School of Occupational Therapy, Social Work and Speech Pathology

Trial of a Peer-to-Peer, Play-based Intervention to Improve Pragmatic Language in