assessment tools, and research assistants who were not blind to treatment condition. Furthermore, while the studies have drawn on prior intervention research, they have not been based on evidence of the skills underlying oral inferential comprehension in children with DLD. Given the knowledge that children with DLD present with poor inferential comprehension and the importance of discourse-level inferential comprehension for communication and later reading comprehension, this presents a significant gap in the evidence base. Therefore, it is clear that further research is required to evaluate the effectiveness of inferential comprehension intervention for young children with DLD based on evidence of the skills contributing to the inferential comprehension in this population, using a randomised controlled trial design, blind research assistants, and equivalent inferential comprehension measures.

Table 9: Common Strategies in Inferential Comprehension Interventions

| Intervention Strategy | Study/ies |
|--|---|
| Dialogic book-sharing using questioning, modelling answers, cloze sentences and expansions | Desmarais et al. (2013) Van Kleeck et al. (2006) |
| Repeated reading of books | Desmarais et al. (2013) Van Kleeck et al. (2006) |
| Scripted questioning | Desmarais et al. (2013) Van Kleeck et al. (2006) |
| Scaffolded prompts – e.g. scripted prompt, modelling ('thinking aloud'), rephrasing / repeating the question, semantic prompt, phonemic prompt | Desmarais et al. (2013) Van Kleeck et al. (2006) |
| Visual cues and mental imagery ('think in pictures') | Joffe et al. (2007) |

Summary of Intervention Studies

This chapter has reviewed the current evidence for interventions targeting inferential comprehension, in addition to related skills such as reading comprehension, narrative, and theory of mind. The findings from the preliminary intervention studies focusing on oral inferential comprehension in children with DLD, in addition to reviews examining the impact of similar programs with typically developing children, have indicated that inferential comprehension can be improved through targeted intervention (Desmarais et al., 2013; Dunst et al., 2012; Spencer Kelley et al., 2015; van Kleeck et al., 2006). The review of intervention studies focusing on reading comprehension, narrative, and theory of mind demonstrates similarity in intervention strategies and generally positive results for language outcomes. However, few studies have measured inferential comprehension as a specific outcome and the methodological quality of studies has varied.

There is a clear evidence gap requiring methodologically strong research to evaluate intervention based on, and targeting, the skills underlying oral inferential comprehension in young children with DLD. It is pertinent that further research is

conducted to evaluate interventions focusing on improving inferential comprehension, with the aim of creating an effective and valid evidence-base of interventions which will improve inferential comprehension in this population of children.

Chapter 5: Study Two

A randomised controlled trial of an oral inferential comprehension intervention for children with developmental language disorder.

Chapter Overview

This chapter presents a randomised controlled trial of a novel oral inferential comprehension intervention developed for 5 to 6 year old children with developmental language disorder. Intervention principles were developed based on the results of Study One (chapter 3) and the literature review (chapter 4) of interventions targeting literal and inferential comprehension, and related areas. The intervention principles were used to create an intervention designed to improve oral inferential comprehension of narratives, which will be discussed first. This will be followed by the RCT which evaluated the intervention with 37 children aged 5 to 6 years with DLD.

Research Rationale

The literature review in chapter 2 identified oral inferential comprehension as an area of difficulty for children with DLD, and demonstrated a significant gap in the research literature relating to the skills underlying inferential comprehension in this population. Study One (chapter 3) provided a profile of the language and cognitive skills which contributed significant individual variance to oral inferential comprehension of narratives in a group of 5 to 6 year old children with DLD. The literature review in chapter 4 identified a lack of evidence for interventions targeting oral inferential comprehension in children with developmental language disorder (DLD) and, in particular, interventions based on an underlying profile of the skills which are important for oral inferential comprehension in this population. This is despite the knowledge that inferential comprehension is a particular area of difficulty for children with DLD, and has a significant impact on communication ability and reading comprehension. Therefore, the second study in this research used the profile from Study One and past research to develop and evaluate a targeted intervention to improve the oral inferential comprehension of young children with DLD.

Aims

The aim of this study was:

1. To develop, trial, and evaluate an intervention targeted at improving the oral inferential comprehension of young children with DLD, based on the results of the profile of skills which contribute to oral inferential comprehension and a literature review.

Inferential Comprehension Intervention

The following section presents the book-sharing intervention designed to improve oral inferential comprehension of narratives in young children with DLD. The principles of the intervention are first described, followed by discussion of the rationales underlying the intervention principles.

Intervention Principles

The intervention principles were developed based on the results of Study One (reported in chapter 3) and drew on strategies from previous intervention research investigating language and reading comprehension, narrative, and theory of mind (summarised in tables 6 – 9 in Chapter 4, and referenced below). Inferential and literal comprehension of narrative, narrative retelling ability (macrostructure and microstructure), theory of mind, and overall vocabulary were selected as important and potentially modifiable intervention *targets*. Table 10 includes the 13 intervention principles.

Table 10: Oral Inferential Comprehension Intervention Principles

| | Intervention Principle | References |
|---|---|---|
| 1 | Ensure that intervention is focused at the discourse-level . Focus on narrative retelling (macrostructure and microstructure) ability , in addition to literal and inferential narrative comprehension , to support the development of well-structured and coherent narrative schemas. | Gillam et al. (2012) van Dijk & Kintsch (1983) |

Table 10 continued.

| | | |
|---|---|--|
| 2 | Use dialogic book-sharing with scripted literal and inferential questions embedded during reading of a text. | Desmarais et al. (2013) van Kleeck (2006) van Kleeck et al. (2006) |
| 3 | Use a range of open-ended inferential comprehension questions (causal, informative, evaluative) to promote inferential thinking and discussion about narratives. | Dunst et al. (2012) Paris & Paris (2007) Spencer Kelley et al. (2015) van Kleeck (2008) van Kleeck et al. (2006) |
| 4 | Integrate developmentally appropriate theory of mind skills in questioning and discussion, including predicting thoughts, feelings, and behaviours, and linking feelings to prior experiences . | Westby & Robinson (2014) |
| 5 | Use think-alouds to model appropriate comprehension processes and to prompt children to engage in inferential thinking (e.g. <i>I think..., I wonder...</i>). | Beck & McKeown (2001) McClintock et al. (2014) McGee & Schickedanz (2007) Paris & Paris (2007) van Kleeck (2008) |
| 6 | Relate the story and events within the story to children's personal experiences and make predictions . | Culatta et al. (2010) Dunst et al. (2012) Spencer Kelley et al. (2015) |
| 7 | Focus on meta-narrative awareness by explicitly unpacking story grammar elements, discussing what makes a 'good' story, and encouraging children to monitor their own and others' retelling of stories in terms of whether all story grammar elements were included. | Westerveld & Gillon (2008) |

Table 10 continued.

| | | |
|----|--|--|
| 8 | Use scaffolding techniques to support children to respond to inferential comprehension questions, including rephrasing the question, providing semantic and phonemic cues, and using cloze sentences. | Desmarais et al. (2013) Paris & Paris (2007) van Kleeck (2006) Westerveld & Gillon (2008) |
| 9 | Use graphic organisers , via the use of story grammar elements and sketches, to create a story map to assist children in understanding, remembering, and recalling the story structure. | Dexter & Hughes (2011) Idol (1987) Kim et al. (2004) Paris & Paris (2007) Ukrainetz (1998) Westerveld & Gillon (2008) |
| 10 | Establish and maintain an explicit focus on inferential comprehension by alerting children to the use of inferencing skills and making learning goals explicit . | Dunning (1992) Paris & Paris (2007) van Kleeck (2006, 2008) |
| 11 | Use stories containing well-defined story structure, higher level vocabulary, and emotions , whilst providing exposure to literate language, and embed discussion of higher level (Tier II) vocabulary during book-sharing . | Beck & McKeown (2007) Beck et al. (2002) Gillam et al. (2012) Hickman et al. (2004) Spencer Kelley et al. (2015) Westerveld & Gillon (2008) |
| 12 | Ensure that book-sharing is engaging by increasing the salience of naturalistic book-sharing strategies (e.g. facial expression, tone of voice, volume, balance of comments and questions, etc). | Dunst et al. (2012) Kaderavek & Justice (2002) Paris & Paris (2007) van Kleeck (2008) |

Table 10 continued.

| | | |
|----|--|--|
| 13 | Use of repeated reading of story books. | Gillam et al. (2012) Morrow & Brittain (2003) Spencer et al. (2013) Spencer Kelley et al. (2015) Strouse et al. (2013) |
|----|--|--|

Rationale for Intervention Principles

1. Ensure that intervention is focused at the **discourse-level**. Focus on **narrative retelling (macrostructure and microstructure) ability**, in addition to **literal and inferential narrative comprehension**, to support the development of well-structured and coherent narrative schemas (Gillam et al., 2012; van Dijk & Kintsch, 1983).

Study One (chapter 3) demonstrated that narrative retelling and literal comprehension were the most significant individual predictors of inferential comprehension ability in young children with DLD, indicating that overall discourse-level skills are important for inferential comprehension of discourse. This suggests that intervention to improve inferential comprehension should approach discourse-level skills in an integrated way. The inferential comprehension intervention was therefore designed to focus on discourse-level skills using story-books (narratives).

Theoretically, focusing on discourse-level skills including narrative comprehension and retell supports the development and organisation of well-specified schemas. As van Dijk and Kintsch (1983) discussed, the greater number and specification of schemas that are available to an individual, the easier the process of discourse comprehension becomes. Schemas are activated quickly during discourse comprehension, functioning through top-down processing to organise the content of discourse and, therefore, provide a basis to form inferences (via interaction between the situation model and textbase) (Bishop, 2014b; Graesser et al., 1997; van Dijk & Kintsch, 1983). As noted by Westby (2012), well-specified schemas allow organised searching for information, comprehension monitoring, and reconstruction (retelling or generation) using the schema as a scaffold, as well as providing a scaffold for integrating text information during comprehension. In

contrast, poorly specified schemas or difficulty accessing schemas may be related to poor inferential comprehension (Westby, 2012). As such, the development of well-specified schemas can be considered to support discourse comprehension by providing structures for organising discourse, allowing more efficient processing which facilitates not only comprehension but also retelling (van Dijk & Kintsch, 1983).

Children with DLD show poor narrative development and tend to have poorly developed schemas (Bishop, 2014b; Dodwell & Bavin, 2008; Fey et al., 2004; Kaderavek & Sulzby, 2000). The inferential comprehension intervention includes repeated reading and retelling of narratives. Repeated and consistent exposure to, and practice of, narrative comprehension and retelling may support children to develop more organised and robust narrative schemas. As such, the children may be able to draw on better-specified schemas as a scaffold to more efficiently and effectively process, comprehend, and recall narratives (Westby, 2012). A number of studies have demonstrated that intervention focused on narrative retelling ability can improve narrative comprehension in typically developing children, children with DLD, and those with poor reading ability and comprehension (Gillam et al., 2012; Morrow, 1985; Westerveld & Gillon, 2008). Gillam et al. (2012) found that discourse-level intervention involving narrative retell and comprehension questions improved both narrative retelling and overall comprehension, demonstrating the importance of targeting discourse-level skills. Supporting the development of cohesive and robust schema should facilitate successful top-down processing during discourse-level tasks (Bishop, 2014b; van Dijk & Kintsch, 1983).

2. Use **dialogic book-sharing** with scripted **literal and inferential questions** embedded during reading of a text (Desmarais et al., 2013; van Kleeck, 2006; van Kleeck et al., 2006).

The benefits of dialogic reading have been investigated in relation to a range of language skills, including comprehension, in young children. Two studies demonstrated that dialogic book-sharing intervention with scripted questions improved inferential comprehension in young children with DLD (Desmarais et al., 2013; van Kleeck, 2008). More recent studies have also demonstrated that dialogic book-sharing, including automated book-sharing, significantly improves the story comprehension of young typically developing and at-risk children (Spencer Kelley et al., 2015; Strouse et al., 2013).

Book sharing during the intervention sessions includes both literal and inferential comprehension questions, with the focus on inferential comprehension. It is important to incorporate both literal and inferential questions during book-sharing, as literal comprehension of narratives provides a foundational knowledge base which children can utilise to form inferences (Culatta, Blank, & Black, 2010; van Kleeck, 2008). Repeated, interactive book-sharing using literal and inferential questions, and modelling the thinking required, provides a naturalistic environment in which narrative comprehension is repeatedly practised in the context in which it most commonly occurs for young children (van Kleeck, 2008). This is a functional approach to intervention, as such a context provides a close approximation of natural language learning, which facilitates intrinsic motivation and generalisation of language skills (Owens, 2010). Therefore, including both literal and inferential questions during repeated book-sharing should facilitate the development of inferential comprehension.

3. Use a **range of open-ended inferential comprehension questions** (causal, informative, evaluative) to promote inferential thinking and discussion about narratives (Dunst et al., 2012; Paris & Paris, 2007; Spencer Kelley et al., 2015; van Kleeck, 2008; van Kleeck et al., 2006).

The aim of the inferential comprehension intervention is to improve overall inferential comprehension and includes a range of inferential comprehension questions and modelling repeated during the context of shared reading. Some questions relate directly to story grammar, while others require specific skills such as prediction. The principle of using a range of open-ended inferential questions was drawn from prior literature and research. These include effective strategies in reading comprehension interventions, such as questioning, prediction, and inferencing which promotes thinking about texts (Dunst et al., 2012; Elbro & Buch-Iversen, 2013; Oakhill et al., 2015; Palinscar & Brown, 1984; van Kleeck, 2008; Wright et al., 2015). As noted by van Kleeck (2008), including inferential questions during shared reading is a naturalistic method of prompting young children to develop the higher level skills required for successful inferential comprehension, such as thinking about how events are causally linked. The repeated practice of a range of specific inferencing skills will provide children with many opportunities to engage in inferential comprehension in the context of discourse and, thus, should support the development of inferential comprehension.

4. Integrate developmentally appropriate **theory of mind skills** in questioning and discussion, including **predicting thoughts, feelings, and behaviours, and linking feelings to prior experiences** (Westby & Robinson, 2014).

The first study in this research found that theory of mind was an important individual predictor of inferential comprehension ability. The intervention was designed to focus on theory of mind skills which relate to inferencing within the context of book-sharing, particularly in terms of character thoughts, feelings, and behaviours. These first order theory of mind skills are not only integral for social-emotional development, but are highly related to inferential comprehension and lend themselves to the context of narratives (Westby & Robinson, 2014).

A literature review by Dunst et al., (2012) found that making predictions and linking events to personal experiences were significant predictors of language and literacy outcomes in book-sharing interventions with young children. The intervention includes a focus on inferring character emotions and linking emotions to personal experiences. It also focuses on making predictions about what might happen after the story is finished, which involves integrating character thoughts, feelings, and behaviours with the story structure as a whole so as to make accurate predictions. Many of the think-alouds integrated during shared reading in the intervention also reflect character thought processes (e.g. "I wonder how bear is feeling...I think he might be feeling... because..."). The mental state verbs used during think-alouds (e.g. think, wonder) and internal state vocabulary (e.g. worried, relieved) promote theory of mind development (Westby & Robinson, 2014). Thus, the intervention supports the development of first order theory of mind skills in the context of narrative discourse, which should also support inferential comprehension.

5. Use **think-alouds** to model appropriate comprehension processes and to prompt children to engage in inferential thinking (e.g. *I think...*, *I wonder...*) (Beck & McKeown, 2001; McClintock, Pesco, & Martin-Chang, 2014; McGee & Schickedanz, 2007; Paris & Paris, 2007; van Kleeck, 2008).

Think-alouds are a strategy used by teachers to model thought processes to children (McGee & Schickedanz, 2007; van Kleeck, 2008). Think-alouds are used to verbalise thought processes and have been taught as a strategy to facilitate reading comprehension (Block & Israel, 2004; Kucan & Beck, 1997; Oster, 2001). Reading

comprehension research has demonstrated positive effects of think-alouds, and a study investigating older children with DLD found that children who engaged in thinking aloud during listening to a text demonstrated improved literal and inferential comprehension (Brown, Pressley, Van Meter, & Schuder, 1996; Kucan & Beck, 1997; McClintock et al., 2014). Other researchers have used think-alouds during shared reading to model thinking to young children, and to scaffold children to respond to comprehension questions during reading (McGee & Schickedanz, 2007; van Kleeck et al., 2006).

Think-alouds are used in the intervention as a naturalistic method of demonstrating inferential thought processes. The repeated exposures to think-alouds provides repeated prompting for children to engage in inferential thinking during book-sharing, in addition to the repeated provision of models of appropriate thoughts and reasoning related to inferential comprehension (van Kleeck, 2008). Thus, the repeated use of this strategy will support children's engagement in inferential thinking and reasoning during book-sharing, and hence the development of, and ability to respond appropriately to questions targeting, inferential comprehension.

6. Relate the story and events within the story to children's personal experiences and make predictions (Culatta et al., 2010; Dunst et al., 2012; Spencer Kelley et al., 2015).

As discussed in the literature review of book-sharing interventions (chapter 4), Dunst et al. (2012) found that relating events and characters to children's personal experiences and making predictions had a significant impact on young children's language and literacy outcomes. The strategy of relating stories to a child's personal experiences is linked to the dialogic reading prompt of 'distancing', in which adults are encouraged to ask the child questions which relate the narrative to the child's life (Zevenbergen & Whitehurst, 2003). Linking events to personal experiences can assist in maintaining an interactive and naturalistic context (Culatta et al., 2010). Relating the story to children's own experiences can also make the interaction more meaningful and motivating, potentially enhancing comprehension by providing a scaffold to support children's comprehension (Culatta et al., 2010).

The third intervention session for each narrative targets character emotions within the narrative and linking emotions to personal experiences. Functional, higher level emotions (e.g. frightened, relieved) are discussed with children and they are asked to provide example/s of an event or experience in which they have felt (or

could feel) that emotion. This practice provides explicit linking of emotions within the narrative to children's personal experiences, providing a tangible foundation upon which to relate their own emotions and experiences to other narratives. Characters and events during the story are also linked to the children's personal experiences during the book-sharing discussions (e.g. "Have you seen a bear before?").

Prediction is a critical inferential skill and an important component of de-contextualised language in school (van Kleeck, 2008). The fourth intervention session for each narrative focuses on predicting what could happen after the story is finished. Making an appropriate prediction requires integration of all the events in the story to form a cohesive understanding of the story as a whole. Consistent practice of predictions based on narrative content may embed understanding of prediction within children's developing narrative schemas, thus supporting them to generalise the skill and make accurate predictions about similar texts in the future (Culatta et al., 2010).

7. Focus on **meta-narrative awareness** by explicitly unpacking story grammar elements, discussing what makes a 'good' story, and encouraging children to monitor their own and others' retelling of stories in terms of whether all story grammar elements were included (Westerveld & Gillon, 2008).

Broadly, meta-linguistic skills reflect an individual's ability to separate language from content and talk about, analyse, reason, and reflect on language (Owens, 2008). It is meta-linguistic awareness which allows us to monitor the expressive and receptive communication of ourselves and others, including comprehension monitoring (Cain & Oakhill, 2007b; Owens, 2008). Meta-narrative awareness reflects the same skills, but in the context of narrative (Westerveld & Gillon, 2008). Focus on building meta-narrative awareness was one of the intervention principles in a study by Westerveld and Gillon (2008), which showed significant improvement in the narrative comprehension abilities of 7 to 9 year old children with poor reading and oral narrative skills.

Theoretically, children who have strong meta-narrative awareness should be able to evaluate, and reflect on, their own and others' understanding and use of narrative. As in Westerveld and Gillon (2008), this intervention supports the development of meta-narrative awareness by including explicit instruction, discussion of story grammar elements, and discussion about the macro- and micro-

structure elements needed to make a 'good' story. Children are encouraged to monitor the narrative retelling, by themselves and by their peers, during retelling of narratives. Supporting the development of this higher level reflective skill should facilitate the consolidation of robust narrative schema, thus providing children with a stronger framework for future narrative processing involving comprehension and retelling.

8. Use **scaffolding techniques** to support children to respond to inferential comprehension questions, including rephrasing the question, providing semantic and phonemic cues, and using cloze sentences (Desmarais et al., 2013; Paris & Paris, 2007; van Kleeck et al., 2006; Westerveld & Gillon, 2008).

Scaffolding is a means of providing support during communication interventions and teaching. The aim is to scaffold the individual's level of functioning to within their zone of proximal development and, during intervention, this is often to facilitate the child to produce a language or speech target correctly or to provide a correct response (Paul, 2007). In this intervention, children's error responses (or failures to respond) to comprehension questions are scaffolded. Primary scaffolds for the intervention include rephrasing the question, providing cloze-sentences (e.g. "bear decided to...."), and providing think-alouds. Phonemic prompts (e.g. "bear felt wor...."), and semantic prompts (e.g. "bear really wanted to show he was brave so he decided to..."), are also used to also scaffold responses.

Similar scaffolding techniques are commonly used in language interventions (Smith-Lock, Leitão, Prior, & Nickels, 2015), and have been used in studies targeting comprehension (Desmarais et al., 2013; van Kleeck et al., 2006; Westerveld & Gillon, 2008). Repeated scaffolding provides children with increased opportunities to express an accurate answer, allowing them to achieve success, and provides practice in responding accurately to comprehension questions. In addition, the scaffolding strategies promote children's use of inferential thinking and language within the context of book-sharing (Kaderavek & Justice, 2002).

9. Use **graphic organisers**, via the use of story grammar elements and sketches, to create a story map to assist children in understanding, remembering, and recalling the story structure (Dexter & Hughes, 2011; Idol, 1987; Kim, Vaughn, Wanzek, & Shangjin Wei, 2004; Paris & Paris, 2007; Ukrainetz, 1998; Westerveld & Gillon, 2008).

Graphic organisers are commonly used in narrative interventions to provide visual support for learning and tasks including comprehension, generation, and retelling (Westerveld & Gillon, 2008). Use of story grammar icons provides a coherent, visual representation of narratives, allowing children to understand and learn how the ideas in a story are related (Cain & Oakhill, 2007b). This provides significant support for narrative comprehension, generation, and retell (Moreau & Zagula, 2002; Westerveld & Gillon, 2008).

Two meta-analyses found positive benefits of graphic organisers for children and adolescents with learning difficulties on a range of areas including reading comprehension and vocabulary (Dexter & Hughes, 2011; Kim et al., 2004). As children with DLD show poor narrative retelling ability, and tend to omit more abstract narrative elements (such as the character's plan and feelings), a story grammar structure which includes these elements was chosen for the intervention. Students with DLD at the Language Development Centre are familiar with the Story Grammar Marker® narrative icons of Braidy the StoryBraid® (Moreau & Zagula, 2002), which are used to support narrative retelling. The story grammar icons include initiating event, character plan, and internal response (feelings), and therefore align with a number of the intervention principles designed to support inferential comprehension.

The story grammar icons are used alongside sketches to create a structured story map for each narrative in the intervention sessions. Pictography (drawing pictures to represent stories chronologically) is a common method of supporting students to remember, and practice retelling, narratives whilst reducing some of the memory load inherent in narrative discourse (Ukrainetz, 1998). The pictures are used to cue recall of important information, ideas, or events organised episodically (Ukrainetz, 1998).

Thus, the story maps include story grammar icons to cue children to each structural component of a narrative, in addition to sketches which represent important information unique to each narrative. The small groups in the intervention engage in the creation of a story map for every narrative, which provides the children with familiarity and 'ownership' of the story map. Story mapping supports children who have learning difficulties by providing a framework on which narratives can be understood and remembered (Idol, 1987). As noted by Idol (1987), supporting poor reading comprehenders using story mapping "...provides a basic framework that

draws the reader's attention to the common elements among narrative stories." (p. 197). The repeated creation and use of story maps for each narrative in the intervention is likely to support schema development which, in turn, should support inferential comprehension.

10. Establish and maintain an explicit focus on inferential comprehension by **alerting children to the use of inferencing skills and making learning goals explicit** (Dunning, 1992; Paris & Paris, 2007; van Kleeck, 2006, 2008).

Research in the area of education has demonstrated that setting explicit learning goals is an important component of learning achievement (Hattie, 2012). Learning goals should include what students are expected to learn, along with self-monitoring and evaluation of learning (Hattie, 2012).

Explicit instruction of inferential comprehension strategies often occurs in reading comprehension with older school-aged children, but does not typically occur with younger children (van Kleeck, 2006, 2008). While learning goals were not explicitly set in an investigation of reading comprehension instruction, Dunning (1992) used 'secret' reminders to help third-grade students remember what to do to help them understand stories better. For younger children, strategic inferencing is modelled by adults during naturalistic interactions, such as in the context of book-sharing (van Kleeck, 2006, 2008). As both explicit goal setting and naturalistic (implicit) modelling of inferencing have been shown to be effective, both strategies are included in this intervention. Accordingly, learning goals are explicitly discussed to ensure children are aware of the focus of learning (e.g. inferential comprehension, in this intervention, termed 'working it out thinking'), and strategic inferential comprehension of narratives is also modelled during book-sharing. At the beginning of intervention sessions, learning goals are discussed explicitly with children so that they know, and are able to state, what they are going to learn. In addition, at the end of each intervention session the children evaluate whether they have achieved the learning goals. In addition to implicit modelling, the inclusion of explicit learning goals, and alerting children to inferential thinking, may assist children to focus on inferential comprehension, and therefore practise and learn inferential comprehension skills with overt awareness.

11. Use stories containing **well-defined story structure, higher level vocabulary and emotions**, whilst providing exposure to literate

language (Westerveld & Gillon, 2008), and embed **discussion of higher level (Tier II) vocabulary** during book-sharing (Beck & McKeown, 2007; Beck, McKeown, & Kucan, 2002; Gillam et al., 2012; Hickman et al., 2004; Spencer Kelley et al., 2015;).

Providing children with exposure to stories with well-defined structures will support the development of comprehensive schemas, as good quality schematic representations rely on good quality models for schema development. In turn, good quality schemas support discourse comprehension, as van Dijk and Kintsch note (1983, p. 237-238) "...once some category of a schema has been assigned, knowledge about the canonical structure of the schema allows the language user to anticipate information in the text, which will then facilitate reading and comprehension". In addition, narratives which contain higher level, functional vocabulary provide children with exposure to, and thus the opportunity to learn, useful vocabulary (Beck et al., 2002). Well selected books "...provide a structured presentation of a richer vocabulary and span content areas that might never emerge in casual conversation." (p. 31, De Temple and Snow, 2003).

The intervention includes discussion of pre-selected, higher level (Tier II), functional vocabulary to support vocabulary (breadth and depth) development and inferential comprehension (Steele & Mills, 2011; van Kleeck, 2008). The first study found that overall receptive and expressive vocabulary breadth was an important contributor to inferential comprehension ability, and past research has shown that vocabulary depth is important for comprehension (Cain & Oakhill, 2014; Florit et al., 2011; Lepola et al., 2012; Ouellette, 2006; Roth et al., 2002).

Higher-level, or Tier II, vocabulary includes words which are functional and can be used across a variety of contexts but which reflect more sophisticated labels for which children already understand the underlying concept, and are less likely to learn incidentally (Beck & McKeown, 2007; Beck et al., 2002). Each book-share during the intervention involves emphasising, introducing, defining and discussing some higher level vocabulary (e.g. slimy, mighty, pleasant). Discussion of higher level vocabulary during book-sharing will support on-line story comprehension, in addition to vocabulary development (both breadth and depth), thus supporting ongoing inferential comprehension (Hickman et al., 2004). Additionally, discussion of higher level vocabulary may also improve the microstructure of narrative retells, as children will have a greater variety of higher level vocabulary to include in narrative

retelling (Gillam et al., 2012). Past research has found that embedding higher level vocabulary explanation and discussion during book-reading supports vocabulary development and story comprehension (Beck & McKeown, 2007; Gillam et al., 2012; Gillam, Olszewski, Fargo, & Gillam, 2014; Hickman et al., 2004; Penno, Wilkinson, & Moore, 2002; Steele & Mills, 2011).

As van Kleeck and Vander Woude (2003) discuss, it is important for adults to use abstract, or decontextualised, language during book-sharing to support literacy development and academic achievements. As the narratives chosen for book-sharing can influence and facilitate the type of abstract language used by adults, it was important to select narratives for the intervention which support abstract language use, particularly in the context of inferential comprehension questions and discussion.

The quality of interaction during book-sharing interventions is a key component to facilitating language development (Kaderavek & Sulzby, 1998; Morrow & Brittain, 2003). For this intervention the selected narratives are well known children's books with exciting, engaging story structures and content, and engaging illustrations (Kaderavek & Sulzby, 1998). The emotions experienced by characters in these stories are higher level but functional emotions which young school-aged children can relate to (e.g. excited, frightened), which also supports the quality of interaction during book-sharing and vocabulary development.

Written language includes a greater concentration of conjunctions, mental and linguistic verbs, adverbs, and elaborated noun phrases (van Kleeck, 2008). Thus, the narratives also provide exposure to literate language, which is integral to academic achievements (Westerveld & Gillon, 2008). This is particularly important for children with DLD, who tend to generate and retell narratives with fewer literate language features and less varied vocabulary than typically developing peers (Boudreau, 2008; Dodwell & Bavin, 2008; Fey et al., 2004; Gillam & Gillam, 2016; Greenhalgh & Strong, 2001; Kaderavek & Sulzby, 2000). These elements of narrative selection improve the likelihood of the children being engaged with the narratives, which supports the quality of book-sharing in the intervention (Kaderavek & Sulzby, 1998). Exposure to narratives with well-defined story structures and vocabulary content provides good quality modelling, supporting the development of narrative schemas, vocabulary, and narrative comprehension. In addition, the selection of well-known

narratives ensures that the intervention can be easily replicated in clinical practice and future research.

12. Ensure that **book-sharing is engaging** by increasing the salience of naturalistic book-sharing strategies (e.g. facial expression, tone of voice, volume, balance of comments and questions, etc) (Dunst et al., 2012; Kaderavek & Justice, 2002; Paris & Paris, 2007; van Kleeck, 2008).

It is imperative that young children are engaged for language learning to take place, as the effectiveness of learning depends significantly on attention and motivation. While children with good comprehension show comparable comprehension monitoring during both low- and high-interest tasks, children with poor comprehension show significantly better comprehension monitoring in high-interest tasks (that is, those in which they are engaged and motivated), compared to low-interest tasks (de Sousa & Oakhill, 1996). Attention is the most basic component required for language processing, and if a child is engaged in a task then they will be attending to the task (Owens, 2010). Therefore, ensuring intervention activities are engaging provides greater opportunity for language learning and in general, greater generalisation of skills (Owens, 2010). Use of naturalistic strategies supports a child's motivation and provides a close model of natural language learning, ensuring that the communicative function of the targeted skill is not lost, thus increasing the chance of generalisation (Owens, 2010). This is particularly pertinent as a small percentage of typically developing children do not enjoy book-sharing, and this percentage may be higher in children with DLD (Kaderavek & Justice, 2002). In addition, early engagement in book-sharing and reading may be linked to later academic success (Kaderavek & Justice, 2002). Behaviours that facilitate successful interaction and engagement in book-sharing include indications that the adult is enjoying the storybook interaction, reading with expression and animation, and close physical proximity between adult and child (Kaderavek & Sulzby, 1998).

The techniques taught in dialogic book-sharing also focus on establishing book-sharing as an interaction, including responding to children's comments and questions, praising and encouraging children during book-sharing, following the child's interests, and having fun (Zevenbergen & Whitehurst, 2003). Engaging children in book-sharing using naturalistic strategies, as used in the intervention, provides a communication environment and dialogue which is meaningful and

reflective of natural language learning, therefore promoting the children's ability to access and respond to the intervention (Kaderavek & Justice, 2002; van Kleeck, 2008).

13. Use of **repeated reading** of story books (Gillam et al., 2012; Morrow & Brittain, 2003; Spencer et al., 2013; Spencer Kelley et al., 2015; Strouse et al., 2013).

Children learn language through repetition and, as such, repetition is a key component of language interventions. Providing multiple exposures to a narrative by using book-sharing as a natural context for learning supports children to develop comprehensive schemas, and thus supports both comprehension and retell of narratives (Morrow, 1985). In addition, one of the unique features of book-sharing is that reading the same book repeatedly allows revisiting of the same topic of conversation, thus providing the adult with the opportunity to model language a number of times (De Temple & Snow, 2003). Repeated reading of books to children also enhances "... opportunities to enrich and consolidate their understanding of new word meanings." (p. 31, De Temple and Snow, 2003), therefore supporting the development of vocabulary breadth and depth.

Reading the same narrative a number of times is a common activity between parent/s and children (Morrow & Brittain, 2003). Research has demonstrated that the language used by a parent during the first readings of a narrative is often used by the child during later readings, as the language used by children during repeated readings changes over time as a result of the language models provided (Martinez & Roser, 1985; Snow & Goldfield, 1983). In one study, higher level language use by a child only occurred after repeated readings of a narrative, and story comprehension also developed over the repeated readings (Yaden, 1988). As noted by Kaderavek and Justice (2002), this change in children's language use and understanding over time reflects the internalisation of a narrative, supported by adult interaction and scaffolding. Theoretically, this also reflects the building and consolidation of narrative schemas (van Dijk & Kintsch, 1983).

A meta-analysis of 16 studies investigating the relationship between repeated book reading and children's language and literacy outcomes found that repeated reading had a positive effect on story vocabulary and comprehension, particularly when books were read at least four times (Trivette, Simkus, Dunst, & Hamby, 2012). Four repeated book-sharing opportunities are provided for each narrative in this

intervention, during which a number of strategies are used to promote inferential comprehension. These repeated opportunities may support the development and consolidation of inferential comprehension skills.

The inferential comprehension intervention was based on these principles, and is described below (see Inferential Comprehension Intervention).

Intervention Study

The remainder of this chapter will present the study evaluating the intervention, which was a randomised controlled trial of the oral inferential comprehension (IC) intervention, and a control comparison phonological awareness (PA) intervention. Participants were randomly allocated to the IC or PA interventions for an 8 week intervention period. Participants were assessed pre-intervention (T1), post-intervention (T2), and again after a maintenance period of 8 weeks (T3).

Hypotheses

The hypotheses were as follows:

Hypothesis 1: Compared to the PA control group, the IC group will show a significantly greater T1 to T2 increase in oral inferential comprehension scores.

Hypothesis 2: The IC group's T1 to T2 increase in oral inferential comprehension scores will be maintained at T3.

Hypothesis 3: Compared to the PA control group, the IC group will show significantly higher oral inferential comprehension scores on a generalisation measure of narrative comprehension at T2.

Hypothesis 4: The proportion of individuals showing a positive reliable change in oral inferential comprehension scores between T1 and T2 will be significantly greater in the IC group.

Methods

Participants

The participants for this study were recruited from pre-primary classes at a Language Development Centre (LDC) in Perth, Western Australia. Following ethics approval from the Curtin University Human Research Ethics Committee and the Western Australian Department of Education, an LDC Principal was contacted and

met with the researcher to discuss the study. The Principal provided written consent for the LDC to participate in the study (see Appendix I for Study Two information letters and consent forms).

Parent/carer information letters and consent forms were sent out to eligible students ($n = \sim 45$) from four pre-primary classes at the LDC in the middle of Term 2, 2015 (May 2015). Eligible pre-primary students included children who the class teacher considered as having mostly intelligible speech at discourse-level with known context⁸. This was to ensure reliability in transcription and scoring of assessments which involved expressive language samples. Thirty-eight signed parent consent forms were returned from parents/carers.

Overall, 37 students were eligible to participate in the study (see Figure 6, p. 156). All of the participants spoke English as their primary language at home. In addition to English as their primary language at home, three participants were also exposed to other languages either at home or through extended family (the languages included Russian, Mandarin, and Malay). Each participant was allocated a de-identified code for use in administration and scoring of assessments.

Interventions

The 37 participants were allocated to small groups of 3 to 4 participants, with five small groups receiving each intervention. Small groups were chosen as the method of intervention delivery as they are common-practice, functional, contextually appropriate, and time- and cost- effective for providing intervention to children with similar goals / language difficulties in clinical practice and research (Cirrin & Gillam, 2008; Cirrin et al., 2010; Morrow & Brittain, 2003; Owens, 2010; Spencer, Petersen, & Adams, 2015). Each group completed two 30-minute intervention sessions per week with the primary researcher for 8 weeks, providing a total of 16 intervention sessions per small group.

A simple reward system with a visual chart was used for both interventions. The participants were provided with a sticker reward at the end of each intervention session if they had demonstrated appropriate listening and attention ('whole body listening'). When participants had demonstrated appropriate listening and attending

⁸ Non-verbal IQ was not used as selection criteria for this study.

for four sessions in a row, as shown on the visual reward chart, they were able to choose a small prize from a prize box (e.g. stamp, eraser, pencil).

Inferential Comprehension Intervention

The following is a description of the inferential comprehension intervention programme and structure. The intervention sessions were based on four narratives selected because of good quality narrative macro- and micro-structure (intervention principle 11). This included: clear story structure and problems encountered by characters; higher level emotions that could be inferred; vocabulary used; and, the perceived engagement of the illustrations. The selected narratives were well-known children's books which are easily accessible, supporting the intervention's replicability. The narratives used for the inferential comprehension intervention include:

1. The Very Brave Bear (Bland, 2013).
2. Monkey Puzzle (Donaldson & Scheffler, 2000).
3. Giraffes Can't Dance (Andreae & Parker-Rees, 2000).
4. The Gruffalo (Donaldson & Scheffler, 2001).

Some of the texts included rhyme, however rhyme was not emphasised during the intervention. Every read-through of the narrative contained think-alouds, explanations and discussion of vocabulary, and inferential questioning and discussion, which interrupted the flow of the rhyme.

The intervention focused on each narrative for two weeks (i.e. over four intervention sessions, see Table 11). The scripted sessions followed a repeated sequence of activities for each narrative (see Table 12).

Table 11: Sequence of Narrative Texts

| Week | Narrative |
|------|--|
| 1 | The Very Brave Bear (Bland, 2013) |
| 2 | The Very Brave Bear (Bland, 2013) |
| 3 | Monkey Puzzle (Donaldson & Scheffler, 2000) |
| 4 | Monkey Puzzle (Donaldson & Scheffler, 2000) |
| 5 | Giraffes Can't Dance (Andreae & Parker-Rees, 2000) |

Table 11 continued.

| | |
|---|--|
| 6 | Giraffes Can't Dance (Andreae & Parker-Rees, 2000) |
| 7 | The Gruffalo (Donaldson & Scheffler, 2001) |
| 8 | The Gruffalo (Donaldson & Scheffler, 2001) |

Table 12: Intervention Sessions Outline

| Session | Focus |
|---------|--|
| 1 | Book sharing, story map, retelling. |
| 2 | Book sharing, story map, retelling. |
| 3 | Book sharing, retelling, character emotions. |
| 4 | Book sharing, retelling, prediction. |

Session 1

The goals of the first intervention session for each narrative were:

1. To activate students' background knowledge to assist with narrative comprehension.
2. To use scaffolding techniques to support children's literal and inferential comprehension of the narrative.
3. To explicitly break down the story grammar of the narrative using literal and inferential questioning, while creating a story map to support narrative retell.

These were achieved through: pre-story knowledge activation (linking to personal experiences, and predicting); reading the narrative using think-alouds and discussion of higher level vocabulary to support comprehension; breaking down and discussing the story structure elements while drawing a story map for visual support; and, practising retelling part of the story using the story map.

Session 2

The goals of the second intervention session for each narrative were:

1. To use scaffolding techniques to support children's literal and inferential comprehension of the narrative.

2. To explicitly break down the story grammar of the narrative using literal and inferential questioning, while creating a story map to support narrative retell.
3. To retell the narrative using structural scaffolds (story map and narrative) to support the inclusion of macrostructure and microstructure elements.

These were achieved through: re-reading the story using think-alouds, inferential questions, and discussing some higher level vocabulary; finishing the story map by breaking down and discussing the story structure elements; and, practising retelling the story using the story map.

Session 3

The goals of the third intervention session were:

1. To use scaffolding techniques to support children's inferential comprehension of character emotions, and to build on background knowledge of emotions by relating to personal experiences.
2. To retell the narrative using structural scaffolds (story map and narrative) to support the inclusion of macrostructure and microstructure elements – specifically, the inclusion of character emotions.

These were achieved through: re-reading the narrative with a focus on inferring ('working it out thinking') and discussing the characters' internal response (feelings); modelling inferential reasoning related to feelings using think-alouds; relating the characters' internal response to the student's personal experiences; linking the internal response to an event which might cause that emotion; and, practising retelling the story using the story map with a focus on including character emotions.

Session 4

The goals of the fourth intervention session for each narrative were:

1. To retell the narrative using structural scaffolds (story map and narrative) to support the inclusion of all targeted macrostructure and microstructure elements.
2. To use scaffolding techniques to support children's ability to make an appropriate prediction based on the events in a narrative.

These were achieved through: re-reading the narrative using think-alouds, explicitly stating feelings, and discussing higher level vocabulary; making predictions with inferential reasoning ('working out' what would happen after the story ended with appropriate causal reasoning); using questioning, discussion, and think-alouds related to evaluative reasoning; and, practising retelling the story using the story map with a focus on including character emotions and causal conjunctions (e.g. because, but, so).

The story grammar elements used as graphic organisers to create a story map were the icons from 'Braidy the StoryBraid®' (Moreau & Zagula, 2002), as the students at the LDC were familiar with the icons from classroom instruction. In addition, as discussed, the Braidy macrostructure aligns well with a focus on inferential comprehension as it includes components which are often implicit in narratives, such as the character's internal response (feelings) and plan. The Braidy macrostructure links the elements of initiating event, internal response, and plan to facilitate narrative comprehension (Moreau & Zagula, 2002). The Braidy icons were used in conjunction with sketches (pictographs) to create a story map for each narrative (Ukrainetz, 1998).

At the beginning of every intervention session the goals of the session were made explicit to the participants. The focus on inferential comprehension was made explicit by referring to inferencing as 'working it out thinking'. Appendix J contains example intervention session plans and related resources for the inferential comprehension intervention.

Control Phonological Awareness Intervention

Phonological awareness was chosen as the target of the control intervention. Phonological awareness is the explicit understanding of, and ability to, break words into smaller units (Gillon, 2007). It is required for literacy development and is comprised of multiple levels (i.e. syllable awareness, onset-rime awareness, and phoneme awareness) (Gillon, 2007). Despite drawing on meta-linguistic awareness, phonological awareness skills primarily rely on phonological processing ability at the word level (e.g. understanding that *cat*, *bat*, and *mat* all share a common ending of sounds). As such, phonological awareness draws on separate language skills to discourse-level inferential comprehension, making it an appropriate control intervention target for this study.

The Gillon Phonological Awareness Training (PAT) Programme (Gillon, 2008) was used as the phonological awareness intervention. The effectiveness of this programme has been supported by a number of studies (Gillon, 2000, 2002, 2007). The intervention sessions followed the progression of goals in the Programme manual, with a focus on phoneme segmentation and blending maintained throughout the intervention. Session plans were developed based on the information and examples provided in the PAT Programme manual (which can be found at: http://www.education.canterbury.ac.nz/people/gillon/gillon_phonological_awareness_training_programme.shtml). See Appendix K for more information about the PA intervention, including session plans and intervention results.

Measures

Participants' oral inferential comprehension of narrative and phonological awareness were assessed as the primary outcome measures. The assessments included:

The Squirrel Story Narrative retell assessment on iPad (Carey et al., 2006), and **The Squirrel Story Narrative Comprehension Assessment (NCA)** with questions adapted to The Squirrel Story (see Appendix C) based on research by Paris and Paris (2003) (see Chapter 3 Measures section for full details). The Squirrel Story NCA includes 14 inferential questions and 5 literal questions, providing a total score out of 28 for inferential comprehension and out of 10 for literal comprehension. The participant watched and listened to The Squirrel Story narrative on iPad using the Australian male voice setting and was then asked comprehension questions while looking through the narrative pictures. Following this, the participant listened to the story again and was asked to retell the story using the pictures. The responses to the comprehension questions and the narrative retell were audio-recorded on the iPad app using the participant's code with no identifying information. The protocol for this assessment was based on the story retelling procedure of the Westerveld and Gillon Language Sampling Protocol (Westerveld & Gillon, 2011). This assessment was carried out at all three assessment points. The assessment was completed over 10 to 15 minutes.

The Peter and the Cat Narrative retell assessment on iPad (Leitão & Allan, 2003), and **Peter and the Cat Narrative Comprehension Assessment (NCA)**, with questions adapted by the researcher for the Peter and the Cat narrative (see

Appendix D)⁹ based on research by Paris and Paris (2003). The Peter and the Cat NCA contains 14 inferential questions and 6 literal questions. As per The Squirrel Story NCA, a scoring guide was created to score each question on a scale (0, 1, or 2 points), providing a total score out of 28 for inferential comprehension and out of 12 for literal comprehension. The procedure was carried out as per The Squirrel Story.

The Peter and the Cat NCA was used as a measure of post-intervention narrative comprehension generalisation. Similar to The Squirrel Story, the Peter and the Cat narrative was chosen due to its clear story structure; problem encountered by the character; higher level emotions that could be inferred; vocabulary used; and, the perceived engagement of the illustrations on the iPad. Further, and in line with The Squirrel Story assessment, the narration was standard across all participant assessments (supporting reliability) and the app was considered to be easily accessible for clinicians to replicate the NCA with both the Peter and the Cat and The Squirrel Story narratives. The assessment was completed over 10 to 15 minutes.

The Preschool and Primary Inventory of Phonological Awareness – PIPA (Dodd, Ozanne, McIntosh, Crosbie, & Teitzel, 2000). The PIPA is one of few standardised phonological awareness assessments available with Australian norms for this age group. Each participant completed a number of phonological awareness assessment tasks (syllable identification, rhyme identification, initial phoneme matching and identification, phoneme segmentation, and letter-sound awareness) using the pictures in a stimulus booklet. The PIPA was standardised on a sample of 583 Australian children aged 3 to 6;11 and demonstrated appropriate internal consistency reliability ($r = 0.85$), test-retest reliability ($r = 0.77$), inter-rater reliability, and construct, concurrent, and criterion-rated validity. The PIPA was carried out at all three assessment points. The assessment was completed over 15 to 20 minutes.

See Table 13 for an outline of the assessment battery completed at each testing point.

⁹ Please see copyright permissions in Appendix A.

Table 13: Study Two Assessments

| Assessment | Date/s completed | Assessor | Assessments completed |
|---------------------------|--|------------------------------|--|
| Pre-intervention (T1) | Weeks 9 – 11, Term 2 and Week 1, Term 3 (June – July, 2015) | Researcher | The Squirrel Story Narrative retell and NCA. PIPA. |
| Post-intervention (T2) | Week 10, Term 3 (September, 2015) | Blind research assistants | The Squirrel Story Narrative retell and NCA. Peter and the Cat Narrative retell and NCA. PIPA. |
| Maintenance (T3) | Weeks 6 – 7, Term 4 (November, 2015) | Blind research assistants | The Squirrel Story Narrative retell and NCA. PIPA. |

Procedures

Participants completed the pre-intervention assessment session with the primary researcher in approximately 30 minutes. Prior to administering the assessment battery, the researcher explained the research in a child-friendly manner and gave each participant the opportunity to provide informed consent (by circling a tick or a cross on a child-friendly consent form). The order of the pre-intervention assessments was counter-balanced across the students in each participating class. The researcher followed the administration and scoring instructions in the PIPA manual, as well as the administration guidelines of The Squirrel Story Narrative retell assessment. Following the pre-intervention assessment, the researcher scored the PIPA according to the test manual and The Squirrel Story NCA according to the scoring guidelines.

Following the pre-intervention assessment and scoring, the participants were randomly allocated to one of the two intervention groups: inferential comprehension (IC) or phonological awareness (PA). Participants in both interventions received two, 30 minute small-group intervention sessions a week over 8 weeks.

The post-intervention and maintenance assessment batteries were completed over two to three short sessions of approximately 15 minutes. These assessments were completed by research assistants who were blind to intervention condition. The research assistants were provided with training and supervision in administering the assessments. See Figure 6 which demonstrates the research process and timeline of Study Two.

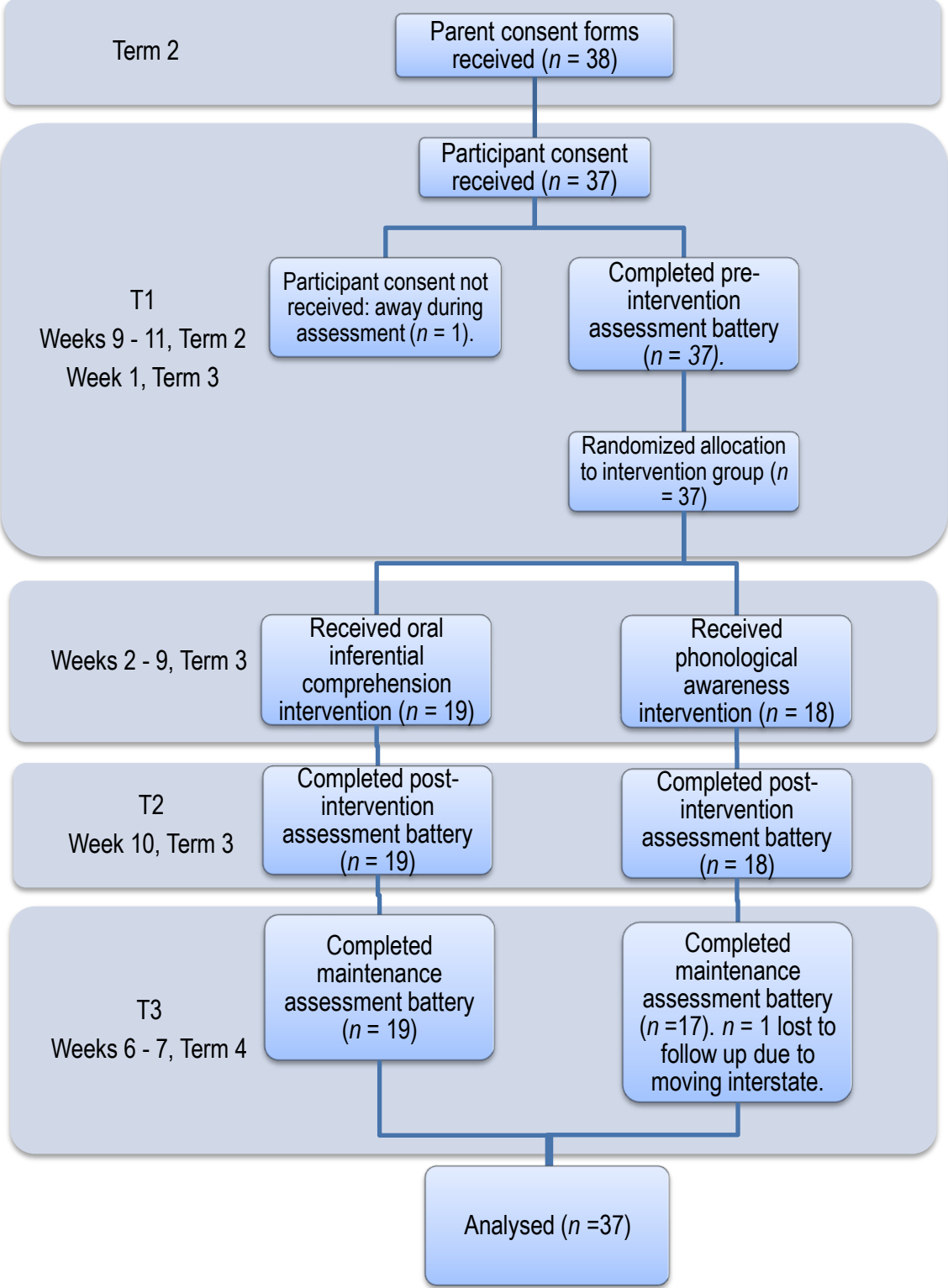


Figure 6. Study Two Research Process Flow Chart

Randomisation

Within participating pre-primary classes, the participants were randomly allocated to each intervention group to control for teaching effects (i.e. a class with 10 participants had 5 participants allocated to the IC intervention and 5 participants allocated to the PA intervention). In addition, class teachers were blind to participants' intervention group with intervention sessions taking place in a quiet room separate from the pre-primary classrooms. The inferential comprehension intervention group ($n = 19$) consisted of 13 males and 6 females. The phonological awareness intervention group ($n = 18$) consisted of 14 males and 4 females. The mean age of the participants ($n = 37$) at pre-test was 5;5 (years; months).

A series of independent samples t tests were completed to compare the two intervention groups on the pre-intervention measures. The means and standard deviations of the IC and PA intervention groups are reported in Table 14. The groups' inferential and literal comprehension scores were not significantly different, $t(35) = .867, p = .392$ and $t(35) = 1.005, p = .322$, respectively.

For phonological awareness, the PIPA average subtest standard scores were not significantly different between the two groups, $t(35) = .041, p = .967$. The individual rhyme awareness, phoneme segmentation, and letter knowledge raw subtest scores were not significantly different between the two groups, $t(35) = .758, p = .454$; $t(35) = .060, p = .952$; $t(35) = 1.244, p = .222$, respectively.

The results from these analyses indicated that the IC and PA groups demonstrated equivalent pre-intervention performance on literal and inferential comprehension of narratives and phonological awareness.

Table 14: Pre-Intervention Means and Standard Deviations of Intervention Groups

| Measure | Inferential Comprehension Intervention (IC Group) | | Phonological Awareness Intervention (PA Group) | |
|--|---|------|--|------|
| | Mean | SD | Mean | SD |
| Squirrel Story NCA inferential comprehension | 10.84 | 2.71 | 11.65 | 2.29 |
| Squirrel Story NCA literal comprehension | 3.21 | 1.13 | 3.53 | 1.28 |
| PIPA subtest scaled score average | 7.83 | 1.93 | 7.84 | 2.25 |
| PIPA raw rhyme awareness score | 5.21 | 2.64 | 4.65 | 2.67 |
| PIPA raw phoneme segmentation score | 0.58 | 1.07 | 0.59 | 1.33 |
| PIPA raw letter knowledge score | 17.42 | 6.95 | 14.12 | 7.37 |

Inter-rater Reliability

Two speech-language pathologists re-scored 10% of the total assessment data at each assessment point to determine inter-rater reliability using intra-class correlation (ICC). The ICC values for every measure at each assessment point indicated appropriate reliability (ICC > .75) (Portney & Watkins, 2000). The ICC values are displayed in Table 15.

Table 15: Inter-rater Reliability

| Time | Measure | ICC |
|------------------------|---|------|
| Pre-intervention (T1) | Squirrel Story Literal Comprehension | .969 |
| | Squirrel Story Inferential Comprehension | .893 |
| | PIPA raw subtest & subtest standard scores | 1.00 |
| Post-intervention (T2) | Squirrel Story Literal Comprehension | .832 |
| | Squirrel Story Inferential Comprehension | .897 |
| | Peter and the Cat Literal Comprehension | .932 |
| | Peter and the Cat Inferential Comprehension | .887 |
| | PIPA raw subtest & subtest standard scores | 1.00 |
| Maintenance test (T3) | Squirrel Story Literal Comprehension | .947 |
| | Squirrel Story Inferential Comprehension | .934 |
| | PIPA raw subtest & subtest standard scores | 1.00 |

Intervention Attendance

Overall attendance of participants in both intervention groups was high, and both intervention groups had the same total average intervention attendance of 95% (see Table 16). The average number of sessions attended by participants in the inferential comprehension group was 15.21/16 intervention sessions (95% overall attendance). The average number of sessions attended by participants in the phonological awareness group was 15.17/16 intervention sessions (95% overall attendance).

Table 16: Number of Sessions Attended by Intervention Participants

| Sessions Attended | IC Group ($n = 19$) | PA Group ($n = 18$) |
|-------------------|-----------------------|-----------------------|
| 12/16 | 1 | 0 |
| 14/16 | 3 | 4 |
| 15/16 | 5 | 7 |
| 16/16 | 10 | 7 |

Analysis Plan

Analyses were conducted in three stages using SPSS Version 22.

Stage 1: Descriptive statistics were calculated.

Stage 2: The assumptions underlying the least squares ANOVA model were tested. These assumptions included normality, homogeneity of variance, sphericity, and independence. Several assumptions were violated, but the violations were controlled in the generalised linear mixed model (GLMM).

Stage 3: A series of GLMMs were run to analyse the intervention effects.

Results

Stage 1: Descriptive Statistics

The means, standard deviations, and range of scores for the literal and inferential scores from the Narrative Comprehension Assessments are displayed in Table 17 (The Squirrel Story NCA – T1, T2, and T3) and Table 18 (Peter and the Cat NCA – T2 generalisation measure).

Table 17: Means, Standard Deviations & Ranges of The Squirrel Story NCA Scores

| Time | Measure | Group | Mean | Standard Deviation | Range |
|------------------------|--|-------|-------|--------------------|-------|
| Pre-intervention (T1) | Squirrel Story Inferential Comprehension | IC | 10.84 | 2.71 | 6-15 |
| | | PA | 11.65 | 2.29 | 8-16 |
| | Squirrel Story Literal Comprehension | IC | 3.21 | 1.13 | 1-5 |
| | | PA | 3.53 | 1.28 | 1-5 |
| Post-intervention (T2) | Squirrel Story Inferential Comprehension | IC | 15.53 | 3.47 | 7-20 |
| | | PA | 12.29 | 2.89 | 6-17 |
| | Squirrel Story Literal Comprehension | IC | 4.32 | 1.53 | 2-7 |
| | | PA | 4.76 | 1.39 | 3-8 |
| Maintenance (T3) | Squirrel Story Inferential Comprehension | IC | 15.05 | 2.88 | 9-22 |
| | | PA | 11.94 | 3.31 | 4-17 |
| | Squirrel Story Literal Comprehension | IC | 4.47 | 1.02 | 3-6 |
| | | PA | 4.41 | 1.06 | 3-6 |

Table 18: Means, Standard Deviations & Ranges of Peter and the Cat NCA Scores

| Time | Measure | Group | Mean | Standard Deviation | Range |
|------------------------|---|-------|-------|--------------------|-------|
| Post-intervention (T2) | Peter and the Cat Inferential Comprehension | IC | 12.16 | 3.50 | 9-22 |
| | | PA | 8.94 | 2.88 | 4-15 |
| | Peter and the Cat Literal Comprehension | IC | 5.68 | 1.34 | 3-8 |
| | | PA | 5.06 | 1.35 | 2-7 |

Stage 2: Assumption testing

The GLMM represents a special class of regression model. The GLMM is 'generalised' in the sense that it can handle outcome variables with markedly non-normal distributions; the GLMM is 'mixed' in the sense that it includes both random

and fixed effects. The GLMMs included one nominal random effect (participant), one categorical fixed effect (group: IC versus PA control), one ordinal fixed effect (time: T1 – T3), and the Group x Time interaction.

The GLMM ‘robust statistics’ option controlled for violations of normality and homogeneity of variance. Violations of sphericity (associated with multiple assessments of the same individuals) were accommodated by changing the covariance matrix from the default of compound symmetry to autoregressive.

Stage 3: Generalised Linear Mixed Models

Thirty-seven participants provided sufficient power for an 80% chance of capturing ‘moderate’ ($f = .22$) intervention effects at an alpha-level of .05. A series of GLMMs were run to analyse the effects of the inferential comprehension intervention, at three time points: 1. pre-intervention (T1), 2. post-intervention (T2) and, 3. maintenance (T3). Inferential and literal comprehension results for The Squirrel Story NCA are reported first, followed by the results for the Peter and the Cat NCA post-intervention generalisation assessment. The alpha-level is .05 and the reported effect sizes include partial eta squared (.01 = small; .06 = moderate; .14 = large) and Cohen’s d (.2 = small; .5 = medium; .8 = large).

Inferential Comprehension (The Squirrel Story NCA)

The Group x Time interaction for The Squirrel Story NCA inferential comprehension scores was significant, indicating an intervention effect for average inferential comprehension scores, $F[2,104] = 8.97$, partial eta-squared = .079, $p < .001$. As such, the main effects for group and time could not be reliably interpreted independently of one another. The Group x Time interaction is displayed in Figure 7.

The nature of the interaction was investigated by examining the simple main effects of time separately for each group. There was a significant effect of time for the IC group, $F[2,104] = 19.50$, partial eta-squared = .157, $p < .001$, but not for the PA group, $F[2,104] = 1.17$, partial eta-squared = .011, $p = .315$. Least significant difference (LSD) contrasts were conducted across the time effect for the inferential comprehension group. For the IC group, there was a significant T1 to T2 increase in average inferential comprehension scores ($t[104] = 5.650$, Cohen’s $d = 1.883$, $p < .001$), followed by a non-significant T2 to T3 decrease ($t[104] = 0.806$, Cohen’s $d =$

0.269, $p = .422$). The T1 – T3 increase was also significant ($t[104] = 5.911$, Cohen's $d = 1.970$, $p < .001$), indicating maintenance of inferential comprehension gains.

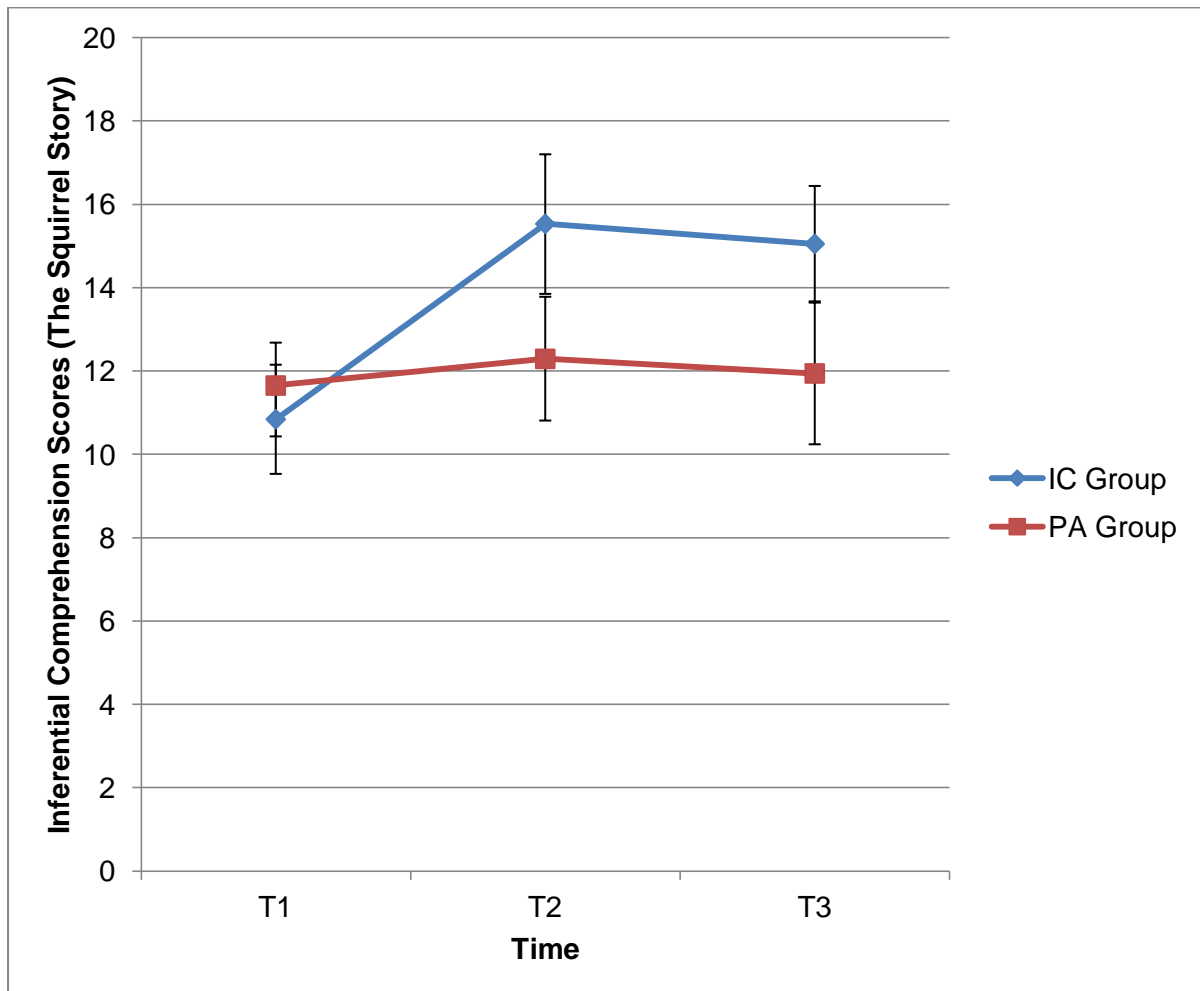


Figure 7. Group x Time interaction for inferential comprehension scores.

Literal Comprehension (The Squirrel Story NCA)

The Group x Time interaction for The Squirrel Story NCA literal comprehension scores was non-significant, $F[2,104] = 0.78$, partial eta-squared = .007, $p = .460$. As such, the group and time main effects were interpreted independently of one another. The group effect was non-significant, indicating that there was no significant difference between the IC and PA groups at any of the three assessments, $F[1,104] = 0.91$, partial eta-squared = .009, $p = .342$. In contrast, the time effect was significant, indicating that both groups changed across time at the same rate, $F[2,104] = 14.12$, partial eta-squared = .120, $p < .001$. The main effect for time is displayed in Figure 8.

LSD contrasts were conducted across the main effect for time. As the Group x Time interaction was non-significant, the time effects apply to both groups. There was a significant T1 to T2 increase in literal comprehension average scores, $t[104] = 4.38$, Cohen's $d = 1.460$, $p < .001$, which was followed by a non-significant T2 to T3 decrease, $t[104] = 0.38$, Cohen's $d = 0.127$, $p = .705$. The T1 to T3 increase remained significant, indicating maintenance of literal comprehension gains for both groups, $t[104] = 4.84$, Cohen's $d = 1.613$, $p < .001$.

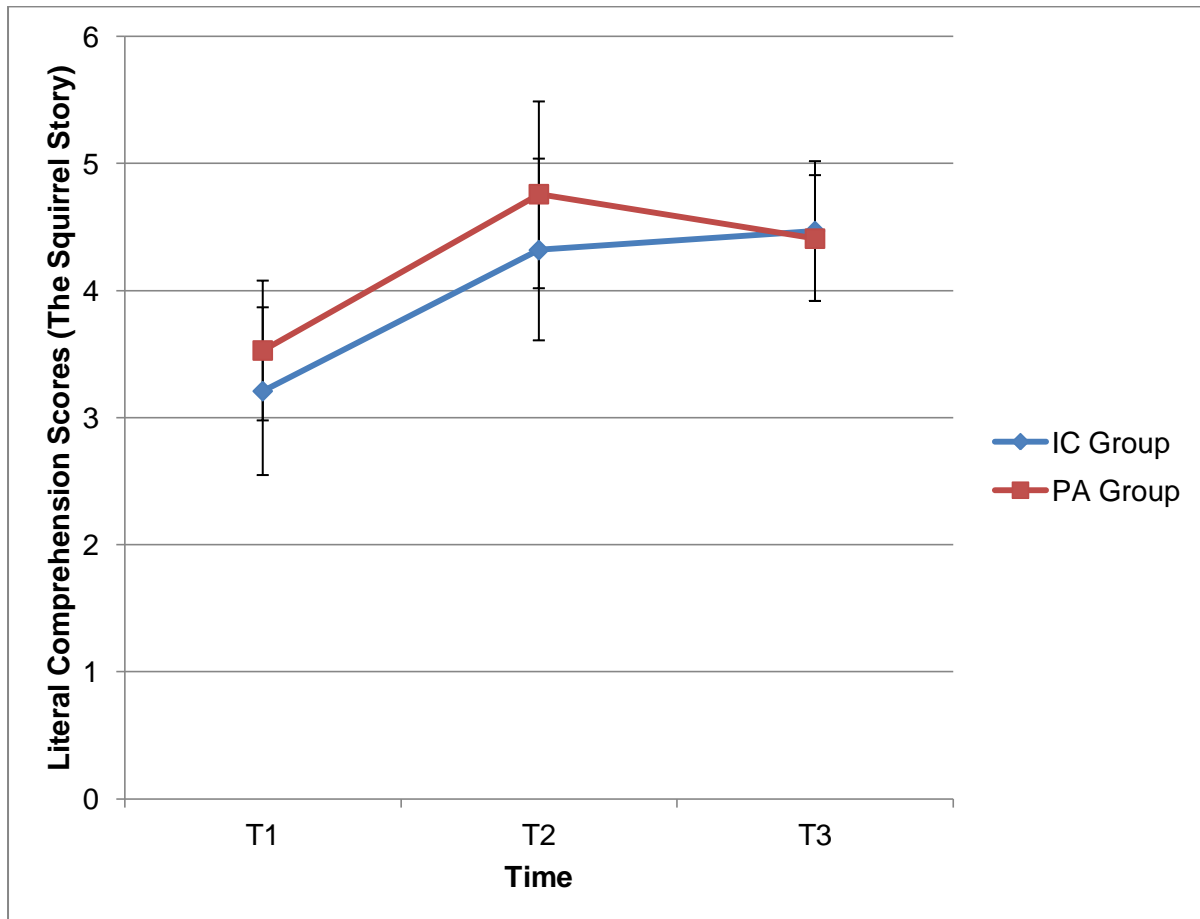


Figure 8. Time effect for literal comprehension scores.

Post-test Inferential and Literal Comprehension (Peter and the Cat NCA – Generalisation Measure)

For the Peter and the Cat NCA at T2, the IC group's inferential comprehension scores were significantly higher than those of the PA group, $F[1,35] = 9.73$, partial eta-squared = .218, $p = .004$. The IC group's literal comprehension scores were also higher than the PA group, but the difference was not significant, $F[1,35] = 2.22$, partial eta-squared = .060, $p = .145$.

Reliable Change

In order to investigate the clinical significance of the results, the reliable change index (RC) was chosen as a meaningful measure of significant change (Jacobson & Truax, 1991). The RC score is calculated by dividing participant changes on the outcome variable (inferential comprehension score) by the standard error of difference between the pre- and post-intervention scores, reflecting the degree to which the participant's inferential comprehension score has changed (Jacobson & Truax, 1991). When the absolute value of the RC score is greater than 1.96, it is likely that the post-intervention score reflects a *real* or *reliable* change. Although this value can be reduced in some situations (Wise, 2004), the Squirrel Story Narrative Comprehension Assessment questions were non-standardised and so the more conservative reliable change criterion of 1.96 was used.

The standard deviation of the participants' inferential comprehension scores at pre-intervention (SD = 2.49) and test-retest reliability were used to calculate the RC score. Test-retest reliability ($r = 0.626$) was provided by calculating the mean of the control group's pre- to post-intervention correlation ($r = 0.581$, $p < .05$), and the experimental group's post-intervention to maintenance correlation ($r = 0.671$, $p < .001$), for inferential comprehension scores. Using a reliable change calculator (Deville, 2004), the reliable change criterion was 4.23. As the comprehension task was scored in total marks, each participant's pre- to post-intervention inferential comprehension score difference was required to exceed 5 to demonstrate reliable change.

A Pearson's chi-square test of contingencies was used to examine whether reliable improvement in inferential comprehension score was related to intervention group. The chi-square test was significant, $\chi^2 (1, n = 37) = 11.56$, $p = .001$, with a large effect $\phi = .56$. The proportion of participants showing reliable improvement in inferential comprehension score was significantly higher in IC group than in the control PA group (see Table 19).

Table 19: Crosstabulation of Reliable Change

| | | Reliable change indicator | |
|----------|-------------------|---------------------------|----------------------|
| | | No reliable change | Reliable improvement |
| IC group | Count | 8 | 11 |
| | Expected count | 12.8 | 6.2 |
| | % within IC group | 42.1% | 57.9% |
| PA group | Count | 17 | 1 |
| | Expected count | 12.2 | 5.8 |
| | % within PA group | 94.4% | 5.6% |

The participants' individual pre- to post-intervention inferential comprehension change scores for The Squirrel Story NCA are displayed in Table 20. The mean pre- to post-intervention change in The Squirrel Story NCA inferential comprehension scores was higher in the IC group ($M = 4.68$) than the PA group ($M = 0.83$).

Table 20: Participant Pre- to Post-Intervention Inferential Comprehension Change Scores (The Squirrel Story NCA)

| | Pre-Intervention Score | Post-Intervention Score | Pre- to Post-Change |
|----------|------------------------|-------------------------|---------------------|
| IC Group | 7 | 7 | 0 |
| | 7 | 19 | 12* |
| | 12 | 17 | 5* |
| | 12 | 13 | 1 |
| | 9 | 7 | -2 |
| | 15 | 14 | -1 |
| | 11 | 16 | 5* |
| | 13 | 18 | 5* |
| | 11 | 17 | 6* |
| | 7 | 15 | 8* |
| | 8 | 16 | 8* |
| | 6 | 17 | 11* |
| | 12 | 14 | 2 |
| 13 | 20 | 7* | |

Table 20 continued.

| | Pre-Intervention Score | Post-Intervention Score | Pre- to Post-Change | |
|----------|---------------------------|----------------------------|---------------------|------|
| IC Group | 12 | 16 | 4 | |
| | 12 | 16 | 4 | |
| | 12 | 17 | 5* | |
| | 15 | 18 | 3 | |
| | 12 | 18 | 6* | |
| | | | Mean | 4.68 |
| PA Group | 10 | 13 | 3 | |
| | 12 | 11 | -1 | |
| | 12 | 10 | -2 | |
| | 14 | 15 | 1 | |
| | 9 | 11 | 2 | |
| | 15 | 17 | 2 | |
| | 8 | 6 | -2 | |
| | 12 | 13 | 1 | |
| | 9 | 7 | -2 | |
| | 10 | 16 | 6* | |
| | 14 | 11 | -3 | |
| | 11 | 13 | 2 | |
| | 12 | 13 | 1 | |
| | 9 | 12 | 3 | |
| 12 | 12 | 0 | | |
| 16 | 15 | -1 | | |
| 10 | 14 | 4 | | |
| 13 | 14 | 1 | | |
| | | | Mean | 0.83 |

Note. Reliable improvement in inferential comprehension score is denoted with an asterisk (*).

Question Types Analysis

A series of paired samples t-tests were run to examine whether the IC group participants demonstrated significant pre- to post-intervention improvement on individual inferential comprehension questions from The Squirrel Story NCA. Mean question score gains were demonstrated on 11 of the 14 inferential comprehension

questions, with significant improvement shown for five of those questions (5, 8a, 12a, 12b, 13a; see Table 21).

Table 21: IC Group Pre- and Post- Intervention (Ix) Inferential Comprehension Question Means

| Question | Pre-Ix <i>M</i> (SD) | Post-Ix <i>M</i> (SD) | <i>M</i> change | <i>t</i> (<i>df</i> = 18) | <i>p</i> | Cohen's <i>d</i> |
|---|-------------------------|--------------------------|--------------------|-------------------------------|----------|---------------------|
| 3a. Look at the animals in this picture. How do you think they are <u>feeling</u> ? | 1.79 (.53) | 1.95 (.23) | 0.16 | 1.14 | .27 | 0.42 |
| 3b. <u>Why</u> do they feel _____? | 1.05 (.85) | 1.32 (.67) | 0.26 | 1.00 | .33 | 0.36 |
| 4b. <u>Why</u> is that an important part of the story? | 0.58 (.69) | 0.58 (.51) | 0 | 0.00 | 1.00 | 0 |
| 5. <u>Why</u> did baby squirrel and his friends decide to go into the apple field? | 0.68 (.48) | 1 (.33) | 0.32 | 2.36 | .03* | 0.79 |
| 7. <u>Why</u> couldn't baby squirrel fit back through the fence? | 0.79 (.42) | 0.74 (.45) | -0.05 | .57 | .58 | 0.11 |
| 8a. Look at baby squirrel in this picture. How do you think he is <u>feeling</u> ? | 1.53 (.51) | 1.79 (.42) | 0.26 | 2.04 | .05* | 0.56 |
| 8b. <u>Why</u> does he feel _____? | 0.84 (.50) | 1.16 (.50) | 0.32 | 1.68 | .11 | 0.64 |
| 9a. What could the mouse and rabbit be <u>saying</u> here? | 1.21 (.42) | 1.16 (.60) | -0.05 | .32 | .75 | 0.1 |

Table 21 continued.

| Question | Pre-ix <i>M</i> (SD) | Post-ix <i>M</i> (SD) | <i>M</i> change | <i>t</i> (<i>df</i> = 18) | <i>p</i> | Cohen's <i>d</i> |
|---|-------------------------|--------------------------|--------------------|-------------------------------|----------|---------------------|
| 9b. <u>Why</u> do you think they would say that? | 0.84 (.38) | 0.95 (.41) | 0.11 | 0.81 | .43 | 0.28 |
| 11. <u>Why</u> does baby squirrel fly so high? | 0.42 (.61) | 0.63 (.68) | 0.21 | 1.45 | .16 | 0.33 |
| 12a. This is the last picture in the story (<i>move iPad away from the child</i>). What <u>do you think</u> happens <u>next</u> ? | 0.37 (.60) | 1.42 (.90) | 1.05 | 4.73 | <.001* | 1.40 |
| 12b. <u>Why</u> do you think so? | 0.05 (.23) | 1.16 (.90) | 1.11 | 4.85 | <.001* | 1.97 |
| 13a. If you were one of baby squirrel's friends and you knew that you weren't meant to go in the apple field, what would you tell baby squirrel so that the same thing didn't happen again? | 0.32 (.58) | 0.95 (.78) | 0.63 | 4.02 | .001* | 0.93 |
| 13b. <u>Why</u> would you tell him that? | 0.37 (.60) | 0.74 (.81) | 0.37 | 1.93 | .069 | 0.53 |

Note. *p* < .05 is denoted with an asterisk (*).

Qualitative Observations

As reflected in the analyses, the majority of participants in the IC group showed a significant increase in inferential comprehension scores from pre- to post-intervention. Examples of some pre- and post- intervention responses of a participant (A) whose pre-intervention inferential comprehension score was low (7/28), and a participant (B) whose pre-intervention inferential comprehension score was higher (13/28), are provided in Table 22 to provide some context for the interpretation of results.

Table 22: Pre- and Post-intervention Responses of IC Group Participants

| The Squirrel Story NCA Responses – IC group | | |
|---|---|---|
| Comprehension question | Pre-intervention | Post-intervention |
| 8a. Look at baby squirrel in this picture. How do you think he is <u>feeling</u> ? | A - Um scared and him gone up in the sky. Coz him think him going in the sky. | A - Shocked... coz he afraid that the gardener might come B - Frighten... acuz him think he |
| 8b. <u>Why</u> does he feel _____? | B - Frightened .. um acuz him stuck in the fence | got to break a fence... |
| 12a. This is the last picture in the story. What <u>do you think</u> happens <u>next</u> ? | A - Um they.. baby squirrel come back to him home (<i>this had already happened on the last page of the story</i>) | A - Um they have dinner coz they're hungry Coz coz... coz ... because they might be hungry |
| 12b. <u>Why</u> do you think so? | Coz coz mummy said 'where you been' B - Um ... um.. don't know | B - Um ... baby squirrel tell all about and go to bed Because a very tired and hungry |
| 13a. If you were one of baby squirrel's friends and you knew that you weren't meant to go in the apple field, what would you tell baby squirrel so that the same thing didn't happen again? | A - Because he... coz him want to go back home Coz coz him scared of um... scared of that...(SP: Mr Badger) Yeh B - Um... don't | A - Um don't go in the apples, um... don't go over there Coz coz um the baby squirrel mum said 'don't go over there' B - To not go to the apple field |
| 13b. <u>Why</u> would you tell him that? | Um... don't go in a apple field | Because a gardener will get very angry and caught them |

Discussion

Although children with DLD demonstrate particularly poor inferential comprehension, to date there has been little intervention research aiming to improve this skill. As such, the aim of Study Two was to develop, trial, and evaluate an intervention targeted at improving the oral inferential comprehension of young children with developmental language disorder. Based on the results of Study One and a literature review of previous research, intervention principles were developed and a book-sharing intervention targeted at improving oral inferential comprehension of narratives was designed. Drawing on the evidence, the intervention focused on the overall discourse-level skills of narrative comprehension and narrative retell, theory of mind skills in the context of narrative, and vocabulary. The intervention was evaluated in a randomised controlled trial involving 37, 5 to 6 year old children with DLD.

The IC group demonstrated significantly higher inferential comprehension scores than the PA group at the post-intervention assessment, and their inferential comprehension gains were maintained over time. The IC group also demonstrated significantly higher inferential comprehension scores on a post-intervention generalisation measure compared to the PA group. The results will be discussed with focus on the primary outcome measure of inferential comprehension. The literal comprehension results will be briefly discussed. Please see Appendix K for phonological awareness results. The limitations of the study will also be addressed.

Inferential comprehension

The inferential comprehension intervention was effective at improving the inferential comprehension scores of the IC group participants. The study's hypotheses were all confirmed as, compared to the PA group, a) the IC group made significant gains in overall inferential comprehension from pre- to post-intervention; b) the IC group's higher inferential comprehension scores were maintained two months following the intervention; c) the IC group showed significantly higher inferential comprehension scores on a post-intervention generalisation measure; and, d) the proportion of individuals showing a positive reliable change in inferential comprehension scores was significantly greater in the IC group.

Findings a) and b) confirmed that the inferential comprehension intervention was effective at improving, and maintaining improvement in, oral inferential comprehension of narratives in the group of 5 to 6 year old children with DLD. The large effect sizes supported these findings. The Squirrel Story NCA was used at all three assessment points to address the limitation of non-equivalent narrative comprehension assessments identified in an earlier intervention study (Desmarais et al., 2013).

The Peter and the Cat NCA was used as an additional measure of narrative comprehension at the post-intervention assessment to investigate whether any inferential comprehension gains had generalised. Finding c) demonstrated that the inferential comprehension gains of the IC group had generalised across the narrative context immediately following the intervention, which was supported by a very large effect. The Peter and the Cat narrative was designed for a slightly older age range, and was therefore more complex. As such, the higher scores demonstrated by the IC group for the Peter and the Cat NCA reflect the ability to process and comprehend higher level narratives.

Finding d) confirmed that a significantly greater proportion of children in the IC group (57.9%) demonstrated reliable improvement compared to the proportion of children in the PA group (5.6%), again supported by a large effect. Some participants in the IC group did not improve, with one participant experiencing no change and two participants showing negative change (-1 or -2). This indicated that the intervention was not effective for all participants. Subjective observations made during intervention sessions for all participants noted that these three participants (all boys) demonstrated poor attention during sessions. In particular, two of these participants (with lower initial scores of 7 and 9, and 7 at post-intervention) required frequent and consistent reminders to show 'whole body listening' throughout the intervention. As mentioned in the rationale for intervention principle 12, effective language learning requires attention and engagement in tasks (Owens, 2010). While naturalistic book-sharing strategies were used throughout the intervention, the strategies may not have been effective at engaging these particular participants (as supported by the subjective observations). Poor attention and engagement in the sessions may therefore have limited these participants' ability to access the intervention. Overall, the reliable change analysis demonstrated that the inferential comprehension

intervention resulted in clinically significant improvement in the inferential comprehension of the majority of the IC group.

Theoretically, the repeated and consistent exposure to, and practice of, narrative comprehension and retelling will have supported the IC participants to develop more organised and robust narrative schema. As such, they may have been able to draw on better-specified schemas as a scaffold to more efficiently and effectively process, comprehend, and recall narratives, and make inferences via interaction between the situation model and textbase (Bishop, 2014b; Graesser et al., 1997; van Dijk & Kintsch, 1983; Westby, 2012). The findings, in particular the finding that inferential comprehension gains had generalised across narratives, support this theoretical hypothesis.

In summary, the hypotheses for Study Two were all confirmed as: the IC group made clinically significant, reliable gains in inferential comprehension which generalised across the narrative context and were maintained over time. As such, the results of this randomised controlled trial demonstrate that the inferential comprehension intervention was effective at improving inferential comprehension of narratives in 5 to 6 year old children with DLD. The intervention targets and principles were based on the results of Study One and past intervention literature. Therefore, the results of this randomised controlled trial validate the profile of skills important for inferential comprehension which was developed by Study One and the strategies drawn from past intervention studies. In particular, the results show that targeting the profile of skills – narrative retelling, literal comprehension, theory of mind, and vocabulary – underlying oral inferential comprehension in young children with DLD was effective at improving inferential comprehension of narratives.

Question-level analysis

The individual question-level analysis investigated whether the IC group showed significant improvement on individual inferential comprehension questions on The Squirrel Story NCA from pre- to post-intervention. The IC group showed improvements on 11 of the 14 inferential comprehension questions, with significant increases shown for five of those inferential comprehension questions, and medium to very large effects ($d = 0.56 - 1.97$). Those inferential comprehension questions included prediction, causal inferences (relating to the initiating event, higher level emotions, and prediction), and evaluative inferences.

Thus, these findings indicate that the participants in the IC group made the most improvement on comprehension of inferential questions which required causal reasoning (including inferring emotions), prediction, and evaluative reasoning. This is underpinned by the intervention principles, which included frequent and repeated exposure to a range of inferential comprehension questions and 'think-aloud' modelling of inferential reasoning, in particular causal reasoning and prediction. In addition, two of the four intervention sessions for each narrative focused on inferring higher level character emotions (third session) and making predictions (fourth session). The fourth session also involved evaluative reasoning discussion (requiring overall understanding of the story theme, and 'gist'). This practice may have embedded understanding of these types of inferences within children's developing narrative schemas, thus supporting them to make accurate inferences when encountering novel narratives.

The IC group showed very little or no mean score gain from pre- to post-intervention for three of the inferential comprehension questions, and non-significant improvement for six questions (some of which, while statistically non-significant, demonstrated medium to large effect sizes, indicating that the question-level analyses may have been underpowered). The questions which showed little or no mean score gain included prediction of character dialogue (question 9a) and causal reasoning relating to the initiating event or consequence (questions 4b and 7).

Prediction of dialogue was not targeted during the intervention, so the result indicates that inferential comprehension improvements did not generalise to this (untargeted) inferencing skill. However, the participants' pre-intervention mean score was above 1 (reflecting the inference of appropriate character dialogue) indicating that the majority of participants were providing fully or partly appropriate responses to the question prior to the intervention, potentially leaving little scope for change.

The causal reasoning questions 4b and 7 immediately followed literal questions to which they were directly related (literal questions: *tell me what's happening in the story now; what is happening now*). They involved integrating understanding of the literal question with prior knowledge from the story (relating to the initiating event and a consequence of actions) to provide an appropriate answer. The pre- and post-intervention mean for questions 4b and 7 were below 1 which indicated that, on average, the IC group participants were not able to answer these questions adequately before or after the intervention. This finding indicates that the

intervention did not improve their ability to answer these questions, and that the participants demonstrated particular difficulty with this type of question (causal inferences relating to initiating event/s and consequence/s following literal questions). Future intervention research should investigate this further and consider targeting these types of inferences more directly.

Overall, the question-level analysis showed that the IC group participants demonstrated the greatest improvement in inferential comprehension skills which were explicitly targeted (intervention principles 3, 4, 6 and 10) during intervention sessions (i.e. emotions, prediction), indicating that focusing on these skills in the intervention was effective.

Past inferential comprehension intervention studies

The findings of this study both align with and further the findings of van Kleeck et al. (2006) and Desmarais et al. (2013), whose studies focused on improving oral inferential comprehension using dialogic book-reading with scripted questions in children with language disorders aged 3 to 5 years (van Kleeck et al., 2006) and 4 to 6 years (Desmarais et al., 2013).

The intervention group in the van Kleeck et al. (2006) study demonstrated significant improvement in both literal and inferential comprehension, however the control group's inferential comprehension scores also improved. While the van Kleeck et al. (2006) intervention focused on book-reading, narrative comprehension itself was not assessed (inferential comprehension was measured by the PLAI (Blank et al., 1978b)). The methodology of this study has addressed the limitations identified by van Kleeck et al. (2006), including: a control group which received intervention, blind research assistants, and maintenance assessment.

Like van Kleeck et al. (2006), Desmarais et al. (2013) found that the participants showed a significant increase in inferential comprehension as reflected by the PLAI-II (Blank et al., 2003). Desmarais et al. (2013) assessed and found improvements in inferential comprehension of narratives, however the narrative assessment tasks used were not equivalent. This confounded interpretation of the results and, as no control group was included, the results could not be clearly attributed to the intervention. This study has addressed these limitations by including a control intervention group, and by using the same narrative for every assessment in addition to a narrative generalisation measure (see Table 23).

The results of this study therefore provide empirical support for and advance the findings of van Kleeck et al. (2006) and Desmarais et al. (2013). The results provide strong evidence that a small group book-sharing intervention improves inferential comprehension of narratives in 5 to 6 year old children with DLD. Additionally, this study's findings align with those of a recent small-group study by Spencer Kelley et al. (2015) which found that an interactive, automated storybook intervention improved the inferential, but not literal, comprehension and vocabulary of 4 year old *at-risk* children from low income families. Taken together, these results indicate that similar book-sharing interventions may be effectively applied to other populations, such as children who are at-risk of later reading comprehension difficulties. The finding that inferential comprehension can be improved in a small group setting is of clinical significance for clinicians and educators, with the potential to provide benefit for less time and cost, and therefore to a greater number of children who have poor inferential comprehension.

Table 23: Similarities and differences between inferential comprehension intervention studies

| | van Kleeck et al. (2006) | Desmarais et al. (2013) | Study Two |
|-----------------------------|-----------------------------|---|------------------------------------|
| Assessment/s | PLAI (Blank et al., 1978b) | PLAI –II (Blank et al., 2003) and narrative comprehension | Narrative Comprehension Assessment |
| Maintenance assessment | No | Yes | Yes |
| Sample size | 30 | 16 | 37 |
| Control group | Yes, untreated | No | Yes, treated |
| Blinded research assistants | No | No | Yes |

Table 23 continued.

| | van Kleeck et al. (2006) | Desmarais et al. (2013) | Study Two |
|-------------------------|-----------------------------------|-----------------------------------|---|
| Intervention type | Scripted dialogic book-sharing | Scripted dialogic book-sharing | Scripted dialogic book-sharing and retelling based on intervention principles |
| Number of narratives | 2 | 5 | 4 |
| Intervention format | Individual | Individual | Small groups |
| Session length | 15 minutes, twice per week | 15 – 20 minutes, once per week | 30 minutes, twice per week |
| Intervention length | 8 weeks | 10 weeks | 8 weeks |

Literal comprehension

Although the focus of this intervention study was inferential comprehension, literal comprehension was an inherent part of the intervention and was also measured as an outcome. The results indicate that intervention focusing on improving inferential comprehension was not effective at improving literal comprehension of narratives in 5 to 6 year old children with DLD. The contrasting results between inferential and literal comprehension are interesting, as they support the notion that the processes of, and skills underpinning, literal and inferential comprehension are different. This is pertinent for both clinical practice and research, as it indicates that inferential and literal comprehension, although related, need to be considered independently in both assessment and intervention, and that different skills need to be targeted to improve literal comprehension.

Although there was no significant difference between the IC and PA groups for literal comprehension during the study on *The Squirrel Story NCA*, both groups demonstrated significant improvement in literal comprehension scores from pre- to post-intervention assessment, with a large effect. Additionally, the overall pre-intervention to maintenance improvement was significant and showed a large effect.

There was no significant difference between the literal comprehension scores of the two groups on the Peter and the Cat NCA post-intervention, although the mean literal comprehension score of the IC group was slightly higher than that of the PA control group. The finding that the literal comprehension ability of all participants improved significantly over time indicates that continuing classroom teaching / intervention or developmental improvement had an influence on participants' literal comprehension. The participants continued to receive their usual program of teaching and intervention at the LDC, which included two in-class intervention sessions by a speech-language pathologist every week. These intervention sessions typically involved a narrative macrostructure retelling focus using story grammar elements (e.g. who, where, when, etc). The explicit teaching and revision of these story grammar elements involves literal comprehension (e.g. "Who are the characters in the story?"). Therefore, the usual intervention provided in-class was likely to have supported participants' literal comprehension development. Additionally, the improvement may have reflected natural maturation of literal comprehension. Future research should consider tighter control of other interventions provided to participants.

Whilst this intervention study included some focus on literal comprehension during book-sharing, it did not directly focus on literal comprehension. This differs to the van Kleeck et al. (2006) intervention study, which included a high proportion of literal questions (70% literal, 30% inferential) and found significant literal comprehension improvement. The findings from this study showed that the amount of literal questioning used in the intervention, whilst potentially supporting inferential comprehension, was not sufficient to lead to significant improvements in literal comprehension ability.

In addition, reflecting the focus of the study, only a minority (5/19) of the NCA questions were literal. Thus, it is possible that too few literal comprehension questions were included to demonstrate any difference between the groups as a result of the intervention. Future research could include additional literal comprehension questions and could also investigate targeting literal comprehension more directly to improve literal narrative comprehension and support inferential comprehension. In particular, as mentioned, the IC group did not show improvement in inferences which draw on literal comprehension, so targeting literal comprehension may support the development of those causal inferences which

require integrating understanding of a literal question with prior knowledge from the story.

Limitations

Although this study demonstrates promising results, a number of limitations must be discussed. Firstly, the same narrative assessment (The Squirrel Story NCA) was used for each assessment (pre-intervention, post-intervention and maintenance). This was to ensure that the results were comparable, as the results of Desmarais et al. (2013) were confounded by use of narrative comprehension assessments which were not equivalent. Using the same assessment introduced the possibility of learning effects, however including the control intervention group minimised the impact of these. In addition, a generalisation measure (Peter and the Cat NCA) was included at the post-intervention assessment to evaluate whether any intervention gains had generalised across narrative comprehension ability.

The Narrative Comprehension Assessments were not standardised, making scoring of the assessments more subjective. However, there are very few standardised assessments available which assess inferential comprehension of narratives, and those available present limitations (discussed previously, please see Measures section in chapter 3). As inferential comprehension was the primary outcome measure in this research, it was imperative that the assessment included a range of inferential comprehension questions. The NCAs were piloted on typically developing children prior to the research (The Squirrel Story $n = 4$; Peter and the Cat $n = 10$). In addition, The Squirrel Story NCA was administered to a typically developing sample of 44 pre-primary aged children in order to develop the scoring guideline and develop norms for the task (see Appendix H). Inter-rater reliability was also completed to ensure that scoring judgements met reliability standards.

This study only examined inferential comprehension of *narratives*. The intervention studies by van Kleeck et al. (2006) and Desmarais et al. (2013) included a measure of inferential comprehension (the PLAI) which was more reflective of comprehension in everyday contexts (Blank et al., 1978b, 2003). It would have been useful to include a similar measure in this study to investigate generalisation of inferential comprehension skills to contexts other than narrative discourse.

In addition, it would have been useful to include measures of theory of mind and vocabulary to investigate the underlying mechanisms of change for the

intervention. Additional measures were not included in this study due to time constraints within the RCT, such as school term dates, classroom schedules, time spent with each participant, and number of research assistants. Future research should aim to include additional measures such as theory of mind, vocabulary breadth and depth, and inferential comprehension across contexts (including measures of classroom performance following intervention), in addition to reporting on narrative retelling outcomes of the intervention.

Although this study included a maintenance assessment two months following the intervention, further long-term follow-up assessment was not completed. Longer-term follow-up (i.e. 1 or more years post-intervention) would be important to investigate maintenance of inferential comprehension gains and transfer to reading comprehension. As discussed by van Kleeck et al. (2006), it would be useful for future research to investigate the long-term outcomes of inferential comprehension intervention in this population.

Although a majority of participants in the IC group experienced an increase in inferential comprehension scores from pre- to post-intervention, one participant experienced no change and two participants experienced small negative change (of 1 to 2 points). Thus, the intervention was not effective for all of the participants in the IC group. As discussed earlier, subjective observations during the intervention included that these participants consistently demonstrated poor attention skills. As such, it may have been valuable to have included an objective rating of attention skills prior to and during the study, to investigate the impact of attention on intervention outcomes. In addition, it is possible that these participants lost interest in the Squirrel Story narrative over the repeated assessments. Future research would benefit from replicating this intervention study and comparing inferential comprehension interventions, including comparison of small group and individual delivery, in addition to investigating factors (e.g. language profiles and attention/motivation) that may impact participants' response to intervention. Future research should also include measures of treatment fidelity (e.g. recording sessions).

The intervention included a range of strategies based on intervention principles which, overall, were demonstrated to be effective. However, it is not clear which of the intervention principles were most effective. It is possible that some of the principles were key, or alternatively that all of the principles in combination were effective. Future research should investigate the effectiveness of the principles used

in the inferential comprehension intervention, as well as whether the intervention would be effective using different narratives. In addition, it would be useful to investigate whether the intervention would be effective for younger and older children with language disorders, and other populations who demonstrate poor inferential comprehension, such as children with ASD.

Future research should address the identified limitations of this study. Despite these limitations, this study has addressed a number of the more significant limitations which were apparent in prior studies, including having an equivalent control intervention group, equivalent narrative comprehension measures, blind teachers, blind research assistants, and maintenance assessment. These inclusions have strengthened the control and validity of the study and filled gaps in prior research evidence.

Study Two Conclusion

This study aimed to develop and evaluate the effectiveness of a novel intervention targeted at improving inferential comprehension of narratives in young children with developmental language disorder. Based on the profile created by Study One and a review of past intervention literature, intervention principles were developed and a small-group intervention was designed to support the development of inferential comprehension by targeting discourse-level skills (inferential and literal narrative comprehension, and narrative retell), theory of mind, and vocabulary using a range of strategies during scripted book-sharing sessions.

A randomised controlled trial of the intervention was completed with 37 participants with DLD aged 5 to 6 years. The results demonstrated that the intervention was effective at improving inferential comprehension of narratives in the group of children who received the intervention, as compared to an equivalent intervention control group, and in maintaining that improvement over time. In addition, inferential comprehension improvement generalised across narratives. The results both support and validate the findings of Study One and the 13 intervention principles underlying the intervention. This study contributes to the small evidence base of interventions targeting oral inferential comprehension in children with DLD. The results will support the clinical practice of speech-language pathologists and teachers working with children with DLD, and provide useful information to inform future intervention studies in the area.

Chapter 6: General Discussion

For language is the armoury of the human mind; and at once contains the trophies of its past, and the weapons of its future conquests. – Samuel Taylor Coleridge, 1817, Chapter 16, *Bibliographia Literaria*.

Chapter Overview

This concluding chapter will integrate the findings of the two studies presented in this thesis. The theoretical and clinical implications will be discussed, in addition to the strengths and limitations of the research. This will lead into a discussion of future directions in this area of research and an overall conclusion to this thesis.

Research Overview

Adequate inferential comprehension skills are imperative for effective oral and written communication. Young children with developmental language disorder demonstrate difficulty with oral inferential comprehension, and many go on to experience later reading comprehension difficulties. While it is clear that children with DLD demonstrate poor inferential comprehension, it was unclear which language and cognitive skills were important for oral inferential comprehension in this population. Additionally, only two intervention studies to date have specifically investigated the effectiveness of targeting oral inferential comprehension in intervention for young children with DLD and each of these studies acknowledged some methodological limitations.

In order to address the clear gap in evidence, this doctoral research had two overall aims. Firstly, it aimed to develop an evidence-based profile of those language and cognitive skills which significantly contribute to, and thus underpin, oral inferential comprehension ability in young children with DLD. Based on this profile, the second aim of the research was to develop, trial, and evaluate an intervention to improve oral inferential comprehension ability in this population.

The results of the first study showed that narrative retelling, literal comprehension, theory of mind, and vocabulary were significant individual predictors of oral inferential comprehension ability in 5 to 6 year old children with developmental language disorder. The results of the second study showed that an intervention targeting the skills identified in Study One, in conjunction with strategies

from past intervention evidence, was effective at improving oral inferential comprehension of narratives in 5 to 6 year old children with DLD.

Theoretical Implications

Discourse comprehension theory

The results of Study One and Study Two support the model of discourse comprehension introduced by van Dijk and Kintsch (1983), and the importance of both bottom-up and top-down skills in language comprehension discussed by Bishop (2014b). The studies have confirmed that both bottom-up and top-down skills are important for inferential comprehension in children DLD, with top-down discourse-level skills (reflecting schemas) playing a crucial role. While the profile supports the model of van Dijk and Kintsch (1983), it also provides novel and pertinent knowledge to inform our understanding of the key skills underlying inferential comprehension of discourse in children with developmental language disorder.

Van Dijk and Kintsch (1983) suggested that discourse comprehension involves multilevel processing. During discourse comprehension, it is thought that the situation model and textbase interact to allow inferences to be drawn and coherence to be established (Graesser et al., 1994). Situation models represent knowledge related to the text being comprehended, and schemas form the basis of these situation models (van Dijk & Kintsch, 1983). Schemas reflect knowledge organisation (e.g. traditional story grammar, reflecting narrative skills) and contain information about cultural and pragmatic factors, in addition to the social context and interaction (e.g. theory of mind). Situation models reflect more personalised information than schemas, but schemas are necessary to develop situation models (van Dijk & Kintsch, 1983). As such, poorly specified schemas, which characterise the language difficulties of children with DLD, may lead to underspecified situation models: thus, discourse comprehension suffers. This hypothesis was supported by the findings of both studies. As noted by Bishop (2014b, p. 229), “The ability to build up mental structures.... provides a suitable framework into which the information can be slotted and which allows appropriate inferences to be drawn about what is not directly stated.”.

Study One demonstrated that discourse-level skills, including narrative retelling and literal comprehension, were significant individual contributors to oral

inferential comprehension ability in children with DLD. The ability to retell narratives (involving macrostructure and microstructure) as well as literal comprehension of narrative (involving recall) reflect schematic structures. Schemas provide the organisation which allows an individual to understand and remember a text; thus poorly defined schemas adversely impact these discourse-level skills (Bishop, 2014b). The ability to recall a narrative in order to retell it *and* to answer literal comprehension questions would be impaired if the schema was poorly defined, because the individual would be unable to attach the information to a robust and organised structure during online narrative comprehension. In turn, this would adversely affect the ability to form inferences. In this way, discourse-level skills, including inferential comprehension, are highly dependent on the variety, structure, accessibility and, critically, robustness of an individual's schemas.

Intervention which targeted these discourse-level skills (narrative retelling, and inferential and literal comprehension) was hypothesised to promote the development of well-specified schemas. Better specified, robust schemas, and hence situation models, would then be available to support inferential comprehension and textual coherence. The findings of both studies support van Dijk and Kintsch's (1983) notion that schemas and situation models are integral for discourse comprehension, and that having robust schemas available provides a foundation for the efficient and accurate organisation of discourse: therefore supporting successful inferential comprehension. The findings also indicate that poorly specified schemas may be an underlying deficit in the poor inferential comprehension of children with DLD (Westby, 2012).

The findings also support Norbury and Bishop's (2002) proposal of weak central coherence as an underlying causal factor in the poor inferential comprehension of children with DLD. This proposal aligns with Pizzioli and Schelstraete's (2013) findings of sentence-level thematic integration deficits in children with DLD, evidenced by difficulty integrating world knowledge, syntactic, and semantic information to form coherent *sentence* representations. Sentence-level integration difficulties are likely to impact higher level representations (i.e. discourse), thus reflecting weak coherence (Norbury & Bishop, 2002; Pizzioli & Schelstraete, 2013). Poorly specified schemas in children with DLD may be the result of deficits in the ability to integrate information to form coherent representations, which adversely impacts inferential comprehension. Focusing on both bottom-up and top-down skills

should therefore support schema development and improve the ability to establish and maintain coherence in narrative discourse, which supports inferencing. The findings of Study Two, which targeted the variety of skills identified as important predictors in Study One, support this hypothesis.

Study One also found that theory of mind and vocabulary were significant individual predictors of inferential comprehension ability. Theoretically, theory of mind reflects the flexible social knowledge and understanding required in the situation model to support successful inferencing (e.g. recognising and identifying emotions). In particular, during the development of first-order theory of mind skills, children's understanding expands to represent the mental states (emotions) of other people (Westby & Robinson, 2014). Personal experiences, and the ability to think about the self (and others) in the past and future are key to this development (Westby & Robinson, 2014). Reflecting and reminiscing on these personal experiences allows the individual to create coherent representations which involve the mental states of themselves and others (theory of mind), thus supporting the development of schemas (Westby & Culatta, 2016). This is integral to narrative development and other skills, such as social problem-solving (Westby & Culatta, 2016). The results of both studies support the important role of theory of mind as a top-down influence on inferential comprehension. Theory of mind may affect situation models, which reflect stored knowledge related to the text, and are "...the cognitive representation of the events, actions, persons, and in general the situation, a text is about" (van Dijk & Kintsch, 1983, p. 11-12). An effective situation model should contain an adequate amount of well-specified semantic (e.g. vocabulary) and pragmatic (e.g. event and context-specific, social, and cultural information) information relevant to a text. In this way, the situation model reflects knowledge related to both vocabulary and theory of mind. Vocabulary may support comprehension in a bottom-up way by building meaning representations in the textbase and situation model, whereas theory of mind may support comprehension in a top-down way via schemas and the situation model. Inferential comprehension depends on the interaction between the situation model and textbase; thus the robustness and relevance of the information in a situation model has a significant influence on inferential comprehension. The results of studies one and two support the importance of both vocabulary and theory of mind in underlying successful inferential comprehension in children with DLD.

Overall, the findings of both studies support van Dijk and Kintsch's (1983) discourse comprehension theory, and the role of both bottom-up and top-down language and cognitive skills in successful discourse comprehension (Bishop, 2014b). However, the results also further our understanding of discourse comprehension in children with DLD, identifying key skills underlying oral inferential comprehension in this population: narrative retelling, literal comprehension, theory of mind, and vocabulary. These skills are important mechanisms of change to target in inferential comprehension interventions for young children with DLD.

Underlying deficits in developmental language disorder

A significant amount of research has aimed to identify the key underlying deficit/s or 'cause/s' of DLD. A number of accounts adopt the perspective of deficits in the production or comprehension of grammar, a primary area of difficulty in DLD. The most widely discussed theories include DLD as a deficit in linguistic knowledge (innate differences in language learning), processing limitations, and more recently, procedural memory (Leonard, 2014).

Accounts of deficits in linguistic knowledge are highly specific and do not explain difficulties in higher level processes such as inferential comprehension. Such an explanation - the 'low level bottleneck' - as described by Bishop (2014b, p. 249), identifies discourse comprehension issues occurring as a result of lower level comprehension difficulties (e.g. word or sentence level). The results of Study One clearly indicated that this is not the case, as word- and sentence- level grammar skills were not significant individual predictors of inferential comprehension ability in this cohort of children. However, this should be investigated in other groups of children with DLD. The findings thus indicate that the inferential comprehension difficulties seen in DLD cannot simply be attributed to an innate deficit in syntactic comprehension.

However, processing limitation and procedural memory accounts may align better with the inferential comprehension difficulties experienced by children with DLD. Firstly, processing limitations have primarily been addressed in terms of speed of processing and processing capacity. From a developmental point of view, restricted processing capacity and/or speed would impact a child from the beginning of language development. This aligns with the findings of Study One, as processing speed and/or capacity would not only detrimentally impact the long-term linguistic

knowledge required for comprehension (i.e. narrative schema and vocabulary development), but also the on-line process of discourse comprehension. A higher level skill such as inferential comprehension is likely to suffer under a cognitive or linguistic processing restriction.

However, Study One found that linguistic processing speed was not a significant individual predictor of inferential comprehension ability. In addition, the findings of Study Two demonstrated that inferential comprehension can be improved, and that improvement can be maintained over time, in children with DLD. Improvement would not be expected under a processing capacity limitation account, unless strategies were in place to reduce the processing load or processing speed (which was not the case). However, the repeated practice of inferential comprehension skills during the intervention in Study Two may have supported processing capacity during discourse comprehension (i.e. by improving integration of information and textual coherence). Additionally, the intervention may have promoted the development of robust schemas: thus, using better-specified schemas may have reduced on-line processing demands, freeing processing capacity for inferential comprehension. As mentioned, the integration of knowledge and information during processing for discourse comprehension may be less effective in children with DLD (Norbury & Bishop, 2002; Pizzioli & Schelstraete, 2013). As such, supporting language processing through repeated practice (to develop comprehensive schemas and familiarise children with inferential comprehension processes) may improve inferential comprehension ability in the practised domain (i.e. narrative).

Another more recent suggestion by Ullman and Pierpont (2005) introduced the Procedural Deficit Hypothesis as a core deficit underlying DLD, with abnormalities in the brain networks responsible for procedural memory leading to the linguistic and non-linguistic (e.g. fine motor) difficulties seen in individuals with DLD. Individuals with DLD can present with deficits in both procedural memory and aspects of declarative memory (Leonard, 2014; Ullman & Pierpont, 2005). Procedural memory represents the implicit learning and use of procedures involving linguistic, motor, or cognitive information (Ullman & Pierpont, 2005). This differs from declarative memory, which represents semantic (factual) and episodic (event-based) knowledge.

Schemas involve information which generally follows a sequenced pattern (e.g. story grammar – when, who, where, causal event/problem, etc) and, as such,

may reflect procedural learning. However, they are also thought to represent episodic information. A core difficulty with the learning and use of schemas, as a result of procedural memory deficits, could thus be a contributory factor to the poor inferential comprehension demonstrated by children with DLD. Ullman and Pierpont's (2005) hypothesis also allows for elements of declarative memory to be implicated, which aligns with the results of Study One (i.e. semantic knowledge as reflected by vocabulary). Ullman and Pierpont (2005) noted that procedural learning takes place gradually over time and requires many repetitions. The repeated book-sharing sessions, which included practice of narrative retelling and comprehension, are hypothesised to have supported schema development. The Study Two intervention was effective at improving inferential comprehension and, thus, the results align with the gradual, repeated learning described in the development of procedural memory.

The results of this research align with theories of both processing limitations and the Procedural Deficit Hypothesis as potential deficits underlying the inferential comprehension difficulties seen in DLD. However, as noted by Bishop (2014), it is unlikely that one solution will apply to all individuals with DLD, and further research is necessary to investigate the processes and skills which contribute to the development and continuation of DLD.

Clinical Implications

The results of this research have a number of clinical implications relating to the understanding and treatment of oral inferential comprehension difficulties in children with DLD. Firstly, the results of Study One provide speech-language pathologists with an understanding of the specific skills which are significant predictors of oral inferential comprehension of narratives in 5 to 6 year old children with DLD. This profile of skills was validated by the findings of Study Two, and includes narrative retelling (macrostructure and microstructure), literal comprehension, theory of mind, and overall vocabulary. With this evidence, clinicians can plan evidence-based, theoretically driven assessment which will support the implementation of targeted interventions. In terms of informing intervention, the Study One findings indicate that a variety of skills can be targeted to support inferential comprehension. In addition, the finding that discourse-level skills (narrative retelling and literal comprehension of narratives) were, cumulatively, the

greatest contributors to inferential comprehension indicated that intervention should be focused at the *discourse-level*, not word- or sentence-level. This profile will enhance clinicians' understanding of oral inferential comprehension difficulties in this population, in addition to directing evidence-based interventions to support those skills which significantly contribute to inferential comprehension.

Secondly, to current knowledge, Study Two provides the first randomised controlled trial of an intervention targeting oral inferential comprehension in young children with DLD, and the first such intervention driven by an evidence-based profile of skills. As previously discussed, there has been a lack of intervention studies targeting oral inferential comprehension in children with DLD, and those conducted have presented methodological limitations, which Study Two aimed to address. The intervention was effective and, therefore, Study Two provides clinicians with the first level II evidence (randomised controlled trial) (NHMRC, 2009) supporting the efficacy of the book-sharing intervention for inferential comprehension. As the intervention was based on the profile of skills identified as important predictors of inferential comprehension in Study One, the results of Study Two also provide support for the findings of Study One.

The 13 intervention principles which were developed based on the profile of Study One and past intervention literature are easily replicable for clinical practice and future research. The results of Study Two support the principles, providing clinicians with evidence-based intervention principles to utilise in intervention targeting inferential comprehension. The intervention was implemented to reflect typical clinical practice as closely as possible: the small group delivery, intensity, and duration of the intervention are commonly reflected in typical clinical practice. Thus, Study Two provides clinicians with an evidence-based intervention which can be replicated in clinical practice.

The lack of assessments measuring oral inferential comprehension of narratives prompted the creation of a task based on prior research (Paris & Paris, 2003) using well-known narrative retell assessments which would be easily accessible to clinicians. The Narrative Comprehension Assessment was created for The Squirrel Story and Peter and the Cat narratives (Carey et al., 2006; Leitão & Allan, 2003) to assess oral narrative comprehension in young school-aged children, with a particular focus on inferential comprehension. Most existing oral and written comprehension assessments reflect comprehension as a total score, combining

literal and inferential abilities. The results of both Study One and Study Two support the concept that literal and inferential comprehension are separate skills. Therefore, assessment should consider literal and inferential comprehension independently (i.e. assessment should yield separate scores for both literal and inferential comprehension). The NCAs will provide clinicians with a relatively quick, engaging, and easily-administered assessment task which includes a broad range of inferential comprehension questions; providing a comprehensive understanding of a child's discourse-level comprehension ability in terms of both literal and inferential comprehension. However, further normative data, reliability, and validity information are required for the NCA tasks.

The results of Study One and Study Two also demonstrate that theory of mind is an important contributor to inferential comprehension, and that its development should be fostered to support inferential comprehension. Children and adolescents with DLD are at increased risk of experiencing social difficulties, including establishing and maintaining friendships, and low self-esteem (Conti-Ramsden & Botting, 2004; Conti-Ramsden et al., 2013; Yew & O'Kearney, 2013). In particular, adolescents with DLD who have language comprehension difficulties are at higher risk of social, emotional, and behavioural difficulties (Conti-Ramsden et al., 2013; Snowling et al., 2006). As such, raising clinicians' awareness of the need to support theory of mind may not only assist with improving inferential comprehension but also have a positive impact on aspects of social competence related to theory of mind (i.e. understanding the perspectives of self and others) (Westby & Robinson, 2014). Theory of mind is not a common area of knowledge or intervention practice for speech-language pathologists, so the results of both studies should increase clinicians' awareness of the importance of theory of mind for inferential comprehension, and the need to target theory of mind in intervention.

Early intervention targeting oral inferential comprehension may act as a protective mechanism for later abilities. Oral inferential comprehension of narratives is a significant predictor of reading comprehension ability in young typically developing children (Silva & Cain, 2015), and the role of general oral comprehension (including narrative comprehension) is increasingly important for reading comprehension from the beginning stages of reading (Language and Reading Research Consortium, 2015). In addition, the majority of academic learning occurs through reading comprehension from the middle primary years of schooling (the shift

from 'learning to read' to 'reading to learn') (Cain & Oakhill, 2007b; Ricketts, 2011). The Study Two findings demonstrated that oral inferential comprehension can be improved in young children with DLD, prior to the development of reading comprehension. Therefore, it is important for clinicians to provide intervention targeting *oral* inferential comprehension to *young* children with DLD. Providing targeted oral inferential comprehension intervention from a young age in children with DLD may support later reading comprehension ability and, thus, learning. For adolescents with DLD, this may provide some protection against the risk of entering a cycle of academic failure (Young et al., 2002).

Overall, the results of both studies provide speech-language pathologists with a profile of the skills underlying, and level II evidence for an intervention to improve, oral inferential comprehension ability in young children with DLD. In addition, the studies provide clinicians with two novel assessments of inferential and literal narrative comprehension in young school-aged children.

Strengths and Limitations

The primary strength of Study One is that it presents, to current knowledge, the first detailed profile of language and cognitive skills which contribute to oral inferential comprehension in young children with DLD. Given that many children with DLD present with difficulty in oral inferential comprehension, the profile is imperative to our understanding of what underlies the skill in this population. The results fill a significant gap in both the research field and the clinical understanding of inferential comprehension in DLD.

There were a number of limitations in the first study which were discussed in chapter 3. While 76 participants with developmental language disorder were recruited, which is a large sample size in the field of DLD research, a larger sample size would have been beneficial for the study's statistical power. As such, the study should be replicated with a larger sample size. The other identified limitations included: lack of standardised assessment of inferential comprehension and executive functions; not including all potential measures predicting inferential comprehension (e.g. vocabulary depth and the central executive component of working memory); and lack of a typically developing sample of children for comparison. A comprehensive profile of the skills contributing to inferential comprehension in young typically developing children would provide clinically useful

information for comparison to the DLD population. In addition, the findings of Study One relate to 5 to 6 year old children with DLD. Given that the language profiles of children with DLD may change over time, it would be beneficial for future research to replicate this study with a wider age range (Conti-Ramsden & Botting, 1999).

Study Two is unique in that, to current knowledge, it is the first randomised controlled trial of an intervention targeting oral inferential comprehension in children with developmental language disorder. There is a paucity of research investigating such interventions in children with DLD, despite the knowledge that these children demonstrate poor oral inferential comprehension and the importance of this skill for later reading comprehension and learning. Additionally, to current knowledge, it is the first intervention study which is based on evidence of the profile of skills underlying inferential comprehension in this population. The evidence-base of interventions for oral inferential comprehension in this population is small, and past studies have identified a number of limitations and the need for replication. Study Two addressed these issues and used a randomised controlled trial design. The significant results demonstrate that oral inferential comprehension of narratives in young children with DLD can be improved, an imperative finding given the literature on the lack of evidence for effective receptive language interventions (Law et al., 2004). The novel intervention can be replicated easily by clinicians using the intervention principles based on the Study One results and past research, scripted session plans, well-known children's books, and small-group service delivery. The intervention study findings are significant, given that many children with reading comprehension difficulties present with an underlying language disorder (Nation et al., 2010; Spencer et al., 2014) and that inferential comprehension is a predictor of reading comprehension ability (Cain & Oakhill, 1999; Oakhill, 1984; Silva & Cain, 2015).

However, there were a number of limitations to Study Two which were discussed in chapter 5. In summary, these included: use of the same assessment at all assessment points (an equivalent treated control group and a generalisation measure were included to control for this issue); lack of standardised assessment of inferential comprehension and assessment of inferential comprehension in contexts other than narrative; and, lack of longer-term (i.e. 12 months or more) follow up. Longer term follow-up would be particularly useful to investigate whether the intervention results were maintained over time, and whether the improvements

influenced later reading comprehension. Inclusion of theory of mind and vocabulary measures (e.g. breadth and depth), and analysis of narrative retelling data, would have informed a comprehensive understanding of the mechanisms of change underlying the intervention. Additionally, measures of attention, engagement and behaviour would have been useful to investigate factors that might have influenced participants' response to the intervention. The NCA questions required expressive language to respond and, although the participants were not scored on grammatical accuracy, future research would benefit from including additional receptive-only assessment (e.g. true/false or pointing responses).

Future Research Directions

Much research is still needed in the area of oral inferential comprehension in children with developmental language disorder. The studies presented here should be replicated and extended. In particular, research should investigate the profile of skills important for inferential comprehension in both younger and older children with DLD to enable a comprehensive understanding of the development of this skill. While a comprehensive understanding of inferential comprehension development in typically developing children is still lacking, recent research has focused on this area, aiming to address the evidence gap (Filiatrault-Veilleux et al., 2016).

Future research should also evaluate inferential comprehension intervention for both younger and older children with DLD, include measures for all underlying mechanisms of change in intervention, investigate the needs of children who do not improve during small-group interventions, and include longer-term follow up to investigate the impact of inferential comprehension intervention on later reading comprehension. In addition, future studies would benefit from exploring generalisation of inferential comprehension gains to other contexts.

While The Squirrel Story Narrative Comprehension Assessment task has some preliminary norms¹⁰, future studies could use both the NCA tasks with different age ranges of typically developing children, and children with DLD, so clinicians and researchers can use the NCA as a norm-referenced assessment of inferential and literal narrative comprehension.

¹⁰ Reference data has been collected on kindergarten to year one typically developing children (3 to 7 years of age), and will be published for clinicians to use.

Overall, given that many children with DLD demonstrate language comprehension difficulties, future research should focus on interventions targeting language comprehension, as this area has received significantly less research focus than language expression and has a significant influence on a child's ability to communicate and learn successfully.

Conclusion

This research has investigated the 'hidden' language skill in children with DLD: oral inferential comprehension. This language skill is particularly poor in children with DLD and, despite being 'hidden', it is crucial for effective communication, reading comprehension, and learning. There has been little research into the skills which support oral inferential comprehension in children with DLD and evaluating interventions which target inferential comprehension in this population. The research presented in this thesis aimed to fill these research gaps by providing a profile of the language and cognitive skills which underpin inferential comprehension in young children with developmental language disorder and by using this profile to develop, trial, and evaluate an intervention targeted at improving oral inferential comprehension of narratives.

The results of this research highlight the skills which are important for oral inferential comprehension in 5 to 6 year old children with DLD and provide support for a book-sharing intervention, developed based on evidence-based intervention principles, to improve oral inferential comprehension of narratives in this population. Oral inferential comprehension can be improved in young children: it is crucial to provide intervention focusing on oral inferential comprehension development in children with DLD from a *young* age in order to support communication and reading comprehension development. It is hoped that this research will increase the current theoretical and clinical evidence-base for speech-language pathologists, thus promoting awareness of oral inferential comprehension in DLD. Overall, it is hoped that the research will encourage and guide further research in this important area, adding to the evidence-base, and thus have a positive influence on the long-term communication, learning, and life outcomes of children with developmental language disorder.

"I felt like an outcast. I didn't feel like I should be there, as if I shouldn't even be at school in the first place... and as the years went on I still just couldn't

understand, my family couldn't understand, why I, I didn't answer questions or anything like that properly... The things I found difficult in class was that I sat there, and I saw my friends whizzing through like all the questions in seconds, and then I'm sitting there still on question one... I just kept thinking that I'm stupid, what is wrong with me, why can't you just answer the stupid question... I had a speech and language therapist and um she helped me to understand what was wrong and to answer questions that I thought I couldn't. She started to show me and give me an understanding that I could actually work out things... The difference is amazing, I feel way way better... I'm happy because I know I can answer questions, I can explain things... because it, it's proven that I have got intelligence and that I can understand and do stuff right, it's great... and my future's definitely changed, and I'm over the moon". – Harry, aged 16 (RALLI Campaign, 2012)

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Appendix A

This appendix contains the copyright permissions obtained for the following material:

- Figure 1.8, p.18 from Bishop, D. (2014). *Uncommon Understanding: Development and Disorders of Language Comprehension in Children* (Classic ed.). Hove, UK: Psychology Press.
- "The perceptual-language distances underlying the scale of abstraction" figure, p.17, from Blank, M., Rose, S., & Berlin, L. (1978). *The Language of Learning: The preschool years*. New York: Grune & Stratton, Inc.
- 'The Squirrel Story Narrative Assessment' story text and iPad app screenshots from Carey, J., Leitão, S., & Allan, L. (2006). *Squirrel Story Narrative Assessment*. Keighley: Black Sheep Press.
- 'Peter and the Cat Narrative Assessment' story text and iPad app screenshots from Leitão, S., & Allan, L. (2003). *Peter and the Cat*. Keighley: Black Sheep Press.

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1/29/2017

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RE: Rights & Permissions (Contact Form) - Routledge.com

Academic Books Permissions <mpkbookspermissions@tandf.co.uk>

Fri 9/12/2016 4:56 PM

To: Emily Dawes <emily.dawes@postgrad.curtin.edu.au>;

Thank you for your email.

We can confirm that this is acceptable.

Best Regards

From: Emily Dawes [mailto:emily.dawes@postgrad.curtin.edu.au]

Sent: 09 December 2016 02:15

To: Academic Books Permissions <mpkbookspermissions@tandf.co.uk>

Subject: Re: Rights & Permissions (Contact Form) - Routledge.com

To Academic Books Permissions,

Thank you for providing permission for me to reproduce Figure 1.8 (p.18) from the book, Bishop, D. (2014). *Uncommon Understanding: Development and Disorders of Language Comprehension in Children* (Classic ed.). Hove: UK: Psychology Press, in my doctoral thesis at Curtin University.

Once completed, the thesis will be made available in online form via Curtin University's Institutional Repository [espace@Curtin \(http://espace.library.curtin.edu.au\)](http://espace.library.curtin.edu.au). The material will be provided strictly for educational purposes and on a non-commercial basis.

I would be most grateful for your consent to the copying and communication of the figure as proposed via Curtin University's Institutional Repository. Full acknowledgement of the ownership of the copyright and the source of the figure will be provided with the material in the thesis.

I look forward to hearing from you again and thank you in advance for your consideration of my request.

Kind regards,

Emily

1/29/2017

RE: Rights & Permissions (Contact Form) - Routledge.com - Emily Dawes

From: Academic Books Permissions <mpkbookspermissions@tandf.co.uk>**Sent:** Wednesday, 7 December 2016 11:34 PM**To:** Emily Dawes**Subject:** RE: Rights & Permissions (Contact Form) - Routledge.com**9780863772603 | UNCOMMON UNDERSTANDING | Edn. 1 | Hardback | Fig 1.8**

Further to your recent emails permission is granted for use of the requested material only in your forthcoming thesis, subject to the following conditions:

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From: emily.dawes@postgrad.curtin.edu.au**Message:**

Hello, Re: permission to reproduce a figure. I am currently completing my PhD thesis in the area of inferential comprehension in children with language impairment. I would like to request permission to reproduce Figure 1.8, p.18 from Bishop, D. (2014). Uncommon Understanding: Development and Disorders of Language Comprehension in Children (Classic ed.). Could you please advise who to contact to request permission and/or if any additional information is required to request permission? Thank you. Kind regards, Emily Dawes (Speech Pathologist, PhD Candidate at Curtin University, Perth, Western Australia)

URL:<https://www.routledge.com/info/contact>**Environment:**


Copyright permission for "The perceptual-language distances underlying the scale of abstraction" figure, p.17, from Blank, M., Rose, S., & Berlin, L. (1978). *The Language of Learning: The preschool years*. New York: Grune & Stratton, Inc.

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"The perceptual-language distances underlying the scale of abstraction" figure, from Blank, M., Rose, S., & Berlin, L. (1978). *The Language of Learning: The preschool years*. New York: Grune & Stratton, Inc.

I hereby give permission for Emily Dawes to include the abovementioned material in her higher degree thesis for Curtin University, and to communicate this material via the espace@Curtin institutional repository. This permission is granted on a non-exclusive basis and for an indefinite period.

I confirm that I am the copyright owner of the specified material.

Signed: 
Name: MARION BLANK
Position: EDUCATIONAL DIRECTOR: MOJO LEARNING
Date: Dec 2, 2016

Please return signed form to **Emily Dawes**, emily.dawes@postgrad.curtin.edu.au

Thank you.

Copyright permission for '*The Squirrel Story Narrative Assessment*' story text and iPad app screenshots from Carey, J., Leitão, S., & Allan, L. (2006). *Squirrel Story Narrative Assessment*. Keighley: Black Sheep Press, and;
'*Peter and the Cat Narrative Assessment*' story text and iPad app screenshots from Leitão, S., & Allan, L. (2003). *Peter and the Cat*. Keighley: Black Sheep Press.

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Keighley: Black Sheep Press.

'*Peter and the Cat Narrative Assessment*' story text and iPad App screenshots:
Leitão, S., & Allan, L. (2003). *Peter and the Cat*. Keighley: Black Sheep Press.

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I confirm that I am the copyright owner of the specified material.

Signed:

Name: Alan Henson

Position: Director

Date: 9/12/2016



Please return signed form to **Emily Dawes**, emily.dawes@postgrad.curtin.edu.au

Thank you.

Appendix B

This appendix contains the Study One information letters and consent forms for Language Development Centre principals, parents/carers of participants, and study participants.

Study One Principal Information Letter



School of Psychology and Speech Pathology

May 2014

Emily Dawes
PhD Candidate
School of Psychology and Speech Pathology
Curtin University of Technology
GPO Box U 1987, Perth
Western Australia, 6845
Ph: +61 8 9266 3472
Fax: +61 8 9266 2464

Dear Principal,

The hidden language skill: oral inferential comprehension in children with specific language impairment.

My name is Emily Dawes and I am a PhD Candidate at Curtin University. I am conducting a study to investigate the oral inferential comprehension of children with specific language impairment. Oral comprehension ability is very important for learning and for literacy development. Research has indicated that children with specific language impairment have difficulty with particular areas of language comprehension, including the ability to inference. The purpose of this study is to create a comprehensive profile of the language and cognitive skills which contribute to oral inferential comprehension ability in children with specific language impairment. The results of the study will help us to understand oral inferential comprehension in children with specific language impairment better. The results may also help Language Development Centres to better support the learning of children with specific language impairment in the future.

My supervisors for this project are Dr Suze Leitao and Dr Mary Claessen from Curtin University.

What does participation in the research involve?

I am seeking the participation of at least 55 pre-primary students from Language Development Centres across Perth, who present with a clear diagnosis of specific language impairment and intelligible speech. This project will involve one screening session of 5 minutes and four to five assessment sessions of around 15 to 20 minutes each. The primary teacher of each participant will also be asked to complete two checklist forms which will each take approximately 5 to 10 minutes to complete.

I would like to invite **XX** Language Development Centre (LDC) to participate in this research.

This would involve the following steps:

Identification of children in pre-primary who present with a clear diagnosis of specific language impairment and intelligible speech.

1. As the Principal, you will provide my research information letter and consent forms to the parents/guardians of identified children.
2. The parents/guardians will return the consent forms to me via the class teacher. They will have the opportunity to discuss any questions they may have with me.
3. The pre-primary teachers will complete a checklist relating to each identified child's pragmatics and language skills.
4. I will come to your LDC to perform one brief hearing screen assessment with each child who has parental consent to participate. Prior to completing the screening, I will talk to each child about the research and ask them to indicate whether they want to be involved by circling 'yes' or 'no' on a consent form. Further data will be collected on the children who demonstrate typical hearing ability. I will provide an information letter to and discuss the results with parents of children who do not pass the hearing screen.

Further data collection

1. I will complete four to five brief (approximately 15 to 20 minute) assessment sessions with each child. Children will be able to take breaks as required. The assessments will take place during Term 3 and/or Term 4, 2014. The total time commitment of each participant will be approximately 60 to 90 minutes (including hearing screen).
2. The assessments will involve various language and cognitive areas, such as narrative, comprehension, vocabulary, working memory and non-verbal thinking skills. For children who have had a non-verbal thinking skills assessment (WPPSI) within the last 12 months, and whose parents have provided consent, I will access the LDC referral data to obtain their scores (the Performance IQ subtests). Children who have not completed a non-verbal thinking skills assessment in the last 12 months will complete this as a part of the assessment battery.
3. I have attached an inventory of the assessments being used for this study. Some parts of the assessments (such as narrative retell) will be audio-recorded so that the assessment can be scored after the assessment session has been completed.
4. The teacher of each participant will complete a checklist of the participant's theory of mind (social cognition) skills.

To what extent is participation voluntary, and what are the implications of withdrawing participation?

Participation in this study is completely voluntary. All potential participants and their parents are advised of this in the information letter.

If parent/guardians give permission for their child to participate in the research, they may withdraw their child, or the child may withdraw themselves, from participation at any time without consequence. If a child is withdrawn from participating in the study, all information and data will be destroyed immediately.

If the project has already been published at the time a participant decides to withdraw, their contribution to research data can not be removed from the publication.

The decision about whether to participate, or to participate and then withdraw, of any participant will not affect the relationship with the research team or Curtin University.

What will happen to the information collected, and is privacy and confidentiality assured?

Information that identifies a participant or the Language Development Centre will be removed from the data collected. The data will be stored in a locked cupboard or on a secure computer at Curtin University which can only be accessed by myself and my supervisors (Dr Suze Leitao, Dr Mary Claessen and Dr Robert Kane). All assessment records will be stored for a minimum period of 7 years, after which it will be destroyed, as in accordance with the Australian Code for the Responsible Conduct of Research and the Western Australian University Sector Disposal Authority.

The data is stored in this way so that, if a participant decides to withdraw, their data can be re-identified and destroyed. This is done by using a system of individual codes which are known only to the research team.

The results of this study may be published, however no identifying information regarding the participants will be used. The identity of the participants and the Language Development Centre will not be disclosed at any time, except in circumstances requiring reporting under the Department of Education Child Protection Policy, or in the circumstance that the research team is legally required to disclose such information. Confidentiality of participant information is assured at all other times.

What are the benefits of this research for the child's education and the school?

The data from this study will be used to create a profile of the skills which underpin oral inferential comprehension ability in young children with specific language impairment. The results of this study will be used to develop a targeted intervention for oral inferential comprehension in children with specific language impairment. It will also add to the theoretical and clinical evidence base for the effective practice of teachers and speech pathologists.

After the completion of the research, a presentation and/or report describing the outcomes of the research can be provided to XX Language Development Centre. With parent/guardian consent, the participants' assessment data (language and cognitive measures) can be provided to XX Language Development Centre, which may assist the Centre in gaining a more comprehensive understanding of each child's language profile.

Are there any risks associated with participation?

There are no known risks associated with participation in this study. The assessments are typical of those used in the usual practice of speech pathologists, and involve the children completing tasks such as naming pictures, retelling a narrative, repeating nonsense words and following instructions. Assessment sessions will not exceed 20 minutes duration and children will be provided with frequent breaks, as required. The times children take part in assessment sessions will be negotiated with class teacher/s in advance, to ensure that minimal disturbance is provided to classroom activities.

Do all members of the research team who will be having contact with children have their Working With Children Check?

Yes. Under the Working with Children (Criminal Record Checking) Act 2004, individuals undertaking research that involves contact with children must pass a Working with Children Check. I have attached evidence of my current Working With Children Check. If another speech pathologist or a Speech Pathology Undergraduate/Masters student will be conducting assessments, evidence of their current Working With Children Check will be provided prior to contact with any participants.

Is this research approved?

The Curtin University Human Research Ethics Committee has given approval for this study. Any questions or verification of approval for this study can be obtained by contacting the Committee.

Study approval number: PSYCH SP 2014-07

Address: Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845. Telephone: 9266 2784, Email: hrec@curtin.edu.au.

The research has also met the policy requirements of the Department of Education, as indicated in the letter attached.

Who do I contact if I wish to discuss the project further?

Please do not hesitate to contact either myself or my research supervisors if you have any questions about the research. I can be contacted by phone (XXX XXX XXXX) or by email (emily.dawes@postgrad.curtin.edu.au). Alternatively, you may wish to contact one of my supervisors, Suze Leitão (S.Leitao@exchange.curtin.edu.au) or Mary Claessen (M.Claessen@curtin.edu.au).

How do I indicate my willingness for this Language Development Centre to be involved in this project?

If you have had all questions about the research project answered to your satisfaction, and are willing for **XX** Language Development Centre to participate, please complete the Consent Form attached. Please contact me by the **DD/MM 2014** if you have completed the consent form and would like **XX** Language Development Centre to be involved.

Thank you.

Regards,

Emily Dawes
Speech Pathologist
PhD Candidate
Curtin University

Dr Suze Leitão
Speech Pathologist
Supervisor and Senior Lecturer
Curtin University

Dr Mary Claessen
Speech Pathologist
Supervisor, Lecturer and Speech
Pathology Program Director
Curtin University

Inventory of Assessments

Screening

- Portable audiometer. Children who demonstrate hearing ability within a cut-off level of 25dB between 500 – 4000Hz will be eligible to participate in this study.

Further Assessment

- The Expressive Vocabulary Test – Second Edition (EVT-2).
- The Peabody Picture Vocabulary Test – Fourth Edition (PPVT-4).
- The Test for Reception of Grammar – Second Edition (TROG-2).
- The Comprehensive Test of Phonological Processing (CTOPP).
- Test of Language Development –Third Edition (TOLD-3) (sentence imitation subtest).
- The Squirrel Story Narrative Assessment.
- The Squirrel Story Narrative Comprehension Assessment.
- The Theory of Mind Inventory (ToMI). This will be completed by the class teacher.
- Children’s Communication Checklist-Second Edition (CCC-2). This checklist will be completed by the class teacher.
- Wechsler Preschool and Primary Scale of Intelligence – Third Edition (WPPSI-3) (Performance IQ subtests: matrix reasoning, block design, picture concepts). This will only be completed for children who have not had a non-verbal thinking skills assessment within the past 18 months.

Study One Principal Consent Form



School of Psychology and Speech Pathology

May 2014

The hidden language skill: oral inferential comprehension in children with specific language impairment.

Consent Form for Language Development Centre Principal

- I have read this document and, as described within it, I understand the aims, procedures, and risks of this project.
- I have been given the opportunity to ask any questions I may have had, and these have been answered to my satisfaction.
- I am willing for the Language Development Centre to be involved in the research project, as described.
- I understand that participation in this project is completely voluntary.
- I understand that the Language Development Centre may withdraw its participation in this project at any time, without consequence.
- I understand that the results of this research may be published, provided that the participants or the Language Development Centre are not identified in any way.
- I understand that the Language Development Centre will be provided with a copy of the research findings upon the completion of this project.

Name of Language Development Centre (please print): _____

Name of Principal (please print): _____

Signature of Principal: _____

Date (DD/MM/YYYY): ____ / ____ / _____

Study One Parent/Carer Information Letter



School of Psychology and Speech Pathology

March 2014

Emily Dawes
PhD Candidate
School of Psychology and Speech Pathology
Curtin University
GPO Box U 1987, Perth
Western Australia, 6845
Ph: +61 8 9266 3472

Dear Parent/Carer,

My name is Emily Dawes and I am a speech pathologist currently completing a PhD at Curtin University. My research is about children's comprehension and how children make inferences.

Research has shown that children with specific language impairment have trouble making inferences. Inferences involve understanding information which is not obvious or 'right there' (e.g. answering questions like 'what will happen next?'). Inferences are very important for communication and reading. The results of my study may help Language Development Centres to support children's learning.

What does participation in the research project involve and are there any risks?

I am inviting your child to take part in my study. This will involve one brief screening session and four to five brief assessment sessions during Term 3 and/or Term 4, 2014. Your child will be out of class for approximately 60 to 90 minutes in total. Your child's teacher will also be asked to complete two checklists about your child's language and social skills. There are no known risks associated with taking part in this study.

If you give permission for your child to participate, I will talk to your child about the research and they will be able to show whether they want to be involved by circling 'yes' or 'no' on a consent form. If your child wants to be involved, I will complete a brief hearing screen with them. Children who show typical hearing ability will take part in further data collection. I will contact you to discuss your child's results if they do not show typical hearing ability in the screen.

The further tasks involve activities such as retelling a story, answering questions about a story, naming pictures, repeating nonsense ('silly') words and following instructions given by puppets. These are typical of those used by speech pathologists in Language Development Centres. If your child completed a nonverbal thinking skills task (such as the WPPSI) in the past 12 months (e.g. as part of their referral to the Language Development Centre), I will access their scores on this assessment with your permission. If your child has not completed a non-verbal thinking skills task in the past 12 months, they will complete this as a part of the other tasks. This will involve

activities such as copying designs of building blocks and choosing pictures that show something in common.

The sessions will take place at your child's school during normal school hours. Each session will last approximately 15 to 20 minutes and will include breaks when needed. Some parts of the sessions, such as retelling a story, will be audio-recorded so that I can score your child's responses after the session. The times your child participates in assessment sessions will be negotiated with their class teacher in advance, to ensure that they provide minimal disturbance to classroom activities

Does my child have to take part?

No. Participation in this study is completely voluntary. You do not have to give permission for your child to take part in this study. If you would like your child to take part, I have included a consent form for you to sign. If you give permission for your child to take part, before I complete any assessment I will briefly discuss with them what we will be doing and I will ask them to circle 'yes' or 'no' to show whether they would like to be involved.

What if either of us was to change our mind?

If you give permission for your child to take part, but then change your mind, you may withdraw your child, or your child may withdraw themselves, at any time without consequence. If your child is withdrawn from the study, all of your child's data will be destroyed immediately.

Your decision about whether to participate in this research or not will not affect your family's relationship with your child's school.

What will happen to the information collected, and is privacy and confidentiality assured?

Your child's name and any identifying details will not appear on any assessment sheets, instead a code will be used. The list of these codes will be stored in a locked cupboard at Curtin University which can only be accessed by myself and my supervisors. Data will be stored for a minimum period of 7 years, after which it will be destroyed according to the Curtin University Functional Records Disposal Authority protocol and the Western Australian University Sector Disposal Authority. The information is stored in this way so that, if you decide to participate and then withdraw, I can re-identify your child's data and destroy it.

The results of this study may be published, however no identifying information regarding your child will be used. Your child's identity and the identity of the Language Development Centre will not be disclosed at any time, except in circumstances requiring reporting under the Department of Education Child Protection Policy, or in the circumstance that the research team is legally required to disclose such information. Confidentiality of your child's information is assured at all other times.

What are the benefits of this research for my child's education?

With your permission, your child's assessment results will be provided to their school. This information will be useful for your child's teacher and speech pathologist. The results of this study will lead to a better understanding of comprehension in children with specific language impairment.

How do I know that the people involved in this research have all the appropriate documentation to be working with children?

Under the Working with Children (Criminal Record Checking) Act 2004, individuals undertaking research that involves contact with children must pass a Working with Children Check. I have provided the Principal of the Language Development Centre with evidence of my current Working with Children Check.

Is this research approved?

The Curtin University Human Research Ethics Committee has given approval for this study. Any questions or verification of approval for this study can be obtained by contacting the Committee.

Study approval number: PSYCH SP 2014-07

Address: Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845.

Telephone: 9266 2784 Email: hrec@curtin.edu.au

The research has also met the policy requirements of the Western Australian Department of Education.

Who do I contact if I wish to discuss the project further?

Please do not hesitate to contact either myself or my research supervisors if you have any questions about the study. I can be contacted by phone (XXX XXX XXXX) or by email (emily.dawes@postgrad.curtin.edu.au). Alternatively, you may wish to contact one of my supervisors, Dr Suze Leitão (S.Leitao@exchange.curtin.edu.au) or Dr Mary Claessen (M.Claessen@curtin.edu.au).

How does my child become involved in this project?

Please ensure that you:

- Read this letter thoroughly;
- Take up my offer to ask any questions you may have about the research.

Once all questions have been answered to your satisfaction, and you are willing for your child to become involved, please complete the attached Consent Form, and return it to the **Language Development Centre** by the **DD/MM 2014**.

Thank you.

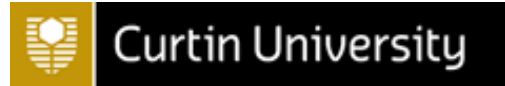
Regards,

Emily Dawes
Speech Pathologist
PhD Candidate
Curtin University

Dr Suze Leitão
Speech Pathologist
Supervisor and Senior Lecturer
Curtin University

Dr Mary Claessen
Speech Pathologist
Supervisor, Lecturer and Speech
Pathology Program Director
Curtin University

Study One Parent/Carer Consent Form



School of Psychology and Speech Pathology

March 2014

The hidden language skill: oral inferential comprehension in children with specific language impairment.

Parent Consent Form

- I have read this document and I understand the aims, procedures, and risks of this project.
- I have been given the opportunity to ask questions about the research project. I am satisfied with the answers to questions I have asked.
- I am willing for my child to become involved in the research project.
- I understand that participation in this project is completely voluntary.
- I understand that both my child and I are free to withdraw from participation at any time, without affecting my family's relationship with the Language Development Centre.
- I give permission for the contribution that my child makes to this research to be published, provided that my child is not identified in any way.
- I give permission for my child's verbal responses to be audio-recorded during assessment sessions so that his/her responses can be scored after the session is finished.
- I give permission for my child's past results of nonverbal thinking skills assessment/s (Performance IQ subtest results of the WPPSI) to be released by the Language Development Centre to the primary researcher for the purposes of the research project.
- I give permission for the results of the assessments conducted with my child for this research to be released to the Language Development Centre.

Name of Child (please print): _____

Date of birth (please print): _____ / _____ / _____

Name of Parent/Carer (please print): _____

Signature of Parent/Carer: _____

Date (DD/MM/YYYY): _____ / _____ / _____

Study One Participant Information Letter



School of Psychology and Speech Pathology
August 2014

Participant Information Letter

Hello,

My name is Emily. I have a project that you might like to help me with.

The project is about getting to know how we understand talking.



Would you like to help me for about an hour? If you would like to help, we will do some quick activities a few times this Term.

If you want to stop at anytime, that's OK, you can.

I won't tell anyone what you say while helping me with the project, unless I need to tell someone like your teacher (e.g. if you tell me that someone has hurt you).

If you would like to help with the project, please draw a circle around the tick on the next page.

If you don't want to help with the project - that's OK too.

You can ask me any questions about the project.

Thank you.

Emily Dawes
Speech Pathologist
PhD Candidate, Curtin University
Email: emily.dawes@postgrad.curtin.edu.au

Study One Participant Consent Form



School of Psychology and Speech Pathology
August 2014



Participant Consent Form

I know I have a choice whether or not I want to do this project.

I know that I can stop whenever I want to. I know I will not get into trouble if I want to stop.

I know that I will be doing some different activities (like telling a story and looking at pictures) to help with this project.

I know that I need to draw a circle around the tick on this page before I can help with the project.



YES

I would like to help with the project

NO

Not this time

Child's name: _____

Today's date: ____ / ____ / _____

Appendix C

This appendix contains The Squirrel Story narrative, Narrative Comprehension Assessment, and The Squirrel Story Narrative Comprehension Assessment Scoring Guide.

The Squirrel Story Narrative

Carey, J., Leitão, S., & Allan, L. (2006). *Squirrel Story Narrative Assessment*. Keighley: Black Sheep Press.

Page 1 Once upon a time there was a mummy squirrel and a baby squirrel. They lived in a big oak tree on the edge of the forest.

Page 2 One sunny day, Mummy squirrel said to baby squirrel, 'would you like to play in the little garden near our tree?'

'Oh, yes please!' said baby squirrel. 'But don't go in the apple field!' Said Mummy. 'The farmer will be very cross and will chase you!'

Page 3 So baby squirrel set off to play. He met baby rabbit and baby mouse and they ran around. After a little while, baby squirrel got hungry.

Page 4 'Let's go and eat the apples in the apple field', he said. The other animals knew it was naughty, but went along. They squeezed through a little hole in the fence.

Page 5 Baby squirrel ate, and ate, and ate until he was very, very full. Soon it was time to go home. They ran to the hole in the fence. But oh dear!!!

Page 6 Baby squirrel was so fat he got stuck in the hole. His friends pushed and pulled, pushed and pulled but couldn't get him out.

Page 7 They tried and tried. Mr. Badger was walking past. 'Can I help you?' He said.









Page 8 He was very strong. He took a big breath, and everyone gave one big, giant PUSH!!!


Page 9 Baby squirrel shot out of the hole, right up into the sky. He flew through the air like a bird.

He shut his eyes. He landed with a thud. And where do you think he was?!

Page 10 He had landed in his very own tree!!! 'Where have you been?' Said Mum.

The Squirrel Story – Narrative Comprehension Assessment

| Page | Screenshot | Comprehension Questions |
|------|---|---|
| 1 |  | 1. <u>Who</u> are the characters in this story? |
| 1 |  | 2. <u>Where</u> does this story happen? |
| 3 |  | 3a. Look at the animals in this picture. How do you think they are <u>feeling</u> ? 3b. <u>Why</u> do they feel _____? |
| 4 |  | 4a. Look at the animals here. Tell me <u>what's happening</u> in the story <u>now</u> ? |
| 4 |  | 4b. <u>Why</u> is that an important part of the story? |
| 5 |  | 5. <u>Why</u> did baby squirrel and his friends decide to go into the apple field? |
| 6 |  | 6. What is happening <u>now</u> ? |
| 6 |  | 7. <u>Why</u> couldn't baby squirrel fit back through the fence? |
| 7 |  | 8a. Look at baby squirrel in this picture. How do you think he is <u>feeling</u> ? 8b. <u>Why</u> does he feel _____? |
| 7 |  | 9a. What could the mouse and rabbit be <u>saying</u> here? |
| 7 |  | 9b. <u>Why</u> do you think they would say that? |
| 9 |  | 10. What happened here? |
| 9 |  | 11. <u>Why</u> does baby squirrel fly so high? |

| | | |
|----|---|---|
| 10 |  | 12a. This is the last picture in the story (<i>move iPad away from the child</i>). What <u>do you think</u> happens <u>next</u> ? |
| - | | 12b. <u>Why</u> do you think so? |
| - | | 13a. If you were one of baby squirrel's friends and you knew that you weren't meant to go in the apple field, what would you tell baby squirrel so that the same thing didn't happen again? |
| - | | 13b. <u>Why</u> would you tell him that? |

The Squirrel Story Narrative Comprehension Assessment Scoring Guide

Narrative Comprehension Assessment questions developed by Emily Dawes, Dr Suze Leitão and Dr Mary Claessen. Questions and scoring based on the Narrative Comprehension Task Prompted Comprehension Questions from:
Paris, A. H., & Paris, S. G. (2003). Assessing narrative comprehension in young children. *Reading Research Quarterly*, 38(1), 36-76. doi: 10.1598/rrq.38.1.3

Assessment and Scoring Rules

- Comprehension questions may be repeated once. However, a question may be repeated twice with use of clinical judgement (i.e. if a distraction impacted the child's attention to the question).
- If a response is very poorly expressed (e.g. nonspecific or very poor syntax) and/or the listener is required to make significant inference to understand the response, take one point from the score for that response (e.g. if the response expressed indicates a score of 2 but it is very unclear, a score of 1 point is given).
- For questions with two parts (excluding question 12), credit may be given in part (b) if a score of 0 was obtained for part (a) provided that the part (b) response is linked to the part (a) response and fits within the scoring criteria.
- For question 9 (character dialogue), the response does **not** need to be given as direct speech.

| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
|-----------------|---------------------------------------|---|--|---|-------------|---------|
| 1. | Who are the characters in this story? | Response includes four to five characters. <i>Mummy squirrel, baby squirrel, baby rabbit, baby mouse, Mr Badger.</i> Accept non-specific language for the badger (e.g. <i>the bear, the wombat, the big fat one</i>). | Response includes two to three of the characters | Response includes only one character, or response is inappropriate. | | |
| 2. | Where does this story happen? | Response includes at least two settings. <i>In the forest, apple field, oak tree, garden</i> | Response includes at least one setting. | Response does not include an appropriate setting. | | |

| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
|-----------------|---|--|---|--|-------------|---------|
| 3a. | Look at the animals in this picture. How do you think they are <u>feeling</u> ? | Response indicates the inference of appropriate character feelings (e.g. <i>happy, excited, glad, delighted</i>) . | Response indicates the inference of general character feelings (e.g. good, ok) or physical feelings (e.g. hungry). | Response is not an appropriate inference of character feelings (e.g. <i>sad, angry, worried</i>). | | |
| 3b. | <u>Why</u> do they feel ____? | Response links character feelings to appropriate reason/actions (<i>they are having fun, they like playing together, playing with their friends, they haven't eaten</i>). The response must include a cognitive verb (e.g. <i>want, like, think</i>) or very clear reason (e.g. <i>fun, playing together, with friends, etc</i>). | Response links character feelings to a general action (<i>running around, outside, playing</i>). | Response does not link character feelings to appropriate action/reason. | | |
| 4a. | Look at the animals here. Tell me <u>what's happening</u> in the story <u>now</u> ? | Response includes the initiating action (<i>eating apples in the apple field</i>) and links it with the causal reason (<i>because baby squirrel/the baby animals are hungry</i>). | Response includes the initiating action OR the causal reason. | Response does not identify the initiating action or other relevant story information. | | |
| 4b. | <u>Why</u> is that an important part of the story? | Response links the initiating action to prior knowledge (<i>because mummy squirrel told baby squirrel not to go in the apple field, you are not allowed to go in the apple field, because the farmer might catch them</i>). | Response links to general / direct prior knowledge (e.g. <i>because he gets fat/can't fit through the hole</i>) or draws on world knowledge (e.g. they are hungry, you need to eat, apples are healthy). | Response does not link to prior or general knowledge about the action. | | |

| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
|-----------------|--|--|---|---|-------------|---------|
| 5. | <u>Why</u> did baby squirrel and his friends go into the apple field? | Response is an appropriate inference that includes the cause of the action (<i>hunger</i>) and the reason for the action (<i>there is food in the apple field</i>). E.g. <i>Because they were very hungry and there were apples/food in the field.</i> | Response in an appropriate inference that includes either the cause of the action (<i>hunger</i>) OR the reason for the action (<i>there is food in the apple field</i>). | Response does not include an appropriate inference (e.g. <i>he likes apples, he didn't listen to his mummy, they were naughty, because it was fun</i>). | | |
| 6. | What is happening now? | Response includes specific identification of the problem and the cause (<i>baby squirrel could not fit through the fence/hole because he was too fat/big</i>). | Response contains non-specific identification of the problem (e.g. <i>he's stuck, he can't get through/out, they can't push him out</i>). | Response does not identify the problem (e.g. <i>the animals are going home, he is getting out of the hole</i>). | | |
| 7. | <u>Why</u> couldn't baby squirrel fit back through the fence? | Response includes accurate identification of reason for problem with two elements (<i>eaten too much AND/SO too big/fat</i>). | Response includes part of the reason for the problem (e.g. <i>eaten too much OR he was too big/fat</i>). | Response does not identify an appropriate reason for the problem (e.g. <i>he is stuck</i>). | | |
| 8a. | Look at baby squirrel in this picture. How do you think he is <u>feeling</u> ? | Response indicates the inference of appropriate higher level character feelings (e.g. <i>worried, scared, frightened, nervous, surprised</i>). | Response indicates the inference of appropriate character feelings (e.g. <i>sad, upset, bad, not happy, mad, angry</i>). | Response is not an appropriate inference of character feelings (e.g. <i>happy, excited</i>) or is a physical feeling (e.g. <i>stuck, squished, hurt</i>). | | |
| 8b. | <u>Why</u> does he feel _____? | Response links the character feelings to appropriate higher level reason/actions (<i>he might be stuck for a long time/forever, he might not get out, he doesn't know what is going to happen</i> | Response links the character feelings to appropriate reason/actions (<i>he is stuck, he can't get out, he can't get through the fence, his tummy is</i> | Response does not link character feeling to an appropriate reason/action (<i>he ate too much, the hole is small, he's fat, he's big</i>). | | |

| | | | | | | |
|-----------------|--|---|---|--|--------------------|----------------|
| | | <i>next, the farmer might catch/eat him).</i> The response must include a cognitive or modal verb (e.g. <i>think, know, might, may</i>) or adverbial of time (e.g. <i>long time, forever</i>). | <i>sore/hurts).</i> | | | |
| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
| 9a. | What could the mouse and rabbit be <u>saying</u> here? | Response indicates the inference of appropriate character dialogue which includes the problem (baby squirrel is stuck in the fence) and plan (Badger needs to help push him out, e.g. <i>'please can you help us, baby squirrel is stuck in the fence'</i>). | Response indicates the inference of appropriate character dialogue which includes either the problem (baby squirrel is stuck in the fence) or the plan (Badger needs to help push him out, e.g. <i>help!, he's stuck!, can you push him?, can you help us?</i>). | Response does not include character dialogue which is relevant to the problem (e.g. <i>I want to go home, the apples were yummy</i>). | | |
| 9b. | <u>Why</u> do you think they would say that? | Response relates the problem (baby squirrel is stuck in the hole) to the goal/outcome resolution (they need help to get baby squirrel through the hole, e.g. <i>Because they wanted Mr Badger to help them to get baby squirrel through the hole, because they need help pushing baby squirrel out, because they can't push baby squirrel out on their own</i>). | Response includes the problem OR the goal/outcome resolution (e.g. <i>because they can't get him out, because they need some help, because he's stuck, because they are not strong</i>). | Response does not include the problem or the goal/outcome resolution (e.g. <i>they want to go home, because he is scared</i>). | | |

| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
|-----------------|---|--|---|---|-------------|---------|
| 10. | What happened here? | Response includes specific information related to at least two actions, including the initiating action (Baby squirrel is <u>pushed</u> out of the hole), the result of the initiating action (baby squirrel <u>flies</u> through the air), and the action of the resolution (baby squirrel <u>lands</u> on his own tree, e.g. <i>Mr Badger pushes Baby squirrel through the fence and he flies through the air; baby squirrel flies through the air and then he lands back on his own tree.</i>) | Response includes one action OR nonspecific information about two actions, including the initiating action (Baby squirrel is pushed out of the hole), the result of the initiating action (baby squirrel flies through the air), and the action of the resolution (baby squirrel lands on his own tree, e.g. <i>baby squirrel is flying, he got/went/popped/came out of the hole and is flying.</i>) | Response does not identify an appropriate action or uses nonspecific information to identify an action (e.g. <i>the squirrel is in the air, he went out in the air, he got out.</i>) | | |
| 11. | <u>Why</u> does baby squirrel fly so high? | Response indicates an appropriate reason for the outcome action (e.g. <i>Mr Badger is very strong / stronger than the baby animals, baby squirrel's friends gave him a <u>very/really</u> big/hard push, the push was <u>so</u> hard/strong.</i>) | Response indicates partially appropriate reason (e.g. <i>he's strong, he gave a hard/big push, Mr Badger helped the baby animals.</i>) | Response does not indicate an appropriate reason (e.g. <i>he's flying, he's so fat, he's a gliding/flying squirrel, because he stretched his arms out.</i>) | | |
| 12a. | This is the last picture in the story (<i>move ipad away from child</i>). What <u>do you think</u> happens <u>next</u> ? | Response presents a prediction that is appropriate and may relate to prior information from or in the context of the story (e.g. <i>mummy squirrel tells baby squirrel off/is cross, baby squirrel goes out to play again but doesn't go in the apple field, baby squirrel has dinner and</i> | Response presents a prediction that is appropriate, but either includes the end of the story script (e.g. <i>baby squirrel tells mummy squirrel what happened, mummy squirrel asks baby squirrel where he's been</i> | Response does not present an appropriate prediction (e.g. <i>baby squirrel lands in his tree, he got back home, the end</i>) | | |

| | | | | | | |
|-----------------|--|--|--|---|--------------------|----------------|
| | | <i>goes to bed).</i> | <i>and baby squirrel tells her) or does not clearly link to the context of the story.</i> | | | |
| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
| 12b. | <u>Why</u> do you think so? | Response presents a reason which links directly and clearly to a prediction made in the response to 14a and may relate to prior information from the story (e.g. <i>he went to bed because he was tired, because Mummy squirrel told him not to go in the apple field, because baby squirrel knew it was naughty to go into the apple field</i>). A score of 2 can only be given for Question 14b if a score of 2 was obtained for Question 14a. If 1 point was scored for 14a, a maximum of 1 point can be obtained for 14b. | Response presents a reason which is appropriate but does not link directly or clearly to prediction response and/or prior information from the story (e.g. <i>he has been up to trouble, mummy squirrel didn't know where baby squirrel was, mummy was cross, it's nearly dinner time</i>). | Response does not present an appropriate reason relating to the prediction (e.g. <i>it's fun, it's night time, it's the end</i>). | | |
| 13a. | If you were one of baby squirrel's friends and you knew that you weren't meant to go in the apple field, what would you tell baby squirrel so that the same thing didn't happen again? | Response indicates the inclusion of multiple events in order to create a narrative-level theme (e.g. <i>We're not allowed in the apple field because it is dangerous/the farmer might chase us, don't go in there because the farmer might catch you</i>). | Response involves a simple theme, including information from one aspect of the story (e.g. <i>don't go in there/the apple field; don't eat too many apples</i>). | Response does not include understanding of an appropriate theme or is very non-specific (e.g. <i>don't go out long, no, to stop, don't go in, go to another farm</i>). | | |

| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
|--------------------------|-------------------------------------|---|---|--|-------------|---------|
| 13b. | <u>Why</u> would you tell him that? | Response includes a reason which indicates overall understanding of the theme (e.g. <i>So the farmer does not catch/chase us, the farmer might be very angry, so we do not get into trouble/danger</i>). | Response includes a reason which indicates understanding of a simple theme (e.g. <i>so you/baby squirrel doesn't get stuck in the fence, he might get fat again, mum said not to go there/you're not allowed, it is safer not to go, it is naughty to go there</i>). | Response does not include an appropriate reason (e.g. <i>he would eat apples, there's someone there</i>). | | |
| TOTAL INFERENTIAL | | | | | /28 | |
| TOTAL LITERAL | | | | | /10 | |

Appendix D

This appendix contains the Peter and the Cat narrative, Narrative Comprehension Assessment, and Peter and the Cat Narrative Comprehension Assessment Scoring Guide.

Peter and the Cat Narrative

Leitão, S., & Allan, L. (2003). *Peter and the Cat*. Keighley: Black Sheep Press.

Page 1. Once there was a boy called Peter who loved animals.

Page 2. One day, when Peter was walking home after school, he heard a cat go miaow. At first Peter didn't know where the cat was. He looked behind him but he couldn't see it. Then the cat miaowed again, louder this time, and Peter saw it stuck up a tree.

Page 3. Being a kind boy, Peter decided to climb up the tree to rescue the cat.

Page 4. When he got to the top though, Peter was very frightened. It was a tall tree and Peter was afraid that he would fall. He sat on a high branch with the cat, hanging on very tight so he wouldn't lose his balance.

Page 5. Peter wondered what to do. 'Maybe if I call out loudly someone will come and rescue me' he thought. So Peter yelled as loudly as he could. He yelled again and again but no one heard him.


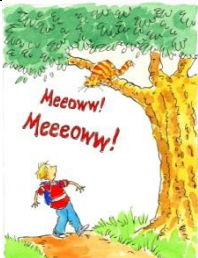


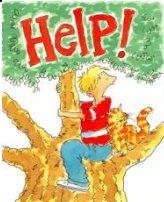
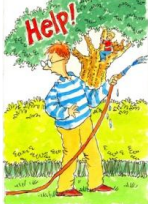

Page 6. Finally, after a long time, and when Peter was nearly exhausted, a man, watering his garden down the street, heard him.



Page 7. When he saw that Peter was stuck up the oak tree the man quickly got a ladder and helped Peter and the cat to get down.

Page 8. Still shaking with fright Peter thanked the man and went home.

Page 9. When Peter got home his mother scolded him because he was very late. Peter explained what had happened and asked her if he could keep the cat. His mum said, "OK, but climbing tall trees is dangerous. Next time get an adult to help you."

Peter and the Cat – Narrative Comprehension Assessment

| Page No# | Screenshot | Comprehension Question |
|----------|---|--|
| 1 |  | 1. <u>Who</u> are the characters in this story? |
| 2 |  | 2. <u>Where</u> does this story happen? |
| 2 | | 3a. Look at the cat in this picture. How do you think the cat is <u>feeling</u> ? 3b. <u>Why</u> does the cat feel _____? |
| 3 |  | 4a. Look at this picture. Tell me <u>what's happening</u> in the story <u>now</u> ? |
| 3 | | 4b. <u>Why</u> is that an important part of the story? |
| 3 | | 5. <u>Why</u> did Peter decide to rescue the cat? |
| 4 |  | 6. What is happening <u>now</u> ? |
| 4 | | 7. <u>Why</u> couldn't Peter get back down the tree? |
| 5 |  | 8a. Peter shouted 'help', what <u>else</u> could Peter be saying here? |
| 5 | | 8b. <u>Why</u> do you think he would say <u>that</u> ? |
| 6 |  | 9. <u>Why</u> did Peter feel nearly exhausted? |
| 7 |  | 10. What happened here? |
| 7 | | 11. <u>Why</u> did the man get a ladder? |

| | | |
|------------|---|---|
| 8 |  | <p>12a. Look at Peter in this picture. How do you think he is <u>feeling</u>?</p> <p>12b. <u>Why</u> does he feel _____?</p> |
| 9 - end |  | <p>13a. This is the last picture in the story (<i>move iPad away from the child</i>). What <u>do you think</u> happens <u>next</u>?</p> |
| end | | <p>13b. <u>Why</u> do you think so?</p> |
| end | | <p>14a. If you were the man watering your garden, what would you tell Peter so that the same thing didn't happen again?</p> <p>14b. <u>Why</u> would you tell him that?</p> |

Peter and the Cat Narrative Comprehension Assessment Scoring Guide

Narrative Comprehension Assessment questions developed by Emily Dawes, Dr Suze Leitão and Dr Mary Claessen. Questions and scoring based on the Narrative Comprehension Task Prompted Comprehension Questions from:

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Assessment and Scoring Rules

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- For questions with two parts (excluding question 13), credit may be given in part (b) if a score of 0 was obtained for part (a) provided that the part (b) response is linked to the part (a) response and fits within the scoring criteria.
- For question 8a (character dialogue), the response does **not** need to be given as direct speech.

| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
|-----------------|--|--|---|---|-------------|---------|
| 1. | <u>Who</u> are the characters in this story? | Response includes the two main characters (<i>Peter/the boy AND the cat</i>) and at least one minor character (<i>Peter's mum, the man, a list of animals</i>). Accept non-specific language for the man (e.g. <i>the man, Peter's dad, the gardener</i>). | Response includes both of the main characters (<i>Peter/the boy and the cat</i>) OR the response includes one main character and one or more minor characters (<i>Peter's mum, the man, a list of animals - e.g. the dog, turtle, mouse, rabbit</i>). | Response includes only minor characters (e.g. <i>a list of animals seen in the picture, Peter's mum, the man</i>), or response is inappropriate. | | |
| 2. | <u>Where</u> does this story happen? | Response includes at least two settings (e.g. <i>near/by/in/up a tree,</i> | Response includes at least one main setting (<i>in a tree, on</i> | Response includes a minor setting (e.g. <i>at home, on</i> | | |

| | | <i>the garden, Peter's house, on the way <u>home</u> from <u>school</u></i>). | <i>his way home from school</i>). | <i>his way walking) or does not include an appropriate setting.</i> | | |
|-----------------|---|--|--|--|-------------|---------|
| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
| 3a. | Look at the cat in this picture. How do you think the cat is <u>feeling</u> ? | Response indicates the inference of specific character feelings (e.g. <i>frightened, scared, worried, terrified</i>). | Response indicates the inference of general character feelings (e.g. <i>sad, upset</i>). | Response is not an appropriate inference of character feelings or physical feelings (e.g. <i>happy, angry, tired, hungry</i>). | | |
| 3b. | <u>Why</u> does the cat feel _____? | Response links character feelings to an appropriate reason/actions (<i>because the cat could/might fall/hurt himself, because the cat does not know how to get down, because the tree is very high up</i>). The response must include a cognitive verb (e.g. <i>want, know, think</i>) or very clear reason (e.g. <i>the tree is very high</i>). | Response links character feelings to a general reason (<i>because the cat is stuck in the tree</i>) or a non-specific reason (requiring inference by the listener). | Response does not link character feelings to appropriate action/reason. | | |
| 4a. | Look at this picture. Tell me <u>what's happening</u> in the story <u>now</u> ? | Response includes the initiating action (<i>Peter is climbing the tree</i>) and links it with the causal reason (<i>because / in order to rescue the cat</i>). | Response includes either the initiating action OR the causal reason, or the response is not clearly expressed (e.g. <i>the boy climbing and help the cat</i>). | Response does not identify the initiating action or other relevant story information. | | |
| 4b. | <u>Why</u> is that an important part of the story? | Response links the initiating action to prior knowledge (<i>because Peter is rescuing the cat</i>). | Response links to general / world prior knowledge (e.g. <i>because Peter gets stuck, because it is dangerous to climb trees, because Peter might hurt himself</i>) or the response is linked to the | Response does not link to prior or general knowledge about the action (e.g. <i>because it is, because the cat is in the tree</i>) or repeats response from question 4a. | | |

| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
|-----------------|--|--|---|---|-------------|---------|
| 5. | <u>Why</u> did Peter decide to rescue the cat? | Response is an appropriate inference that includes the cause of the action (<i>the cat is stuck in the tree</i>) and the reason for the action (<i>the cat might get hurt/fall out of the tree / the cat cannot get down by itself/ Peter is a kind boy / the cat could be stuck for a long time</i>). | Response in an appropriate inference that includes either the cause of the action (<i>cat is stuck</i>) OR the reason for the action (<i>cat might get hurt/fall OR Peter is a kind boy</i>), or is poorly expressed. | Response does not include an appropriate inference (e.g. <i>he likes cats</i>). | | |
| 6. | What is happening <u>now</u> ? | Response includes specific identification of the problem and the cause (<i>Peter is stuck in the tree with the cat/Peter is scared because/and so he is afraid he will fall/the tree is very high</i>). | Response contains non-specific identification of the problem or the cause (e.g. <i>he's stuck, he can't get back down the tree</i>), OR identification of the problem and the cause which is poorly expressed. | Response does not identify the problem (e.g. <i>they are in the tree</i>). | | |
| 7. | <u>Why</u> couldn't Peter get back down the tree? | Response includes accurate identification of reason for problem with two elements (<i>the tree is very high/tall SO Peter was scared/afraid that he would fall</i>). | Response includes part of the reason for the problem (e.g. <i>the tree is high/tall, Peter felt afraid/scared/frightened, he is stuck</i>) OR is poorly expressed. | Response does not identify an appropriate reason for the problem (e.g. <i>he is calling out</i>). | | |
| 8a. | Peter shouted 'help', what <u>else</u> could Peter be saying here? | Response indicates the inference of appropriate character dialogue which includes the problem (Peter and the cat are stuck in the tree) and plan (someone needs to help get them down the tree, e.g. | Response indicates the inference of appropriate character dialogue which includes either the problem (stuck in the tree) or the plan (need help to get down, e.g. | Response does not include character dialogue which is relevant to the problem (e.g. <i>I want to go home</i>). | | |

| | | <i>'someone please help me get down, I am stuck in a tree!')</i> . | <i>help, I'm stuck!, get me down, someone help me).</i> | | | |
|-----------------|--|--|--|---|-------------|---------|
| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
| 8b. | <u>Why</u> do you think he would say <u>that</u> ? | Response relates the problem (Peter is stuck in the tree) to the goal/outcome resolution (he needs help to get down, e.g. <i>Because he needed help to get him/the cat down the tree, because he can't get down from the tree by himself</i>). | Response includes the problem OR the goal/outcome resolution (e.g. <i>because he can't get down, because he needs help, because he's stuck</i>), OR is poorly expressed. | Response does not include the problem or the goal/outcome resolution (e.g. <i>because he is scared</i>). | | |
| 9. | <u>Why</u> did Peter feel nearly exhausted? | Response indicates an appropriate reason for the physical feeling (e.g. <i>because Peter has been stuck in the tree for a long time, because Peter has been shouting for a long time, because Peter shouted and no one heard him</i>). | Response indicates partially appropriate reason (e.g. <i>he has been shouting, no one heard him</i>). | Response does not indicate an appropriate reason (e.g. <i>he is stuck, he wants to go home</i>). | | |
| 10. | What happened here? | Response includes specific information related to at least two actions, including the initiating action (the man heard Peter's call for help), the result of the initiating action (the man got a ladder), and the resolution of the action (the man helped Peter and the cat to get back down the tree, e.g. <i>a man heard Peter shouting and got a ladder; the man got a ladder and helped Peter get down the tree</i>). | Response includes one action OR nonspecific information about two actions, including the initiating action (the man heard Peter's call for help), the result of the initiating action (the man got a ladder), and the resolution of the action (the man helped Peter and the cat to get back down the tree, e.g. <i>the man heard him, the man got a ladder, the man helped Peter down the tree, the man got him down</i>). | Response does not identify an appropriate action or uses nonspecific information to identify an action (e.g. <i>he got out, he heard, a ladder</i>). | | |

| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
|-----------------|--|---|---|---|-------------|---------|
| 11. | <u>Why</u> did the man get a ladder? | Response indicates an appropriate reason for the action (e.g. <i>because the tree was too tall/dangerous to climb, because Peter could get down a ladder safely</i>). | Response indicates partially appropriate reason (e.g. <i>for Peter to climb down</i>). | Response does not indicate an appropriate reason (e.g. <i>because Peter is stuck</i>). | | |
| 12a. | Look at Peter in this picture. How do you think he is <u>feeling</u> ? | Response indicates the inference of appropriate higher level character feelings (e.g. <i>worried, scared, frightened, surprised, relieved</i>). | Response indicates the inference of appropriate, but less relevant, character feelings (e.g. <i>happy</i>). | Response is not an appropriate inference of character feelings (e.g. <i>sad, angry, excited</i>) or is a physical feeling (e.g. <i>hurt, hungry</i>). | | |
| 12b. | <u>Why</u> does he feel _____? | Response links the character feelings to an appropriate higher level reason/actions (<i>worried/scared/frightened because he thought he might hurt himself/because it was scary climbing down the tree; surprised because he thought he might be stuck in the tree forever; relieved because he is safely out of the tree</i>). The response must include a cognitive or modal verb (e.g. <i>think, know, might</i>), adverbial of time or degree (e.g. <i>long time, ages, almost, nearly</i>), or very clear reason (e.g. <i>Peter and the cat got down from the tree</i>). | Response links the character feelings to an appropriate reason/actions (<i>worried/scared/frightened because he was stuck/because the tree was high/tall</i>) or is poorly expressed. | Response does not link character feeling to an appropriate reason/action (<i>the man came</i>). | | |

| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
|-----------------|---|---|---|--|-------------|---------|
| 13a. | This is the last picture in the story <i>move iPad away from the child</i> . What <u>do you think</u> happens <u>next</u> ? | Response presents a prediction that is appropriate (e.g. <i>Peter has afternoon tea / dinner / goes to bed / watches TV/ has a bath; Peter plays with /feeds the cat</i>). | Response presents a prediction that is appropriate and may relate to prior information from the story (e.g. <i>Peter does not go in the tree again; Peter keeps the cat; Peter goes to school; Peter finds other animals</i>). | Response does not present an appropriate prediction (e.g. <i>he got back home, he told his mum what happened, he got in trouble, the end</i>) | | |
| 13b. | <u>Why</u> do you think so? | Response presents a reason which links directly and clearly to the prediction made in the response to 13a and may relate to prior information from the story (e.g. <i>he went to bed because he was tired, he had dinner because he was hungry after being stuck in the tree for so long, he had a bath because he was dirty after being in the tree, he played with the cat because he was allowed to keep it</i>). A score of 2 can only be given for Question 13b if a score of 2 was obtained for Question 13a. If 1 point was scored for 13a, a maximum of 1 point can be obtained for 13b. | Response presents a reason which is appropriate but does not link directly or clearly to prediction response and/or prior information from the story (e.g. <i>mum said he could keep the cat, mummy was cross, it's nearly dinner time</i>). | Response does not present an appropriate reason relating to the prediction (e.g. <i>it's fun, it's night time, it's the end</i>). | | |
| 14a. | If you were the man watering your garden, what would you tell Peter so that the same thing didn't happen again? | Response indicates the inclusion of multiple events in order to create a narrative-level theme (e.g. <i>We're not allowed to climb trees because it is dangerous/you might fall down/hurt yourself, we're not</i> | Response involves a simple theme, including information from one aspect of the story (e.g. <i>don't go in the tree/don't climb the tree, you'll get stuck, ask for help</i>). | Response does not include understanding of an appropriate theme or is very non-specific (e.g. <i>no, to stop, don't do it</i>). | | |

| | | | | | | |
|--------------------------|-------------------------------------|--|--|--|--------------------|----------------|
| | | <i>allowed to climb trees so next time ask for help).</i> | | | | |
| Question number | Comprehension Question | 2 points | 1 point | 0 points | Inferential | Literal |
| 14b. | <u>Why</u> would you tell him that? | Response includes a reason which indicates overall understanding of the theme (e.g. so he does not hurt himself / fall down). | Response includes a reason which indicates understanding of a simple theme (e.g. so he doesn't get stuck, mum said not to climb trees/you're not allowed, it is naughty to go there). | Response does not include an appropriate reason (e.g. he will get the cat). | | |
| TOTAL INFERENTIAL | | | | | /28 | |
| TOTAL LITERAL | | | | | | /12 |

Appendix E

Inhibition (Executive Functions) Assessment - Dragon/Dog Task

Code: _____

Date of assessment: _____

Raw Score: _____

'We are going to play a body parts game! I am going to say a body part and I want you to show me where it is on your body as quickly as you can!... Show me your...'.
Head, nose, ears, shoulder, hands, knee, foot, toes, tummy

'Now show me how well you listen... show me how you shake your hands... feet... head. Good listening!'

If the child does not know the body parts/action, teach them the concepts and repeat the assessment at another time.

'We are going to play a game with the ipad now! You are going to see two puppets on the ipad. There is a nice dog puppet, and a naughty dragon puppet! You need to do what the nice dog tells you to do, but do NOT do what the naughty dragon tells you to do! Make sure you listen hard. Remember to do what the dog tells you. Do NOT do what the dragon tells you'.

Play ipad introduction of puppet characters.

Four practice items: *provide child with feedback. Correct response feedback:* 'Good – do what the dog tells you to!', 'good, don't do what the dragon tells you to!' *Incorrect response feedback:* 'remember to do what the dog tells you', 'remember do NOT do what the dragon tells you!'.

Clap your hands (dog)

Clap your hands (dragon)

Touch your leg (dog)

Touch your leg (dragon)

Ten test items: do not provide the child with feedback. Puppet instructions are presented approximately 4 to 5 seconds apart.

| Instruction | Movement (circle) | | | Score |
|---------------------------|------------------------|--------------------|------------------|-------|
| Shake your head (dog) | Completed movement (2) | Other movement (1) | Did not move (0) | |
| Touch your toes (dragon) | Completed movement (0) | Other movement (1) | Did not move (2) | |
| Touch your nose (dog) | Completed movement (2) | Other movement (1) | Did not move (0) | |
| Touch your ears (dog) | Completed movement (2) | Other movement (1) | Did not move (0) | |
| Touch your head (dragon) | Completed movement (0) | Other movement (1) | Did not move (2) | |
| Touch your shoulder (dog) | Completed movement (2) | Other movement (1) | Did not move (0) | |
| Shake your hands (dragon) | Completed movement (0) | Other movement (1) | Did not move (2) | |
| Touch your knee (dragon) | Completed movement (0) | Other movement (1) | Did not move (2) | |

| | | | | |
|---------------------------|------------------------|--------------------|------------------|--|
| Touch your foot (dog) | Completed movement (2) | Other movement (1) | Did not move (0) | |
| Touch your tummy (dragon) | Completed movement (0) | Other movement (1) | Did not move (2) | |
| Total score | | | | |

Inhibition (Executive Functions) Assessment - Grass/Snow Task

Code: _____ Date of assessment: _____

Raw Score: _____

'We are going to play another silly game! What colour is grass? What colour is snow? I'll tell you the rules of the silly game now - you need to point to the WHITE card when I say 'grass' and point to the GREEN card when I say 'snow'! Ok? Let's practice. Remember to point to the white card when I say grass and the green card when I say snow'.

If the child does not name the colours correctly, provide a picture (grass/snow) as a prompt and phonemic prompt (gr...; whi...) if needed. If the child does not know the colours, teach them the colours and repeat the assessment at another time.

Two practice items: *snow (point to green) and grass (point to white). Provide corrective feedback. Correct response feedback: 'Good – point to green when I say snow!', 'good – point to white when I say grass!'*

Incorrect response feedback: 'remember to point to GREEN when I say SNOW', 'remember to point to WHITE when I say GRASS!'

Ten test items: do not provide the child with feedback. Test items are presented approximately 3 to 4 seconds apart. The child's first response is scored (even if the child self-corrects).

| Item | Response (circle) | | | | Score |
|-------------|-------------------|-----------|------------------|--------|-------|
| Grass | Green (0) | White (2) | Self-correct (1) | NR (0) | |
| Snow | Green (2) | White (0) | Self-correct (1) | NR (0) | |
| Snow | Green (2) | White (0) | Self-correct (1) | NR (0) | |
| Grass | Green (0) | White (2) | Self-correct (1) | NR (0) | |
| Snow | Green (2) | White (0) | Self-correct (1) | NR (0) | |
| Grass | Green (0) | White (2) | Self-correct (1) | NR (0) | |
| Grass | Green (0) | White (2) | Self-correct (1) | NR (0) | |
| Snow | Green (2) | White (0) | Self-correct (1) | NR (0) | |
| Grass | Green (0) | White (2) | Self-correct (1) | NR (0) | |
| Snow | Green (2) | White (0) | Self-correct (1) | NR (0) | |
| Total score | | | | | |

Appendix F

Theory of Mind Inventory Example Report

This appendix includes an example participant ToMI report which was created using the online scoring software provided by the authors (<http://www.theoryofmindinventory.com/>). Identifying information (e.g. child's gender and date of birth) has been removed from the report.

Professional Form

Theory of Mind Inventory (ToMI)

You generated a report for a child that is 5 years old.

Report Form

COMPOSITE SCORE

Composite Mean = 7.4048 Percentile = 1st-7th*

EARLY ToM SUBSCALE

Subscale Mean = 12.8571 (of 20) Percentile = 1st-7th*

Subscale Item Scores

Item designed to assess score

| | | |
|-----|--|------|
| 3. | affect recognition (complex) | 13.6 |
| 6 | affect recognition (emotion-expression relationship) | 7 |
| 24. | intentionality | 11.7 |
| 25. | affect recognition (basic) | 16.3 |
| 28 | social referencing | 11 |
| 37. | sharing attention - initiating | 17.4 |
| 38. | sharing attention - responding | 15.9 |

BASIC ToM SUBSCALE

Subscale Mean = 8.2632 (of 20) Percentile = 1st-7th*

Subscale Item Scores

Item designed to assess score

| | | |
|----|---|------|
| 1. | physiologically-based behavior | 18.2 |
| 4. | emotion-based behavior | 7.3 |
| 7. | mental state term comprehension (think) | 7.1 |
| 8. | false beliefs in context of unexpected change of location | 4.8 |
| 9. | seeing leads to knowing | 4.8 |

| | | |
|-----|---|------|
| 10. | mental state term comprehension (know) | 7.2 |
| 11. | appearance-reality distinction | 9.7 |
| 12. | false beliefs in context of unexpected contents | 4.8 |
| 15. | certainty (knowing/guessing) | 7.2 |
| 16. | mental-physical distinction | 11 |
| 26. | pretense | 14 |
| 29. | counterfactual-reasoning | 8 |
| 30. | mental-physical distinction | 11.1 |
| 31. | ability to deceive | 11.9 |
| 32. | level 1 visual perspective-taking | 7.8 |
| 33. | speech acts (promises) | 4.7 |
| 35. | speech acts (secrets) | 4.8 |
| 39. | mental state term comprehension (believe) | 4.8 |
| 42. | attribute-based behavior | 16.4 |

ADVANCED ToM SUBSCALE

Subscale Mean = 4 (of 20) Percentile = 1st-7th*

Subscale Item Scores

Item designed to assess score

| | | |
|-----|--|-----|
| 2. | sarcasm | 7.2 |
| 5. | second-order false desire attribution | 2.6 |
| 13. | idiomatic language | 5.1 |
| 14. | use of language to intentionally deceive | 2.7 |
| 17. | understanding display rules | 9.6 |
| 18. | complex social judgment | 2.5 |
| 19. | white lies | 5 |
| 20. | understanding lies versus jokes | 4.9 |
| 21. | level 2 visual perspective-taking | 4.7 |
| 22. | second order understanding of belief | 2.7 |
| 23. | second order understanding of emotion | 5 |
| 27. | complex social judgment | 3.2 |
| 34. | empathy | 5.8 |
| 36. | humor (play on words) | 4.2 |
| 40. | biased cognition | 2.4 |
| 41. | mind as active interpreter | 3 |

* At or below the 10th percentile for child's age.

Appendix G

Study One – Compromised Multiple Regression Models

This appendix contains the initial analytic procedure involving Principal Components Analysis and Generalised Linear Mixed Models. These analyses were not reported in the thesis due to statistical issues (suppressor effects) discussed in the Analysis Plan and Rationale section. The analytic procedure consisted of three steps and all analyses were conducted with SPSS Version 22. Sixty-seven participants sufficiently powered the principal components analysis (PCA) (11 measures x 5 participants per measure = minimum 55 participants) and provided the GLMM with an 80% chance of capturing 'moderate' ($f^2 = .12$) relationships between the outcome and each of the predictors. Participants' oral inferential comprehension score was the primary outcome measure.

Step 1: Data Reduction Using Principal Components Analysis

A principal components analysis (PCA) using the sample of 67 participants was conducted, focusing on 14 variables.

1. Narrative retell – macrostructure.
2. Narrative retell – microstructure.
3. Literal comprehension of narrative.
4. Expressive grammar.
5. Receptive grammar.
6. Expressive vocabulary.
7. Receptive vocabulary.
8. Phonological working memory.
9. Rapid naming.
10. Episodic buffer working memory (sentence repetition).
11. Executive function (dragon dog task - go/no-go).
12. Executive function (grass/snow task - verbal response inhibition).
13. Performance IQ.
14. Theory of Mind.

The Kaiser-Meyer-Olkin value ($>.5$) and significant Bartlett's Test ($p <.001$) indicated that the data were suitable for PCA. When the variables were subjected to a PCA, four components met the Kaiser criterion of eigenvalues greater than 1. The four-component solution explained a respectable 62.35% of the variance in the measures. The eigenvalues are reported in Table 24, and the component loadings yielded by a promax rotation are reported in Table 25 (component loadings of less than .4 were removed to improve interpretability of the components).

Table 24: PCA Variance Explained ($n = 67$, 14 measures)

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|-----------|---------------------|------------|--------------|-------------------------------------|------------|--------------|
| | Total | % variance | Cumulative % | Total | % variance | Cumulative % |
| 1 | 4.61 | 32.94 | 32.94 | 4.61 | 32.94 | 32.94 |
| 2 | 1.75 | 12.49 | 45.42 | 1.74 | 12.49 | 45.42 |
| 3 | 1.21 | 8.64 | 54.07 | 1.21 | 8.64 | 54.07 |
| 4 | 1.16 | 8.28 | 62.35 | 1.16 | 8.28 | 62.35 |
| 5 | .93 | 6.64 | 68.99 | | | |
| 6 | .90 | 6.43 | 75.42 | | | |
| 7 | .82 | 5.87 | 81.29 | | | |
| 8 | .69 | 4.90 | 86.19 | | | |
| 9 | .54 | 3.87 | 90.06 | | | |
| 10 | .50 | 3.56 | 93.62 | | | |
| 11 | .35 | 2.46 | 96.08 | | | |
| 12 | .25 | 1.77 | 97.85 | | | |
| 13 | .21 | 1.51 | 99.35 | | | |
| 14 | .09 | .65 | 100.00 | | | |

Four components were identified. The first and fourth components were relatively distinct, whereas the second and third components were not as distinct, as two variables (phonological memory and expressive vocabulary) shared loadings between the components. Table 26 reports the correlations among the components.

The components were defined as:

Component 1 – Discourse. The Discourse component was defined by the measures of narrative retell – macrostructure and microstructure, and literal comprehension of narrative.

Component 2 – Language Memory and Structure. The Language Memory and Structure component was defined by episodic buffer memory, phonological memory, expressive grammar, receptive grammar, and expressive vocabulary.

Component 3 – Semantic-Pragmatic. The Semantic-Pragmatic component was defined by phonological memory, expressive vocabulary, receptive vocabulary, theory of mind, and executive function (go/no-go).

Component 4 – Processing. The Processing component was defined by rapid naming, Performance IQ, and executive function (verbal response inhibition).

Table 25: PCA Pattern Matrix ($n = 67$, 14 measures)

| | Component | | | |
|---|-----------|------|-------|------|
| | 1 | 2 | 3 | 4 |
| Narrative macrostructure | .976 | | | |
| Narrative microstructure | .876 | | | |
| Literal comprehension | .677 | | | |
| Sentence repetition (episodic buffer) | | .836 | | |
| CTOPP - Phonological working memory | | .807 | -.493 | |
| Expressive grammar | | .781 | | |
| Expressive vocabulary | | .559 | .445 | |
| Receptive grammar | | .438 | | |
| Theory of Mind | | | .861 | |
| Receptive vocabulary | | | .569 | |
| Executive functions – dragon/dog | | | .485 | |
| CTOPP - Rapid naming (linguistic processing) | | | | .738 |
| Performance IQ | | | | .595 |
| Executive functions – grass/snow | | | | .576 |

Table 26: Component Correlation Matrix ($n = 67$)

| Component | 1 | 2 | 3 | 4 |
|-----------|-------|-------|-------|-------|
| 1 | 1.000 | .299 | .259 | .196 |
| 2 | .299 | 1.000 | .411 | .429 |
| 3 | .259 | .411 | 1.000 | .269 |
| 4 | .196 | .429 | .269 | 1.000 |

Step 2: A Generalised Linear Mixed Model (GLMM) for Predicting Inferential Comprehension from the Component Variables

Following the PCA, a generalised linear mixed model (GLMM) was tested to predict inferential comprehension ability from the four identifiable components. For each participant, the four component scores were computed using the regression option available through SPSS's Data Reduction procedure. The GLMM is 'generalised' in the sense that it can accommodate outcome variables with markedly non-normal distributions, and is 'mixed' in the sense that it includes both random and fixed effects. The GLMMs included two nominal random effects (participant and site) and four scale predictors (Discourse, Language Memory and Structure, Semantic-Pragmatic, and Processing). Intra-site dependencies were controlled by specifying a GLMM in which participants were nested within site. Table 27 reports the GLMM results.

Table 27: GLMM Results (*n* = 67)

| | Coefficient | Std. Error | t | p | 95 % Confidence Interval | |
|-----------------------------|-------------|------------|-------|-------|--------------------------|-------|
| | | | | | Lower | Upper |
| Discourse | 1.25 | .34 | 3.72 | <.001 | 0.58 | 1.93 |
| Language Memory & Structure | -0.46 | .34 | -1.37 | .18 | -1.14 | 0.22 |
| Semantic-Pragmatic | 1.01 | .07 | 15.34 | <.001 | .88 | 1.15 |
| Processing | .09 | .65 | .14 | .89 | -1.21 | 1.40 |

The Discourse component was a significant predictor of inferential comprehension, explaining 13.32% of variance in inferential comprehension scores. Semantic-Pragmatic was also a significant predictor, explaining 8.18% of variance in inferential comprehension scores. In contrast, neither Language Memory and Structure nor Processing significantly predicted inferential comprehension score, explaining a non-significant 1.3% and 0.07% of variance, respectively. The positive regression coefficients for Discourse (1.25) and Semantic-Pragmatic (1.01) indicate that increases in Discourse and Semantic-Pragmatic scores were associated with increases in inferential comprehension score. The components explained a total of 22.87% variance in inferential comprehension scores.

Step 3: GLMMs for Predicting Inferential Comprehension from Component Variables

A series of four GLMMs were tested in order to identify the predictors of inferential comprehension. GLMM1 used the three salient Discourse measures as predictors, GLMM2 used the five salient Language Memory and Structure measures as predictors, GLMM3 used the five salient Semantic-Pragmatic measures as

predictors, and GLMM4 used the three salient Processing measures as predictors. The results are reported in the following Tables.

Table 28: GLMM1 (Discourse) Results (*n* = 67)

| | Coefficient | Std. Error | t | p | 95 % Confidence Interval | |
|--------------------------|-------------|------------|------|-----|--------------------------|-------|
| | | | | | Lower | Upper |
| Narrative macrostructure | .90 | 1.09 | 0.83 | .41 | -1.27 | 3.07 |
| Narrative microstructure | .16 | .91 | .17 | .86 | -1.66 | 1.97 |
| Literal comprehension | .15 | .15 | 1.02 | .31 | -0.15 | 0.45 |

Table 29: GLMM2 (Language Memory and Structure) Results (*n* = 67)

| | Coefficient | Std. Error | t | p | 95 % Confidence Interval | |
|-------------------------------------|-------------|------------|--------|-------|--------------------------|-------|
| | | | | | Lower | Upper |
| Sentence repetition | .01 | .02 | .37 | .71 | -.04 | .05 |
| CTOPP - Phonological working memory | -.12 | .01 | -14.87 | <.001 | -.14 | -.10 |
| Expressive grammar | .20 | .37 | .55 | .58 | -.54 | .94 |
| Receptive grammar | .03 | .03 | 1.06 | .29 | -.03 | .08 |
| Expressive vocabulary | .04 | .05 | .73 | .47 | -.07 | .15 |

Table 30: GLMM3 (Semantic-Pragmatic) Results (*n* = 67)

| | Coefficient | Std. Error | t | p | 95 % Confidence Interval | |
|-------------------------------------|-------------|------------|-------|-------|--------------------------|-------|
| | | | | | Lower | Upper |
| CTOPP - Phonological working memory | -.08 | .03 | -2.44 | 0.18 | -.15 | -.01 |
| Expressive vocabulary | .01 | .01 | 1.47 | .15 | -.003 | .02 |
| Receptive vocabulary | .08 | .05 | 1.82 | .07 | -.01 | .18 |
| Theory of Mind | .20 | .01 | 32.40 | <.001 | .19 | .21 |
| Executive functions – dragon/dog | -.012 | .19 | -.64 | .52 | -.49 | .25 |

Table 31: GLMM4 (Processing) Results (*n* = 67)

| | Coefficient | Std. Error | t | p | 95 % Confidence Interval | |
|----------------------------------|-------------|------------|-------|-------|--------------------------|-------|
| | | | | | Lower | Upper |
| CTOPP - Rapid naming | -.02 | .01 | -1.97 | .05 | -.03 | .00 |
| Performance IQ | .09 | .01 | 8.12 | <.001 | .07 | .11 |
| Executive functions – grass/snow | -.08 | .09 | -.88 | .39 | -.27 | .11 |

Individually, none of the salient Discourse measures was a significant predictor of inferential comprehension after controlling for the two other salient measures. Of the salient Language Memory and Structure measures, only phonological memory was a significant predictor of inferential comprehension, after controlling for the other four salient measures. Phonological memory explained 6.3% of the variance in inferential comprehension scores; however the negative regression coefficient for phonological memory indicated that increases in phonological memory score were associated with decreases in inferential comprehension score.

Two of the salient Semantic-Pragmatic measures, phonological memory and theory of mind, were significant predictors of inferential comprehension after controlling for the other four salient measures. The negative regression coefficient for phonological memory again indicated that increases in phonological memory score were associated with decreases in inferential comprehension score, and phonological memory explained 1.72% of the variance in inferential comprehension scores. Theory of mind explained 5.95% of the variance in inferential comprehension scores. The positive regression coefficient for theory of mind indicated that increases in theory of mind score were associated with increases in inferential comprehension score.

One of the salient Processing measures, Performance IQ, was a significant predictor of inferential comprehension after controlling for the other two salient measures. Performance IQ explained 10.89% of the variance in inferential comprehension scores. The positive regression coefficient for Performance IQ indicated that increases in Performance IQ score were associated with increases in inferential comprehension score.

As discussed, the results of these analyses are compromised due to statistical issues (suppressor effects) and, as such, the results are uninterpretable within the theoretical framework of this thesis.

Appendix H

The Squirrel Story Narrative Comprehension Assessment Pilot Study

Introduction

This appendix describes a pilot study of The Squirrel Story Narrative Comprehension Assessment (NCA) with a typically developing sample of pre-primary aged children. The pilot study used The Squirrel Story NCA assessment developed during this doctoral research.

Aims

The first aim of the pilot study was to confirm and validate the scoring and scoring guide of The Squirrel Story NCA using the responses from a typically developing population of pre-primary aged (5 to 6 year old) students. The second aim of the pilot study was to collect local (West Australian) normative data on The Squirrel Story NCA, therefore allowing the assessment to be used as an Australian norm-referenced tool for speech-language pathologists and teachers¹¹.

Method

The pilot study aimed to recruit 60 typically developing male and female pre-primary aged students from mainstream schools. Following ethics approval from the Curtin University Human Research Ethics Committee and the Western Australian Department of Education, information about the study was sent to 16 school principals in the metropolitan area of Perth, Western Australia. Six principals provided written consent to participate. The principals identified pre-primary aged children who were eligible to participate (children identified by their teacher as having typical speech and language skills, mostly intelligible speech, and no known diagnoses of developmental disorders or disabilities). Information letters and consent forms were sent to the parents/carers of eligible pre-primary aged children at participating schools in Term 4 (November), 2014. Forty-seven consent forms were returned from the parents/carers of eligible pre-primary aged children.

Data collection was completed by a research assistant (a speech-language pathologist) who was trained in the administration of The Squirrel Story NCA. The participants were provided with the opportunity to provide consent prior to completing assessment. Assessments were completed in a quiet room at the participant's

¹¹ Data on kindergarten (3 to 4 year old) and year one (6 to 7 year old) typically developing children has been collected recently. The entire dataset for kindergarten, pre-primary and year one typically developing children will be published in the near future.

school in one session of approximately 15 minutes. Each participant completed the comprehension questions and narrative retell after listening to The Squirrel Story on the iPad app (see Measures section in chapter 3 for full details). Forty-four participants provided consent and completed assessment. Three participants were away during the data collection period and therefore did not complete assessment.

The development of the scoring guide for The Squirrel Story NCA took place in three stages. Firstly, a scoring guide (0, 1, or 2 points for each question) was created for the NCA based on the scoring rubric used by Paris and Paris (2003) for the Narrative Comprehension Task. Paris and Paris (2003) found high inter-rater agreement across three story books using their scoring rubrics, demonstrating that the rubric was reliable across different books and raters. Additionally, they found high inter-task correlations between the books, showing that children's scores were consistent across books. The coding of responses developed by Blank et al. (1978b) for the Preschool Language Assessment Instrument (PLAI) was also referred to during the development of the scoring guide. The PLAI included a four-point scale for scoring responses (0 = inadequate; 1 = ambiguous; 2 = acceptable; 3 = fully adequate) (Blank et al., 1978b).

The creation of the scoring guide involved writing a scoring rubric and a predicted list of possible responses for each score for every question (e.g. for the question "Who are the characters in this story?", a score of 2 = response includes four to five characters. *Mummy squirrel, baby squirrel, baby rabbit, baby mouse, Mr Badger*; a score of 1 = response includes two to three of the characters; a score of 0 = response includes only one character, or response is inappropriate). In general, a score of 0 indicated no response or an irrelevant, inappropriate or highly ambiguous answer; a score of 1 indicated a partially appropriate response or a response which was correct but very non-specific; and a score of 2 indicated a fully correct response with all required elements (Blank et al., 1978b; Paris & Paris, 2003).

The Paris and Paris Narrative Comprehension Task (2003) included 5 implicit (inferential) and 5 explicit (literal) questions. The Squirrel Story NCA included 14 inferential questions and 5 literal questions, providing a total score out of 28 for inferential comprehension and out of 10 for literal comprehension.

Secondly, the research assistant and the doctoral candidate completed scoring of the 44 participants' comprehension responses according to the draft scoring guide. Any scoring discrepancies were discussed with two experienced speech-language pathologists to establish agreement. The Squirrel Story NCA scoring guide (rubric and possible responses) was modified during the scoring process as agreement was reached. During this stage, questions involving character feelings (e.g. "Look at baby squirrel in this picture. How do you think he is feeling? Why does he feel...?") were separated into two parts to differentiate responses which

could adequately infer an appropriate emotion (i.e. score of 0, 1, or 2) and those which could provide appropriate reasoning for the emotion (i.e. a separate score of 0, 1, or 2).

Third, the final version of The Squirrel Story NCA scoring guide was completed. This final scoring guide was used in this doctoral research for both Study One and Study Two. The Squirrel Story NCA and scoring guide are included in Appendix C.

Results

The final sample size for analysis was $n = 40$. Four participants were excluded from analysis due to having a diagnosis of a developmental disorder (autism spectrum disorder), poor language ability (receiving speech-language pathology services), or having received less than 18 months exposure to English.

The typically developing participants were aged between 5;5 and 6;5 (years; months) at the time of assessment ($M = 5;11$). The sample included 17 males and 23 females. The histograms for both inferential and literal comprehension appeared normally distributed. Descriptive statistics for the sample are reported in the following Table.

Descriptive Statistics for The Squirrel Story Narrative Comprehension Assessment ($n = 40$)

| | Mean | SD | Range |
|---------------------------|-------|------|--------|
| Inferential comprehension | 15.00 | 3.24 | 9 – 22 |
| Literal comprehension | 5.80 | 1.40 | 3 – 9 |

Appendix I

This appendix includes the Study Two information letters and consent forms for the Language Development Centre principal, parents/carers of participants, and the study participants.

Study Two Principal Information Letter



School of Psychology and Speech Pathology

May 2015

Emily Dawes
Speech Pathologist
PhD Candidate
School of Psychology and Speech Pathology
Curtin University of Technology
GPO Box U 1987, Perth
Western Australia, 6845
Ph: +61 8 9266 3472
Fax: +61 8 9266 2464

Dear Principal,

A pilot study of oral inferential comprehension intervention for children with specific language impairment.

My name is Emily Dawes and I am a PhD Candidate at Curtin University. I am conducting a study to investigate the effectiveness of an intervention targeting oral inferential comprehension in Pre-Primary aged children with specific language impairment. Although research has indicated that children with specific language impairment have difficulty with the ability to inference, very few studies have been conducted to evaluate the effectiveness of interventions for oral inferential comprehension. The intervention being implemented targets areas which were identified in a previous study I conducted as being significant predictors of inferential comprehension in children with specific language impairment. Therefore the purpose of this study is to evaluate the effectiveness of an oral inferential comprehension intervention specifically designed for children with specific language impairment. This may help Language Development Centres support the comprehension and ongoing learning of children with specific language impairment in the future.

My supervisors for this project are Dr Suze Leitão and Dr Mary Claessen from Curtin University.

What does participation in the research involve?

I am seeking the participation of approximately 40 Pre-Primary students from XX Language Development Centre, who present with a diagnosis of specific language impairment. This project will involve a brief assessment session (20 - 30 minutes) with each participant at the beginning and end of Term 3, and in the middle of Term 4, 2015. The participating children will be randomly allocated to one of two groups. The first group will receive the inferential comprehension intervention, while the second, comparison group will receive phonological awareness intervention. The interventions will take place during Term 3, 2015.

I would like to invite XX Language Development Centre to participate in this research.

This would involve the following steps:

1. Identification of children in Pre-Primary who present with a clear diagnosis of specific language impairment and for whom English is the primary language spoken at home.

- Pre-Primary teachers will identify children in their class who present with speech which is mostly intelligible.
- As the Principal, you will provide my research information letter and consent forms to the parents/carers of identified children via the class teacher.
- The parents/carers will return the consent forms to me. They will have the opportunity to discuss any questions they may have with me.
- I will come to XX Language Development Centre to discuss the research with each child who has parental consent and ask them to circle a tick(yes) or cross(no) on a consent form to indicate if they agree to participate in the project.

2. Data collection and intervention:

- I will complete a brief (20-30 minute) assessment session with each child who is a participant in the study at the beginning and end of Term 3, and in the middle of Term 4, 2015. The assessments will involve narrative retell, narrative comprehension questions and phonological awareness tasks. Some parts of the assessments (such as narrative retell) will be audio-recorded so that the assessment can be scored after the assessment session has been completed.
- Each participant will be randomly allocated to one of two groups. Both groups will receive an intervention of the same duration and intensity. One group will receive intervention targeting inferential comprehension and the other group will receive intervention targeting phonological awareness. I will provide the intervention to participants in small groups at the LDC, for approximately 30 minutes two times per week during Term 3, 2015. I will arrange with classroom teachers prior to Term 3 times which will best fit in with their timetable.

To what extent is participation voluntary, and what are the implications of withdrawing participation?

Participation in this study is completely voluntary. All potential participants and their parents are advised of this in the information letters.

If parent/carers give permission for their child to participate in the research, they may withdraw their child, or the child may withdraw themselves, from participation at any

time without consequence. If a child is withdrawn from participating in the study, all information and data will be destroyed immediately.

If the project has already been published at the time a participant decides to withdraw, their contribution to research data can not be removed from the publication.

The decision about whether to participate, or to participate and then withdraw, of any participant will not affect the relationship with the research team or Curtin University.

What will happen to the information collected, and is privacy and confidentiality assured?

Information that identifies a participant or the Language Development Centre will be removed from the data collected. The data will be stored in a locked cupboard or on a secure computer at Curtin University which can only be accessed by myself and my supervisors (Dr Suze Leitão and Dr Mary Claessen). All assessment records will be stored for a minimum period of 25 years, after which it will be destroyed, as in accordance with the Australian Code for the Responsible Conduct of Research and the Western Australian University Sector Disposal Authority.

The data is stored in this way so that, if a participant decides to withdraw, their data can be re-identified and destroyed. This is done by using a system of individual codes which are known only to the research team.

The results of this study may be published, however no identifying information regarding the participants will be used. The identity of the participants and the Language Development Centre will not be disclosed at any time, except in circumstances requiring reporting under the Department of Education Child Protection Policy, or in the circumstance that the research team is legally required to disclose such information. Confidentiality of participant information is assured at all other times.

What are the benefits of this research for the child's education and the school?

The data from this study will be used to examine the effectiveness of an intervention targeting oral inferential comprehension in children with specific language impairment. The results of this study will be used to inform the effective and evidence-based practice of speech pathologists and teachers, and will be highly relevant to practice at the LDC.

Participants in both groups are expected to demonstrate a significant improvement in their ability in the targeted area of intervention – children taking part in the inferential comprehension intervention are expected to demonstrate a significant improvement in their oral comprehension ability, and children taking part in the phonological awareness intervention are expected to demonstrate a significant improvement in their phonological & phonemic awareness ability. Therefore, both interventions are expected to have a significant and positive effect on the participants' language and literacy development.

On completion of the research, a presentation and/or report describing the outcomes of the research can be provided to XX LDC.

Are there any risks associated with participation?

There are no known risks associated with participation in this study. The language assessments involve the children completing familiar tasks such as retelling and answering questions about a narrative, thinking of rhyming words and identifying initial, medial and final sounds in words – such tasks are commonly used by speech pathologists at LDCs. The assessment sessions will be completed in 20-30 minutes and children will be provided with breaks, as required. The intervention will also involve the children completing familiar small group (tabloid) activities in their school as part of the daily routine. The activities will be fun and appropriate for Pre-Primary aged children, and very similar to the activities used by speech pathologists in LDCs.

Do all members of the research team who will be having contact with children have their Working With Children Check?

Yes. Under the Working with Children (Criminal Record Checking) Act 2004, individuals undertaking research that involves contact with children must pass a Working with Children Check (WWC). I have attached evidence of my current Working With Children Check and will provide evidence of a current WWC for all researchers involved in data collection.

Is this research approved?

The Curtin University Human Research Ethics Committee has given approval for this study. Any questions or verification of approval for this study can be obtained by contacting the Committee.

Study approval number: HR79/2015

Address: Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845.

Telephone: 9266 2784, Email: hrec@curtin.edu.au.

The research has also met the policy requirements of the Department of Education, as indicated in the letter attached.

Who do I contact if I wish to discuss the project further?

Please do not hesitate to contact either myself or my research supervisors if you have any questions about the study. I can be contacted by phone (XXX XXX XXXX) or by email (emily.dawes@postgrad.curtin.edu.au). Alternatively, you may wish to contact one of my supervisors, Dr Suze Leitao (S.Leitao@exchange.curtin.edu.au) or Dr Mary Claessen (M.Claessen@curtin.edu.au).

How do I indicate my willingness for the Language Development Centre to be involved in this project?

If you have had all questions about the research project answered to your satisfaction, and are willing for XX Language Development Centre to participate, please complete the **Consent Form** attached. Please contact me by the **XX May 2015** if you have completed the consent form and would like XX Language Development Centre to be involved.

Thank you,

Regards,

Emily Dawes
Speech Pathologist
PhD Candidate
Curtin University

Dr Suze Leitão
Speech Pathologist
Supervisor and Senior Lecturer
Curtin University

Dr Mary Claessen
Speech Pathologist
Supervisor, Lecturer and Speech
Pathology Program Director
Curtin University

Study Two Principal Consent Form



School of Psychology and Speech Pathology

May 2015

A pilot study of oral inferential comprehension intervention for children with specific language impairment.

Consent Form for Language Development Centre Principal

- I have read this document and, as described within it, I understand the aims, procedures, and risks of this project.
- I have been given the opportunity to ask any questions I may have had, and these have been answered to my satisfaction.
- I am willing for this Language Development Centre to be involved in the research project, as described.
- I understand that participation in this project is completely voluntary.
- I understand that this Language Development Centre may withdraw its participation in this project at any time, without consequence.
- I understand that the results of this research may be published in a journal, provided that the participants or Language Development Centre are not identified in any way.
- I understand that the Language Development Centre will be provided with a copy of the research findings upon the completion of this project.

Name of Language Development Centre (please print): _____

Name of Principal (please print): _____

Signature of Principal: _____

Date (DD/MM/YYYY): ____ / ____ / _____

Study Two Parent/Carer Information Letter



School of Psychology and Speech Pathology

May 2015

Emily Dawes
Speech Pathologist
PhD Candidate
School of Psychology and Speech Pathology
Curtin University of Technology
GPO Box U 1987, Perth
Western Australia, 6845
Ph: +61 8 9266 3472
Fax: +61 8 9266 2464

Dear Parent/Carer,

My name is Emily Dawes and I am a speech pathologist currently completing a PhD at Curtin University. My research is about children's language understanding (comprehension) and how children make inferences. I am carrying out a study to investigate the effectiveness of therapy designed to improve language comprehension for children who speak English as a primary language and whose speech is mostly intelligible (easy to understand).

What does taking part in the research project involve and are there any risks?

I am inviting your child to take part in my study if they speak English as a primary language and have mostly intelligible speech. This will involve three brief assessment sessions over Term 3 and Term 4, 2015. It will also involve your child receiving a therapy programme which will be targeted to improve either their language comprehension or their literacy skills (phonological awareness). Therapy will be provided at your child's school, for approximately 30 minutes two times per week, as a part of the normal classroom routine.

If you give permission for your child to participate I will talk to your child about the research and they will be able to show whether they want to be involved by circling 'yes' or 'no' on a consent form.

Your child will complete one brief assessment session at the beginning and end of Term 3, and in the middle of Term 4, 2015. The assessment session will take 20 - 30 minutes, including breaks. The assessments involve activities such as retelling a story, answering questions about a story, rhyming, and listening for the first, middle and end sounds in words (e.g. what is the first sound in 'cat'?). These are typical of the assessments used by speech pathologists at Language Development Centres. Some of the assessment tasks (such as retelling a story) will be audio-recorded so that your child's story can be transcribed and scored after the assessment session has finished.

I will run small-group therapy sessions with your child during Term 3, which will focus on improving their language comprehension OR improving their phonological awareness skills. Your child will be randomly allocated to one of the therapy programmes. Sessions will involve small group activities, typical of the group activities usually run by speech pathologists at the LDC. If your child takes part in the language comprehension therapy, the activities will involve shared reading and retelling of stories. If your child takes part in the phonological awareness therapy, the activities will involve games which target linking letters to sounds, breaking down words into sounds, and blending sounds together to make words (these are pre-literacy skills which allow children to develop reading and writing). The sessions will run as a regular part of your child's classroom routine for the duration of Term 3, 2015. Your child will continue to take part in the normal classroom activities and weekly speech-language pathology sessions at the LDC.

Does my child have to take part?

No. Participation in this study is completely voluntary. You do not have to give permission for your child to participate in this study. If you would like your child to participate, I have included a consent form for you to sign. If you give permission for your child to take part, before I complete any assessment I will discuss with your child what we will be doing and I will ask them to circle 'yes' or 'no' on a child-friendly consent form to show whether they would like to be involved in the research or not.

What if either of us was to change our mind?

If you give permission for your child to participate, but then change your mind, you may withdraw your child, or your child may withdraw themselves, at any time without consequence. If your child is withdrawn from the study, all of your child's data will be destroyed immediately.

Your decision about whether to participate in this research or not will not affect your family's relationship with the Language Development Centre.

What will happen to the information collected, and is privacy and confidentiality assured?

Your child's name and any identifying details will not appear on any assessment records, instead a code will be used. The list of these codes will be stored in a locked cupboard at Curtin University which can only be accessed by myself and my supervisors. Data will be stored for a minimum period of 25 years, after which it will be destroyed according to the Curtin University Functional Records Disposal Authority protocol and the Western Australian University Sector Disposal Authority. The information is stored in this way so that, if you decide to participate and then withdraw, I can re-identify your child's data and destroy it.

The results of this study may be published, however no identifying information regarding your child will be used. Your child's identity and the identity of the Language Development Centre will not be disclosed at any time, except in circumstances requiring reporting under the Department of Education Child Protection Policy, or in the circumstance that the research team is legally required to disclose such information. Confidentiality of your child's information is assured at all other times.

What are the benefits of this research for my child's education?

With your permission, your child's assessment results will be provided to the Language Development Centre. This information will be useful for your child's teacher and speech pathologist.

It is anticipated that your child will experience significant improvement in the language area targeted in the therapy programme they receive – either language comprehension or phonological awareness. This may assist their general language and literacy development and their continued learning. Your child will receive the therapy in addition to their regular classroom activities and weekly speech-language pathology sessions at the LDC.

The results of this study may be used to improve the practice of Language Development Centres and speech pathologists. The results may also lead to the development of more language comprehension therapies for children with language impairment.

How do I know that the people involved in this research have all the appropriate documentation to be working with children?

Under the Working with Children (Criminal Record Checking) Act 2004, individuals undertaking research that involves contact with children must pass a Working with Children Check. I have provided the Principal of the Language Development Centre with evidence of my current Working with Children Check.

Is this research approved?

The Curtin University Human Research Ethics Committee has given approval for this study. Any questions or verification of approval for this study can be obtained by contacting the Committee.

Study approval number: HR79/2015

Address: Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845.

Telephone: 9266 2784

Email: hrec@curtin.edu.au

The research has also met the policy requirements of the Western Australian Department of Education.

Who do I contact if I wish to discuss the project further?

Please do not hesitate to contact either myself or my research supervisors if you have any questions about the study. I can be contacted by phone (XXX XXX XXXX) or by email (emily.dawes@postgrad.curtin.edu.au). Alternatively, you may wish to contact one of my supervisors, Dr Suze Leitao (S.Leitao@exchange.curtin.edu.au) or Dr Mary Claessen (M.Claessen@curtin.edu.au).

How does my child become involved in this project?

Please ensure that you:

Read this letter thoroughly;

Take up my offer to ask any questions you may have about the research.

Once all questions have been answered to your satisfaction, and you are willing for your child to become involved, please complete the attached **Consent Form**, and return it to your child's teacher at XX Language Development Centre by **XX 2015**.

Thank you,

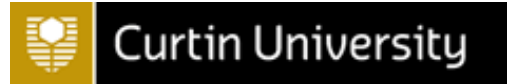
Regards,

Emily Dawes
Speech Pathologist
PhD Candidate
Curtin University

Dr Suze Leitão
Speech Pathologist
Supervisor and Senior Lecturer
Curtin University

Dr Mary Claessen
Speech Pathologist
Supervisor, Lecturer and Speech
Pathology Program Director
Curtin University

Study Two Parent/Carer Consent Form



School of Psychology and Speech Pathology

May 2015

A pilot study of oral inferential comprehension intervention for children with specific language impairment.

Parent Consent Form

- I have read this document and I understand the aims, procedures, and risks of this project.
- I have been given the opportunity to ask any questions, and these have been answered.
- I am willing for my child to become involved in the research project, as described.
- I understand that participation in this project is completely voluntary.
- I understand that my child will be given the opportunity to provide consent to participate in this project.
- I understand that both my child and I are free to withdraw from participation at any time, without affecting my family's relationship with my child's teacher or my child's school.
- I give permission for the contribution that my child makes to this research to be used in conference talks and published in a journal, provided that my child is not identified in any way.
- I give permission for my child's verbal responses to be audio-recorded during assessment sessions so that his/her responses can be scored after the session is finished.
- I give permission for my child's assessment data to be released to the Language Development Centre.

Is English the main language spoken in your home? (please circle) Yes / No

Please list any other language/s spoken at home: _____

Name of Child (please print): _____

Date of Birth (DD/MM/YYYY): ____ / ____ / ____

Child's class teacher: _____

Name of Parent/Carer (please print): _____

Signature of Parent/Carer: _____

Date (DD/MM/YYYY): ____ / ____ / ____

Study Two Participant Information Letter



School of Psychology and Speech Pathology

March 2015

Participant Information Script

Hello,

My name is Emily. I have a project that you might like to help me with.

The project is about getting to know how we understand talking.



Would you like to help me in Term 3? If you would like to help, we will do some activities like sharing books or playing games with letters and sounds. We will do these activities for about half an hour two times a week in Term 3.

If you want to stop at anytime, that's OK, you can.

I won't tell anyone what you say while helping me with the project, unless I need to tell someone like your teacher (e.g. if you tell me that someone has hurt you).

If you would like to help with the project, please draw a circle around the tick on the next page.

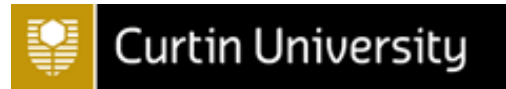
If you don't want to help with the project - that's OK too, please draw a circle around the cross on the next page.

You can ask me any questions about the project.

Thank you.

Emily Dawes

Study Two Participant Information Consent Form



School of Psychology and Speech Pathology

March 2015



Participant Consent Form

I know I have a choice whether or not I want to do this project.

I know that I can stop whenever I want to. I know I will not get into trouble if I want to stop.

I know that I will be doing some different activities (like listening and telling a story, and listening to sounds in words) to help with this project.

I know that I need to draw a circle around the tick on this page before I can help with the project.



YES

I would like to help with the project



NO

Not this time

Child's name: _____

Today's date: ____ / ____ / _____

Appendix J

This appendix contains example session plans and resources from the inferential comprehension (IC) intervention which was developed and evaluated during Study Two (chapter 5). Example session plans (1 – 4) for *The Very Brave Bear* (Bland, 2013) narrative are provided, followed by examples of the session plan resources used in the intervention ('work it out' thinking poster, example kick-off/emotions brainstorm page, and predictions brainstorm page).

Inferential Comprehension Intervention The Very Brave Bear Session 1

Goals:

1. To activate students' background knowledge to assist with narrative comprehension.
2. To use scaffolding techniques to support children's literal and inferential comprehension of the narrative.
3. To explicitly break down the story grammar of the narrative using literal and inferential questioning while creating a story map to support narrative retell.

Narrative: 'The Very Brave Bear' by Nick Bland

| Activity & Time | Description & Script | Materials |
|--|--|---------------------------------|
| Pre-story knowledge activation 2 - 5 mins | <p><i>'We are going to read a story. Let's have a look at the front cover (show front cover). Can anyone guess who the story is about?... (provide a think aloud if no child provides an idea, e.g. I think that the story is about a bear and a buffalo, what do you think?).'</i></p> <ul style="list-style-type: none"> • Link to prior knowledge: <i>have you seen a bear / buffalo before? Where? When? Where do you think the bear and buffalo live? What do you think might happen in the story?</i> (prediction – use visual clues, bear/buffalo have back to each other, arms crossed, facial expressions). • <i>What do you think the title of the story could be? ... The story is called 'The Very Brave Bear' and it was written by Nick Bland.</i> | 'The Very Brave Bear' narrative |
| Read the story 10 mins | <p><i>'Now we are going to read the story together!'</i></p> <ul style="list-style-type: none"> • Begin reading the story. Make comments (think alouds) and model inferential thinking: (first page) <i>'the log looks very wobbly, I wonder if bear will fall off!..'</i> (second page) <i>'Bear looks so surprised and scared ... I don't think he knew Boris Buffalo was in the mud!..'</i> (on the tree) <i>'I think Bear feels grumpy because Boris was just as brave as him climbing up the tree!</i> (at hill) <i>'I wonder what they will do next...?' Use clue from the text to predict – going back into the jungle (and link with conjunction 'because').</i> | 'The Very Brave Bear' narrative |

| | | |
|---------------------------------------|--|--|
| | <p>(at bees) <i>'wow, they are both very brave! Who do you think will be the bravest?'</i></p> <p>(at cave) <i>'I wonder if they will go into the cave. What do you think?....'</i></p> <p>(running away) <i>'bear and Boris look so frightened! They are not brave now! I wonder what is in the cave...?'</i></p> <p>(when frog appears) <i>'I think they feel so relieved that it was only a little frog in the cave!'</i></p> <ul style="list-style-type: none"> • Introduce higher level vocabulary (4-5 words) – do this during every re-read of the narrative. Discuss throughout and ask children what the words mean: <ul style="list-style-type: none"> <i>Slimy</i> – muddy, oozy, slippery <i>Grin</i> – smile <i>Brave</i> – to not show fear (show courage), ready to face danger/pain <i>Somersault</i> - to turn in the air <i>Mighty</i> – very great strength/power <i>Pleasant</i> – happy, nice, good <i>Steep</i> – rising/falling sharply (almost straight) <i>Boast</i> – talking with pride about what you have done <i>Hurry</i> – to go quickly <i>Agreed</i> – to have the same view/opinion as someone else <i>Equally</i> – the same | |
| <p>Build story map</p> <p>15 mins</p> | <p>Explicitly break down story grammar elements to build a story map – ask literal and inferential questions and model inferential thinking, map story components to Braidy icons. Alert to inferential thinking by using the phrase 'we are going to WORK OUT...'. As you discuss each story grammar element, stick the matching Braidy icon on an A3 page and use arrows (→) to map to the next story component. Draw a quick picture ('sketch' – discuss what this is) next to the icon.</p> <p><i>'We are going to practice telling this story so we can become good story tellers. Good story tellers remember to include all the parts in a story, as well as special words like the character's feelings which make the story interesting! Being a good story teller also helps us to understand stories better. We are going to help ourselves remember what happens in the story by making a story map using our Braidy icons and drawing sketches of what happens (a sketch is a really quick drawing). The story map will help our brains to make a strong memory of the story. So our GOAL today is to start a story map with pictures to help us remember the story. What is our goal?'</i></p> <ul style="list-style-type: none"> • Open the book to the first page. • Show the children the setting icon for when. <i>'WHEN do you think the story took place?'</i> – accept any reasonable response and discuss why (e.g. it is not dark so probably not night time). <i>One day/once upon a time - Let's stick our WHEN icon at the top of the page, and I am going to draw a quick sketch of X(a sun, a book) to help us remember WHEN</i> | <p>*'The Very Brave Bear' narrative</p> <p>* small paper Braidy icons</p> <p>* A3 paper</p> <p>* Glue</p> <p>*pencil / texta</p> |

| | | |
|-------------------------|--|-------------------------------|
| | <p><i>the story took place</i>’.</p> <ul style="list-style-type: none"> • Show children the character icon. ‘<i>WHO is the main character in the story?</i>’ – Bear. Use visual prompt if needed (<i>have a look at the picture to help you remember</i>). ‘<i>Bear! Let’s stick our WHO icon next to the WHEN icon on our story map, and I am going to draw a quick sketch of bear to help us remember. Who else is in the story?</i>’. Discuss and use pictures in narrative as support (Boris buffalo, tiny frog). • Show the children the setting icon for where. ‘<i>WHERE do Bear and Boris Buffalo live?</i>’ – discuss responses and refer to visual clues (e.g. plants, trees, bog/mud). ‘<i>In the jingle jangle jungle! Let’s stick our WHERE icon on our story map, and I am going to draw a quick sketch of a jungle to help us remember where the story took place</i>’. • Show the children the kick-off icon (turn to appropriate page in the narrative). ‘<i>What do you think the kick-off was in the story?</i>’ Provide support if needed (cloze-sentence- <i>Bear was picking berries when Boris Buffalo jumped....</i>). ‘<i>The kick-off was that Boris Buffalo jumped out of the mud and Bear fell off his wobbly log! Let’s stick our kick-off icon on our story map, and I am going to draw a quick sketch of Boris Buffalo jumping out of the mud and Bear falling off his log to help us remember what the kick-off is.</i>’ • Show the children the feelings icon (internal response). Alert to inferential thinking – ‘<u><i>Now we’re going to talk about feelings. We’re going to WORK OUT how the characters were feeling!</i></u>’ ‘<i>How do you think that Bear felt when Boris Buffalo jumped out from the mud?</i>’ Discuss feelings (scared, surprised) and provide think-aloud for support (<i>I think that Bear felt <u>scared because</u> he had did not know that Boris was in the mud, what do you think?</i>). Briefly discuss physical, visual clues (eyes wide, eyebrows up, lost balance/fell off log) ‘<i>Bear felt <u>scared because</u> he did not know that Boris was in the mud. Let’s stick our FEELINGS icon on our story map, and I am going to draw a quick sketch of Bear with a scared face to help us remember how he felt</i>’. • Turn to the second page of the book. Show the children the plan icon. Alert to inferential thinking – ‘<u><i>Now we know how the characters feel, we’re going to WORK OUT what they plan to do next!</i></u>’ ‘<i>What did Boris Buffalo say to Bear?....(discuss) ‘I didn’t mean to scare you!’ and what did Bear say back? ..(discuss)..‘I wasn’t even scared!’ So what was Bear’s PLAN?</i>’ Discuss the plan, provide think-aloud for support (<i>I think that the plan was....</i>). ‘<i>So Bear decided to show Boris that he was brave – he said ‘I’m just as brave as you. The bravest thing you can do, I can do it too!’ Let’s stick our PLAN icon on our story map, and I am going to draw a quick sketch of Boris with a speech bubble to help us remember what the plan was</i>’. | |
| <p>Retell the story</p> | <p><i>‘Wow, look at our story map for The Very Brave Bear! What was our goal today? (to start a story map with pictures). Did we achieve our goal? (yes!) We are going to work some more on it next time, but first we are going to</i></p> | <p><i>*The Very Brave</i></p> |

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| <p>2 - 5 mins</p> | <p><i>practice telling the story with our story map. I'll have a go, then we'll tell it together...'</i></p> <ul style="list-style-type: none"> • Practice a group retell of the story (using the story map) with the children. <p>e.g. <i>One day (when) there was bear (who) who lived in the jungle (where). Bear was picking berries when Boris Buffalo jumped out from the mud and Bear fell off his wobbly log (kick-off). Bear felt scared because he did not know that Boris was in the mud (internal response), so he decided to show Boris that he was brave, 'I'm just as brave as you. The bravest thing you can do, I can do it too!' he said! (plan)</i></p> | <p>Bear' narrative * Story map</p> |
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The Very Brave Bear Session 2

Goals:

1. To use scaffolding techniques to support children’s literal and inferential comprehension of the narrative.
2. To explicitly break down the story grammar of the narrative using literal and inferential questioning while creating a story map to support narrative retell.
3. To retell a narrative using structural scaffolds (story map and narrative) to support the inclusion of macrostructure and microstructure elements.

Narrative: ‘The Very Brave Bear’ by Nick Bland

| Activity & Time | Description & Script | Materials |
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| Re-read the story 5 - 10 mins | <p><i>‘Who remembers the story we talked about last time?... That’s right, The Very Brave Bear! Who remembers what the kick-off was?...(provide cloze sentence as prompt: Bear was picking berries when....) yes, the kick-off was that bear was picking berries when Boris Buffalo jumped out from the mud and bear fell off his log! Who remembers how he felt? (provide phonemic cue as prompt: he felt scar...) He felt scared! Poor bear! So what did he decide to do?...he decided to show Boris Buffalo that he was just as brave! We are going to read the story again to help us remember what happened, so we can finish our Very Brave Bear story map and practice our story telling!’</i></p> <ul style="list-style-type: none"> • Begin reading the story. Make comments (think alouds) and ask inferential questions: (at kick-off) <i>‘why did Boris Buffalo jump out of the mud?’</i> (discuss reasons – to see if Bear wanted to come in –play/chat/have fun together). (swinging through trees) <i>‘why did Bear do all these things like crossing the river and swinging through trees?’</i> Link to prior knowledge (he wanted to show Boris that he was brave) (at cave) <i>‘Bear and Boris look so scared and frightened.. I wonder who they think is in the cave...’</i> • Introduce higher level vocabulary (4-5 words) – explain <i>‘to tell a good story we need to use special words to describe what characters do, think and feel. They make the story interesting!’</i>. Discuss throughout and ask children what the words mean. | ‘The Very Brave Bear’ narrative |
| Build story map 15 – 20 mins | <p>Revise the story map created in the first session: <i>‘We are going to practice telling the story again using our story map to help us. Remember that good story tellers remember to include all the parts in a story, as well as special words, like character feelings, which make the story interesting!’</i></p> <p><i>One day (when) there was bear (who) who lived in the jungle (where). Bear was picking berries when Boris Buffalo jumped out from the mud and Bear fell off his wobbly log (kick-off). Bear felt scared because he did not know that Boris was in the mud (internal response), so he decided to</i></p> | *‘The Very Brave Bear’ narrative * small paper Braidy icons * A3 paper |

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| | <p><i>show Boris that he was brave, 'I'm just as brave as you. The bravest thing you can do, I can do it too!' he said! (plan)</i></p> <p>Explicitly break down story grammar elements to finish building the story map – ask literal and inferential questions to map to Braidy icons. As you discuss each story grammar element, stick the matching Braidy icon on an A3 page and use arrows (→) to map to the next story component. Draw a quick picture ('sketch') next to the icon.</p> <p><i>'Now we are going to finish making our story map using our Braidy icons and drawing sketches of what happens. The story map will help our brains to make a strong memory of the story. So our GOAL today is to finish our story map with pictures to help us remember the story. What is our goal?'</i></p> <ul style="list-style-type: none"> • Open the book to the third page (the plan). <i>'How did Bear feel when he saw Boris jump out of the mud?...Bear felt scared because he did not know that Boris was in the mud. The last part of the story map we created was the plan – who remembers what the plan was? (provide cloze sentence as prompt: Bear decided...) yes! Bear decided to show Boris that he was brave.'</i> • Turn to the next page: Show the children the icon for attempt/action. <i>'WHAT did Bear do first?' – discuss and look at the picture. 'First Bear did a somersault and splashed into the bog! Let's stick our ATTEMPT icon on the story map – that shows when something happens (action) or when the characters try to do something (attempt) to follow their plan – I am going to draw a quick sketch of Bear splashing into the bog to help us remember Bear's first attempt to show Boris how brave he is'.</i> • Turn to the next page: Show the children the icon for attempt/action. <i>'WHAT did Bear do next?' – discuss and look at the picture. 'Next Bear climbed up the tallest tree he could find... and what did Boris do?... He climbed up right behind! Let's stick our ATTEMPT icon on the story map. I am going to draw a quick sketch of Bear climbing up the tall tree and Boris climbing behind to show Bear's next attempt'.</i> • Turn to the next page: Show the children the icon for attempt/action. <i>'WHAT did they do next?' – discuss and look at the picture. 'Next Boris climbed up the steepest hill he could find and tumbled down,... and what did Bear do?... He went right behind! Let's stick our ATTEMPT icon on the story map. I am going to draw a quick sketch of Boris and Bear tumbling down the hill to show the next attempt'.</i> • Turn to the next page: Show the children the icon for attempt/action. <i>'WHAT did they do after that?' – discuss and look at the picture. 'After that Bear and Boris crossed a racing river! Let's stick our ATTEMPT icon on the story map. I am going to draw a quick sketch of Boris and Bear crossing the racing river to show the next attempt'.</i> • Link actions/attempts to feelings and plan throughout to repeat modelling of inferential thinking, e.g. <i>'bear tried crossing the racing</i> | <p>* Glue *pencil / texta</p> |
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| | <p><i>river because he wanted to show Boris that he was brave, not scared!</i>'.</p> <ul style="list-style-type: none"> • Turn to the next page: Show the children the icon for attempt/action. <i>'WHAT did they do next?' – discuss and look at the picture. 'Next Bear and Boris swung between the trees! Let's stick our ATTEMPT icon on the story map. I am going to draw a quick sketch of Boris and Bear swinging between the trees to show the next attempt'.</i> • Turn to the next page: Show the children the icon for attempt/action. <i>'WHAT did they do next?' – discuss and look at the picture. 'Next Bear and Boris tried to catch a porcupine to show they were both as brave! Let's stick our ATTEMPT icon on the story map. I am going to draw a quick sketch of Boris and Bear after they tried to catch a porcupine to show the next attempt'.</i> • Turn to the next page: Show the children the icon for attempt/action. <i>'WHAT did they do next?' – discuss and look at the picture. 'Next Bear and Boris tried to wear a beard of bees! Let's stick our ATTEMPT icon on the story map. I am going to draw a quick sketch of Boris and Bear wearing a beard of bees to show the next attempt'.</i> • Turn to the next page: Show the children the kick-off icon. <i>'Hmm, Bear and Boris thought their next attempt would be to go in the cave, but what happened?! ...discuss. What was the next kick-off in the story?' Discuss and turn page. 'The next kick-off was that Bear and Boris came across a very scary cave and hear a loud 'roar'! Let's stick our KICK-OFF icon on the story map. I am going to draw a quick sketch of Boris and Bear looking at the cave and a roar coming out to show the next kick-off'.</i> • Show the children the feelings icon (internal response). <i>'How do you think that Bear and Boris Buffalo felt when they heard the roar?' Discuss feelings (scared, frightened, terrified) and provide think-aloud for support (I think that Bear & Boris felt <u>scared because</u> they thought there was a very scary creature in the cave, what do you think?). Briefly discuss physical, visual clues (eyes wide, mouth open, running away) <i>'Bear & Boris felt <u>scared because</u> they thought that there was a very scary creature in the cave. Let's stick our FEELINGS icon on our story map, and I am going to draw a quick sketch of Bear & Boris with a scared face to help us remember how they felt'.</i></i> • Show the children the plan icon. <i>'What did Bear and Boris Buffalo decide to do?' Discuss the plan, provide think-aloud for support (I think that the plan was....). 'So Bear & Boris decided not to go in the cave and run away instead! Let's stick our PLAN icon on our story map, and I am going to draw a quick sketch of Bear and Boris running away to help us remember what the plan was'.</i> • Turn to the next page: Show attempt/action icon. <i>'WHAT happened next?' – discuss and look at the picture. 'Next from inside the cave came a tiny little frog! What did the frog say to Bear and Boris?... 'I</i> | |
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| | <p><i>didn't mean to scare you!' and what did he do? ... invited them into the cave! Out came a tiny frog, 'I didn't mean to scare you' he said, and so Bear and Boris went inside the cave. Let's stick our ACTION icon on the story map – I am going to draw a quick sketch of the little frog with a speech bubble to help us remember what happened next. How do you think that Bear and Boris felt when they realised it was just a frog?...discuss and link to reasoning (relieved because...)'</i></p> <ul style="list-style-type: none"> • Turn to the next page: Show the tie-up icon. <i>'WHAT did Bear and Boris agree?...(discuss and provide cloze sentence as support: They agreed that they were both equally as...). 'They agreed that they were both equally as brave – they were the same amount of brave! How do you think they felt?... discuss possible emotions (happy, pleased, relieved) and provide think-aloud as support. 'In the end, Bear and Boris Buffalo felt pleased because they agreed they were equally as brave'.</i> | |
| <p>Retell the story 5 mins</p> | <p><i>'Wow, look at our story map for The Very Brave Bear! What was our goal today? (to finish the story map with pictures). Did we achieve our goal? (yes!)</i> <i>We have finished! Now we can tell the whole story and we have the icons and pictures on the story map to help us remember what happens in the story. Let's practice telling the story with our story map. I'll have a go, then we'll tell it together..."</i></p> <ul style="list-style-type: none"> • Practice a group retell of the story (using the story map and the narrative) with the children. <p><i>One day there was bear who lived in the jungle. Bear was picking berries when Boris Buffalo jumped out from the mud and Bear fell off his wobbly log. Bear felt scared because he did not know that Boris was in the mud, so he decided to show Boris that he was brave, 'I'm just as brave as you. The bravest thing you can do, I can do it too!' he said!</i> <i>First Bear did a somersault and splashed into a bog. Next Bear climbed the tallest tree and Boris climbed right behind. Then Boris climbed up and tumbled down the steepest hill and Bear went right behind. After that Bear and Boris crossed a racing river, swung between the trees, tried to catch a porcupine and tried to wear a beard of bees!</i> <i>Then they came to a scary cave and heard a loud 'roar'! They felt scared because they thought there was a scary creature in the cave so they decided not to go in the cave and to run away instead. Then from inside the cave came a tiny frog who said 'I didn't mean to scare you', so Bear and Boris went inside the cave. In the end, Bear and Boris Buffalo felt pleased because they agreed that they were equally as brave.</i></p> | <p>*'The Very Brave Bear' narrative * Story map</p> |

The Very Brave Bear Session 3

Goals:

1. To use scaffolding techniques to support children's inferential comprehension of character emotions and to build on background knowledge of emotions by relating to personal experiences.
2. To retell a narrative using structural scaffolds (story map and narrative) to support the inclusion of macrostructure and microstructure elements – specifically, the inclusion of character emotions.

Narrative: 'The Very Brave Bear' by Nick Bland

| Activity & Time | Description & Script | Materials |
|--|--|--|
| <p>Re-read the story and discuss character's internal responses (feelings)</p> <p>20 - 25 mins</p> | <p><i>'Who remembers the story we have been telling?... That's right, The Very Brave Bear! We are going to read the story again to help us remember what happened, so we can practice our story telling! Today we are going to talk about the FEELINGS in the book – how Bear and Boris Buffalo felt. So our goal today is to WORK OUT how the characters in the book are FEELING – we need to remember the feeling words in the book and what they mean. What is our goal?'</i></p> <ul style="list-style-type: none"> • Begin reading the story. Ask inferential questions related to feelings: (first page) <i>'how did Bear feel when Boris jumped out of the mud?'</i> discuss appropriate feelings – relate to the children's experiences, <i>'how would you feel if someone jumped out at you and you didn't expect it?'</i> (surprised, shocked, scared, frightened) and the reason <u>why</u> the character would feel like that – model using think-alouds (<i>I think that Bear felt surprised and scared because he did not know that Boris was there – it was a surprise!</i>). • Relate to other occurrences in the book – e.g. <i>'how did Bear and Boris feel when they saw the dark cave / heard the roar?'</i>. Discuss emotions and synonyms (scared, frightened, terrified, worried) and the reason <u>why</u> they would feel that emotion. Link to children's personal experiences and brainstorm kick-offs when the children have experienced that emotion. <i>'Have you felt scared before?'</i>, <i>'what made you feel scared?'</i>, <i>'why did you feel scared?'</i>. Link to causal connector <u>because</u> (e.g. <i>you felt scared because...</i>). Link to plan – <i>'what would your plan be if you heard a roar from a dark cave?'</i>. • Continue reading the story. Ask causal inferential questions: (Bear's plan) <i>'Why do you think that Bear decided to show Boris that he was brave?'</i> Discuss possible reasons (e.g. he didn't want to let Boris think he was scared, he felt embarrassed because he was scared when Boris appeared) and relate to character traits (e.g. Bear is proud). (at cave) <i>'Why didn't Bear and Boris go into the cave?'</i> discuss and link to reason, use cloze-sentence as a prompt (<i>'because they thought that there might be a ...'</i>). (page with frog) <i>'How do you think Bear and Boris felt when they</i> | <p>**The Very Brave Bear' narrative * Kick-off / emotions brainstorm page (scared; brave).</p> |

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| | <p><i>realised it was just a frog inside the cave?’ discuss appropriate feelings (surprised, relieved) and link to the reason using causal connector <u>because</u>.</i></p> <ul style="list-style-type: none"> • Continue reading the story. (last page) <i>‘what did Bear and Boris agree on in the end?’</i> discuss (they were both as brave). <i>‘How were Bear and Boris brave?’</i> discuss actions – relate to the children’s experiences, <i>‘how would you feel if you... climbed a tall tree/swung between trees/crossed a racing river, wore a beard of bees, etc?’</i> (brave, proud, scared) and the reason <u>why</u> the character would feel like that – model using think-alouds (<i>I think that Bear and Boris felt brave because they were doing dangerous actions</i>). • Relate to the children’s personal experiences and brainstorm kick-offs when the children have experienced that emotion. <i>‘Have you felt brave before?’</i>, <i>‘what made you feel brave?’</i>, <i>‘why did you feel brave?’</i>. Link to causal connector <u>because</u> (e.g. <i>you felt brave because...</i>). <p><i>What was our goal today? (to work out how the characters are feeling). What feeling words did we talk about? What do they mean? Did we achieve our goal? (yes!)</i></p> | |
| <p>Retell the story 5 – 10 mins</p> | <p>Revise the story map created in the first session: <i>‘We are going to practice telling the story again using our story map to help us. Remember that good story tellers remember to include all the parts in a story, as well as special words, like character feelings we’ve just talked about, which make the story interesting! Our next goal for today is for you to tell the story and include all the feeling words we talked about.’</i></p> <ul style="list-style-type: none"> • Practice a group retell of the story (using the story map and the narrative) with the children. <p><i>One day there was bear who lived in the jungle. Bear was picking berries when Boris Buffalo jumped out from the mud and Bear fell off his wobbly log. Bear felt scared because he did not know that Boris was in the mud, so he decided to show Boris that he was brave, ‘I’m just as brave as you. The bravest thing you can do, I can do it too!’ he said! First Bear did a somersault and splashed into a bog. Next Bear climbed the tallest tree and Boris climbed right behind. Then Boris climbed up and tumbled down the steepest hill and Bear went right behind. After that Bear and Boris crossed a racing river, swung between the trees, tried to catch a porcupine and tried to wear a beard of bees! Then they came to a scary cave and heard a loud ‘roar’! They felt scared because they thought there was a scary creature in the cave so they decided not to go in the cave and to run away instead. Then from inside the cave came a tiny frog who said ‘I didn’t mean to scare you’, so Bear and Boris went inside the cave. In the end, Bear and Boris Buffalo felt pleased because they agreed that they were equally as brave.</i></p> | <p>**‘The Very Brave Bear’ narrative * Story map</p> |

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| | <p><i>Well done! What was our second goal for today? (to tell the story with the feeling words). Did we achieve our goal of including the feeling words? (yes!). You are becoming excellent story tellers because you included the feeling words which make the story interesting!</i></p> | |
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The Very Brave Bear Session 4

Goals:

1. To retell a narrative using structural scaffolds (story map and narrative) to support the inclusion of all targeted macrostructure and microstructure elements.
2. To use scaffolding techniques to support children's ability to make an appropriate prediction based on the events in a narrative.

Narrative: 'The Very Brave Bear' by Nick Bland

| Activity & Time | Description & Script | Materials |
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| Re-read the story 5 minutes | <p><i>'Who remembers the story we have been telling?... That's right, The Very Brave Bear! We are going to read the story again to help us remember what happened, so we can practice our story telling!'</i></p> <ul style="list-style-type: none"> • Re-read the story, making a small number of comments/think alouds. Pause to let the children tell you what happens next, e.g. <i>then Bear and Boris Buffalo...</i> • Add in internal response of characters, e.g. at first kick-off, <i>Bear felt scared because he did not know that Boris was in the mud.</i> • Introduce higher level vocabulary (4-5 words) – explain <i>'to tell a good story we need to use special words to describe what characters do, think and feel. They make the story interesting!'</i>. Discuss throughout and ask children what the words mean. | **The Very Brave Bear' narrative * Story map |
| Retell the story – group retell 5 – 10 mins | <p>Revise the story map created in the first session: <i>'We are going to practice telling the story again using our story map to help us. Remember that good story tellers remember to include all the parts in a story, as well as special words, like character feelings we've just talked about, which make the story interesting! Our goal today is to tell the story and include all the parts of the story and all the special feeling and connecting words which make the story interesting. What is our goal?'</i></p> <ul style="list-style-type: none"> • Practice a group retell of the story (using the story map and the narrative) with the children. <p><i>One day there was bear who lived in the jungle. Bear was picking berries when Boris Buffalo jumped out from the mud and Bear fell off his wobbly log. Bear felt scared because he did not know that Boris was in the mud, so he decided to show Boris that he was brave, 'I'm just as brave as you. The bravest thing you can do, I can do it too!' he said!</i></p> <p><i>First Bear did a somersault and splashed into a bog. Next Bear climbed the tallest tree and Boris climbed right behind. Then Boris climbed up and tumbled down the steepest hill and Bear went right behind. After that Bear and Boris crossed a racing river, swung between the trees, tried to catch a porcupine and tried to wear a beard of bees!</i></p> <p><i>Then they came to a scary cave and heard a loud 'roar'! They felt scared because they thought there was a scary creature in the cave so they decided not to go in the cave and to run away instead. Then from inside</i></p> | **The Very Brave Bear' narrative * Story map |

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| | <p><i>the cave came a tiny frog who said ‘I didn’t mean to scare you’, so Bear and Boris went inside the cave. In the end, Bear and Boris Buffalo felt pleased because they agreed that they were equally as brave.</i></p> | |
| <p>Story predictions – 15 – 20 minutes</p> | <p><i>‘What was our goal for today? (to tell the story with all the parts and special words). Did we achieve our goal? (yes!). You are excellent story tellers! You remembered to include the special feeling words and the connecting words we’ve been talking about. Now we are going to WORK OUT what we think happens next, AFTER the story finishes. That is not something that HAS already happened, but something that IS GOING TO happen, so to think of something that is going to happen NEXT we have to think of something new and link it to what we know from the story. So our next goal for today is to WORK OUT what is going to happen next. What is our second goal?’.</i></p> <ul style="list-style-type: none"> • <i>Revise ending of story: Bear and Boris went into frog’s cave and they felt pleased because they agreed that they were both brave! What are they doing with frog in his cave?..(discuss – having tea/a drink)..What do you think happens NEXT? Or rephrase, What do you think happens AFTER the story is finished?</i> • <i>Discuss appropriate predictions and brainstorm – ensure each child has a turn to brainstorm a prediction. Discuss which predictions are likely and why (using connector because), link to personal experiences when possible. Provide a think-aloud as support/modelling – e.g. I think that Bear and Boris have dinner with the frog, BECAUSE they feel hungry after doing so many brave activities; I think Bear and Boris go home and have a rest, BECAUSE they feel tired after doing so many brave activities; I think Bear and Boris go on more adventures together, BECAUSE they have agreed that they are both equally as brave!</i> • <i>Ask questions to monitor children’s reasoning of likely vs. unlikely predictions, link to evaluative reasoning: e.g. do you think that Bear and Boris should do those brave activities again? Why/why not? Do you think Bear and Boris should have gone into the cave the first time they saw it? Why/why not?</i> <p><i>‘What was our second goal for today (to work out what is going to happen next). Did we achieve our goal? (yes!). You have been very clever at thinking of what Bear and Boris Buffalo might do NEXT, AFTER the story is finished! Next time we are going to read a different story!’</i></p> | <p>*‘The Very Brave Bear’ narrative * Predictions brainstorm page</p> |

'Work it out' inferential thinking poster


Work it
out...



Image source: <http://nothingbutmonkeybusiness.blogspot.com.au/2013/03/little-detectives-problem-solving-march.html>

Kick-off/Emotions Brainstorm Page: 'Brave'

I felt brave when...



The worksheet features a central heart shape. Inside the heart, on the left, is a smaller heart with a dotted pattern. To the right of this is the text "I felt brave when...". Below the text is a rectangular photograph of the character Merida, who has long, curly red hair and is wearing a blue tunic. Six arrows radiate from the central heart to six different locations around the page. Each location consists of a simple line drawing of a face with two eyes and a mouth, and a line drawing of a shoe. Below each face and shoe are two horizontal lines for writing.

Image source: http://feministfiction.com/wp-content/uploads/2012/08/brave_merida.jpg

Predictions Brainstorm Page

? ? ? ? ?
 What do YOU think happens NEXT?

Image source: http://www.clipartpanda.com/clipart_images/the-kids-have-done-some-deep-36587520

Appendix K

This appendix includes information about the control phonological awareness intervention, including intervention goals, an example intervention session plan, and the results of the intervention.

Control Phonological Awareness Intervention

Each phonological awareness intervention session involved two to three activities, each of which focused on a different phonological awareness goal. The principles of the PAT Programme aligned with the synthetic phonics approach implemented at the Language Development Centre. The graphemes/phonemes used in the intervention sessions matched the progression of grapheme/phoneme correspondences introduced at the LDC, so participants were familiar from classroom instruction.

The principles of the PAT Programme intervention, taken directly from The Gillon Phonological Awareness Training Programme Handbook (Gillon, 2008, p.4), are displayed below¹².

1. Phonological awareness training should focus on the development of skills at the phoneme level (Brady, Fowler, Stone, & Winbury, 1994; Brennan & Ireson, 1997; Cary & Verhaeghe, 1994; Lundberg, Frost, & Petersen, 1988; Yopp, 1988).
2. Phonological awareness activities should be integrated with letter sound knowledge training (Cunningham, 1990; Hatcher, Hulme, & Ellis, 1994).
3. A range of phoneme analysis and synthesis activities should be incorporated with particular attention given to phoneme segmentation skills (Ayres, 1995; O'Connor, Jenkins, Leicester, & Slocum, 1993; Schneider, Kuspert, Roth, & Vise, 1997; Torgesen, Morgan, & Davis, 1992; Torgesen, Wagner, & Rashotte, 1994).
4. The integration of letter sound knowledge with phonological awareness activities should include manipulative materials and should engage the children in reflecting upon the phonological awareness task (Alexander, Andersen, Heilman, Voeller, & Torgesen, 1991; Clarke-Klein, 1994; Cunningham, 1990; Defior & Tudela, 1994; Gillon & Dodd, 1995, 1997; Truch, 1994).
5. Flexibility in programme implementation is required (Brady et al., 1994).
6. A direct approach to phonological awareness training has greater benefits for literacy development than an indirect approach (Ayres, 1995).
7. An intensive individual or small group model of service delivery is necessary for children with severe deficits (Brady et al., 1994; Byrne & Fielding-Barnsley, 1995; Torgesen et al., 1994).

¹² The Gillon Phonological Awareness Training Programme Manual (2008) and resources are available for download at http://www.education.canterbury.ac.nz/people/gillon/gillon_phonological_awareness_training_programme.shtml

Intervention Structure

The intervention session goals and structure followed the sequence of the PAT Programme (Gillon, 2008, p. 9-27). The goals and activities were repeated in each of the two intervention sessions during each week of the intervention. The goals included focus on rhyme, phoneme analysis (listening for same/different sounds), phoneme identity, phoneme segmentation and blending, tracking speech sounds (identifying the number and order of sounds in words), and grapheme-phoneme (letter-sound) correspondences.

Intervention Session Plans

This following session plan provides an example of those developed for the intervention study using the information and examples in the PAT Programme manual (Gillon, 2008).

Phonological Awareness Intervention - Session 1

Goals:

1. Rhyme: to teach children to identify phonological similarities in spoken word pairs (onset-rime).
2. Phoneme Analysis: to teach children to analyse and manipulate sounds in isolation.
3. Phoneme Identity: to teach children to identify phonemes in words.

| Activity | Description & Script | Time | Materials |
|---|---|--------|--|
| Rhyme bingo | <p><i>'We are going to play a rhyming game! Rhyming words sound the same at the end. Cat, pat – they rhyme because they sound the same at the end. Cat, log – they don't rhyme because they don't sound the same at the end.'</i></p> <ul style="list-style-type: none"> • Provide 3-4 examples of words which rhyme. Give each child a rhyme board. • Ask children to name the pictures on the rhyme board. • Place rhyming picture/word cards face down on the table. Children take turns to pick a card and find a rhyming word on their board. If they find a rhyming word, they place a counter over it. | 10mins | <ul style="list-style-type: none"> • Rhyme Board 1 form PAT programme – 1 for each child • Counters |
| Phoneme analysis – tracking speech sounds | <p><i>'Now we're going to play a different game! We are going to listen to sounds. You need to listen really carefully so you can hear if I say the same sound or a different sound. You will put a counter in the box for every sound you hear. If the sounds are different, you have to use a different coloured block. If they are the same, you have to use the same colour block. Let's have a go!'</i></p> <p>***Use a reward game.</p> <ul style="list-style-type: none"> • Give each child a phoneme discrimination board and coloured counters (approximately 5-6 with 3 different colours). • Do two to three demos to show the children how to represent same/different sounds (e.g. <i>show me /p/ /p/</i>) | 10mins | <ul style="list-style-type: none"> • Coloured blocks or counters • Phoneme discrimination board. • Phoneme analysis list of wide contrasting sounds. • Reward game |

| | | | |
|---|--|--------|---|
| | <p>– two counters of the same colour. Ask children to repeat the sounds after you and point to each counter as they say the sound. <i>Show me /s/ /p/.</i> – change the first counter to a different colour. <i>Show me /s/ /m/, show me /s/ /m/ /m/.</i></p> <ul style="list-style-type: none"> Continue the game – use only wide contrasting sounds. | | (buzzer). |
| <p>Picture matching. Phoneme identity – identifying initial consonant sounds in words.</p> | <p><i>'Now we're going to look at some pictures – I have some pictures showing lots of different animals. We are going to try and find some animals which start with the same sound!'</i></p> <ul style="list-style-type: none"> Ask children to name the pictures. Ask children if the animal names start with the same sound (e.g. <i>do dog and deer start with the same sound? Yes! They both start with a 'd' sound.... do seal and dog start with the same sound? No! Seal starts with a 's' sound and dog starts with a 'd' sound, they are different.</i>). Use animal pictures and progress to food pictures if time. | 10mins | <ul style="list-style-type: none"> Phoneme identity picture cards: animals and food. |

Phonological Awareness Intervention Results

Raw scores were used for analysis of the phonological awareness measure in order to minimise loss of sensitivity to change in standard scores over the relatively short period of time of the study (standard scores used 6 month age band intervals). The means, standard deviations and range of scores for the phonological awareness assessments are displayed in Table 32.

Table 32: Means, Standard Deviations & Ranges of Phonological Awareness Scores

| Time | Measure | Group | Subtest Raw Score (RS) | RS Standard Deviation | RS Range |
|-----------------------|----------------------|-------|------------------------|-----------------------|----------|
| Pre-intervention (T1) | Rhyme awareness | IC | 5.21 | 2.64 | 2-10 |
| | | PA | 4.65 | 2.67 | 0-10 |
| | Phoneme segmentation | IC | 0.58 | 1.15 | 0-3 |
| | | PA | 0.59 | 1.33 | 0-5 |
| | Letter knowledge | IC | 17.42 | 6.95 | 0-26 |
| | | PA | 14.12 | 7.37 | 3-31 |

Table 32 continued.

| Time | Measure | Group | Subtest Raw Score (RS) | RS Standard Deviation | RS Range |
|------------------------|----------------------|-------|------------------------|-----------------------|----------|
| Post-intervention (T2) | Rhyme awareness | IC | 5.42 | 2.82 | 3-12 |
| | | PA | 7.65 | 3.46 | 2-12 |
| | Phoneme segmentation | IC | 1.58 | 2.09 | 0-7 |
| | | PA | 3.47 | 3.91 | 0-11 |
| | Letter knowledge | IC | 22.47 | 7.34 | 3-31 |
| | | PA | 20.71 | 7.87 | 6-32 |
| Maintenance (T3) | Rhyme awareness | IC | 6.16 | 2.95 | 3-12 |
| | | PA | 7.65 | 2.67 | 3-12 |
| | Phoneme segmentation | IC | 3.47 | 2.46 | 0-8 |
| | | PA | 2.88 | 3.20 | 0-10 |
| | Letter knowledge | IC | 24.53 | 6.71 | 1-32 |
| | | PA | 22.18 | 7.70 | 7-32 |

Rhyme

The Group x Time interaction was significant, indicating an intervention effect for rhyme raw scores, $F[2,104] = 4.55$, $p = .013$. As such, the main effects for group and time could not be reliably interpreted independently of one another. The Group x Time interaction is displayed in Figure 9.

The nature of the interaction was investigated by examining the simple main effects of time separately for each group. There was a significant effect of time for the PA group, $F[2,104] = 15.12$, $p < .001$, but not for the IC group, $F[2,104] = 1.44$, $p = .242$. LSD contrasts were conducted across the time effect for the PA group. There was a significant T1 to T2 increase in rhyme scores ($p < .001$), followed by a non-significant T2 to T3 increase ($p = .833$). The T1 to T3 increase was significant ($p < .001$) indicating maintenance of rhyme gains in the PA group.

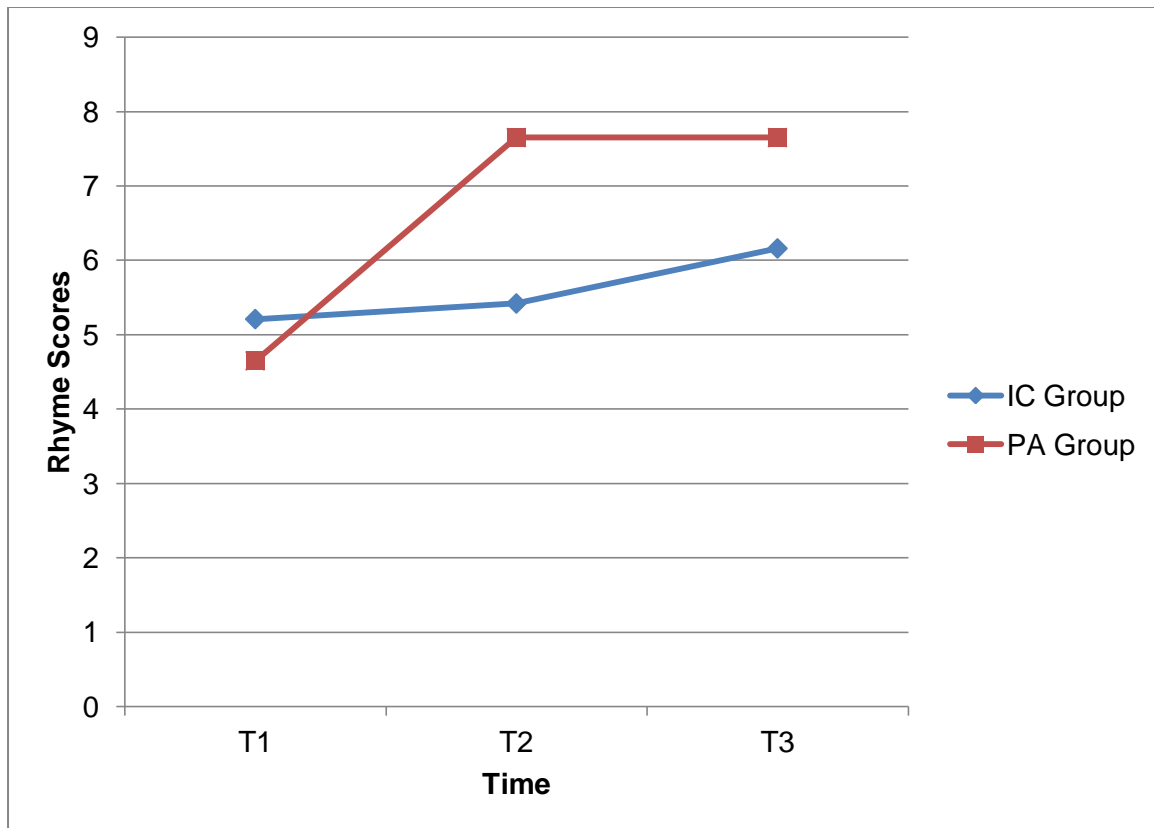


Figure 9. Group x Time Interaction for Rhyme Scores.

Phoneme Segmentation

The Group x Time interaction was significant, indicating an intervention effect for phoneme segmentation raw scores, $F[2,104] = 5.825$, $p = .004$. As such, the main effects for group and time could not be reliably interpreted independently of one another. The Group x Time interaction is displayed in Figure 10.

The nature of the interaction was investigated by examining the simple main effects of time separately for each group. There was a significant effect of time for both the PA group, $F[2,104] = 7.09$, $p = .001$, and the IC group, $F[2,104] = 11.47$, $p < .001$. LSD contrasts were conducted across the time effect for both groups. For the PA group, there was a significant T1 to T2 increase in phoneme segmentation scores ($p < .001$) followed by a non-significant T2 to T3 decrease ($p = .118$). The T1 to T3 increase for the PA group was significant ($p = .001$), indicating maintenance of phoneme segmentation gains.

For the IC group, there was a significant T1 to T2 increase in phoneme segmentation scores ($p = .043$) followed by a further significant T2 to T3 increase ($p = .004$). The T1 to T3 increase for the IC group was significant ($p < .001$). The T1 to T2 phoneme segmentation raw score increase for the PA group was significantly greater than the T1 to T2 increase for the IC group, $F[1,70] = 4.58$, $p = .036$.

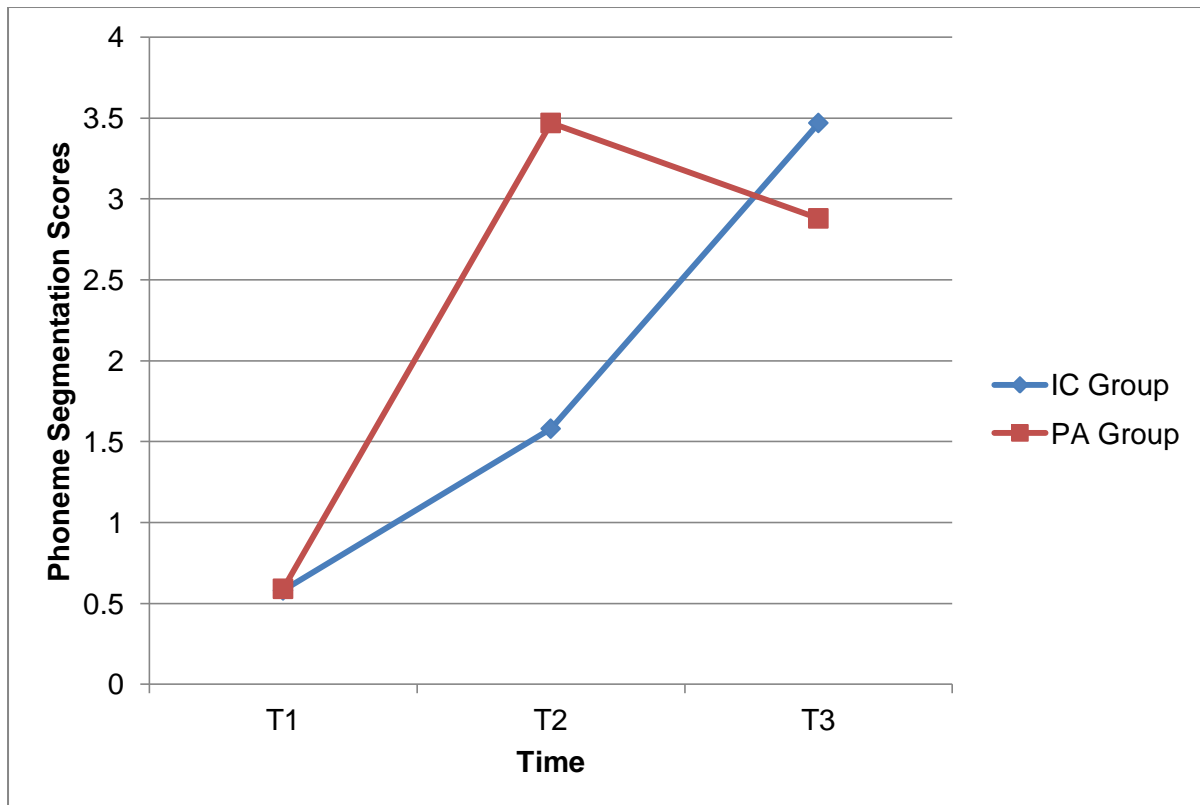


Figure 10. Group x Time Interaction for Phoneme Segmentation Scores

Letter Knowledge

The Group x Time interaction was non-significant, contraindicating an intervention effect, $F[2,104] = 0.40, p = .669$. The main effect for group was also non-significant, indicating that the two groups had comparable letter knowledge skills at each of the three assessments, $F[1,104] = 1.06, p = .306$. However, the main effect for time was significant, $F[2,104] = 70.86, p < .001$. The non-significant Group x Time interaction indicated that the time effect (displayed in Figure 11) could be generalised across the two groups.

LSD contrasts conducted across the main effect for time showed a significant increase in letter knowledge raw scores from T1 to T2 ($p < .001$), followed by a further significant increase from T2 to T3 ($p < .001$). The T1 to T3 increase was significant ($p < .001$) indicating maintenance of letter knowledge gains for both groups.

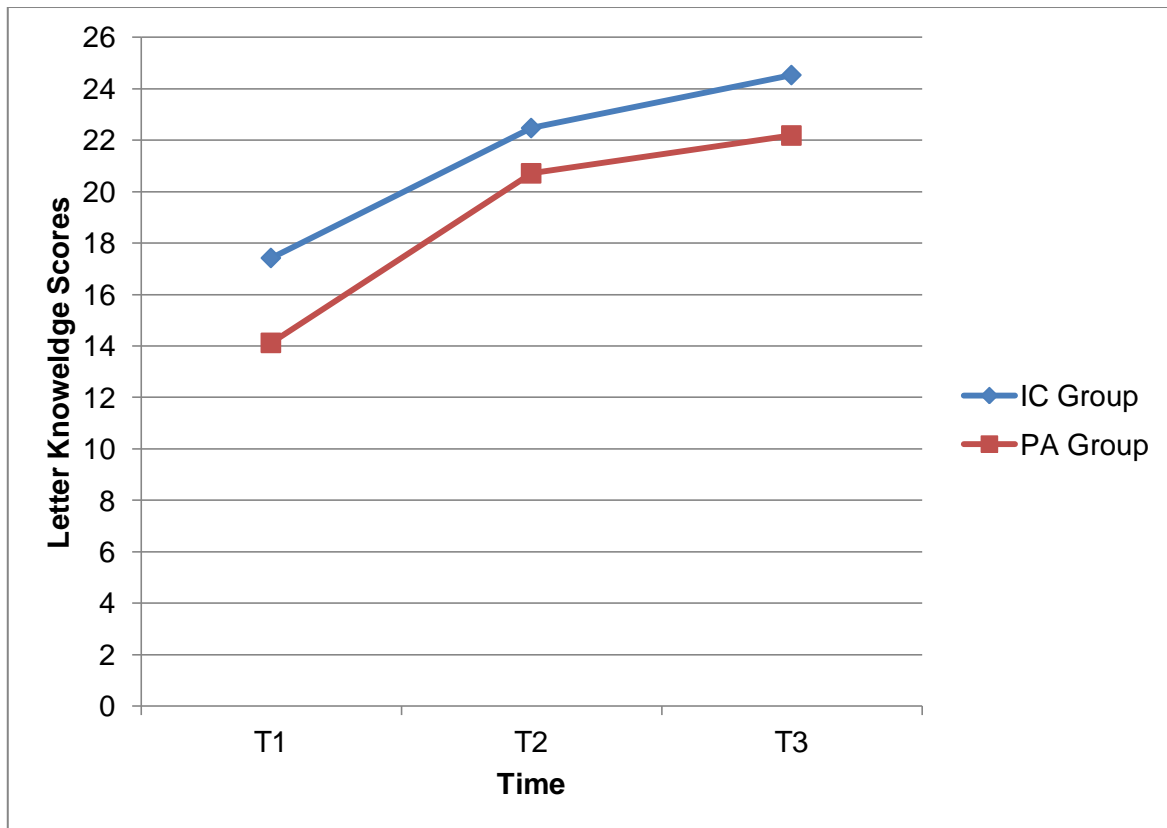


Figure 11. Time Effect for Letter Knowledge Scores

Discussion of Phonological Awareness Results

The phonological awareness intervention significantly improved most of the targeted phonological awareness skills in the PA group. The intervention, based on The Gillon PAT Programme (Gillon, 2008), focused on rhyme, tracking speech sounds, phoneme segmentation, and blending. The standardised phonological awareness assessment used in the study assessed a variety of phonological awareness skills. The three subtests which aligned with the intervention goals were used in the analyses.

For rhyme awareness, the PA group showed significant improvement from pre- to post-intervention assessment compared to the IC group. The rhyme awareness gains were maintained over time. These findings indicated that the PA intervention was effective at improving rhyme skills, although rhyme was only an intervention focus for the initial weeks of the intervention. Thus, a short focus on rhyming skills as part of an 8 week intervention was effective at improving, and maintaining improvement, in rhyming ability.

The PA group showed a significant increase in phoneme segmentation from pre- to post-intervention assessment. The PA group's increase in raw scores for phoneme segmentation between pre-intervention and maintenance was significant. This indicated that the phoneme segmentation ability of the PA group improved

significantly during the intervention, and was maintained two months following the intervention.

The IC group also showed a significant increase in phoneme segmentation raw scores between pre- to post-intervention assessment, and also between post-intervention and maintenance assessments. However, the PA group's pre- to post-intervention improvement in phoneme segmentation raw score was significantly greater than that of the IC group, thus the results indicated that the intervention was effective at improving the phoneme segmentation skills of the children in the PA group beyond that attributable to continuing classroom instruction.

The IC and PA groups demonstrated similar performance on letter knowledge (grapheme-phoneme correspondences). Raw scores for both groups improved significantly from pre- to post-intervention and from post-intervention to maintenance assessment. Across both intervention groups, the pre-intervention to maintenance increase in letter knowledge was significant.

The Language Development Centre which the participants attended had a significant focus on synthetic phonics instruction for literacy development. As such, the participants received daily, intensive synthetic phonics instruction which included grapheme-phoneme correspondence, segmentation, and blending. Therefore, it is not surprising that the IC group also made significant gains in letter knowledge and phoneme segmentation, due to the frequency and intensity of classroom instruction received.

The results demonstrated that the PA group made significant gains on rhyming and phoneme segmentation skills, and similar gains to the IC group on grapheme-phoneme correspondence. The intervention was therefore effective at improving some phonological awareness skills, beyond the progress attributable to the participants' regular, intensive classroom instruction which targeted similar skills.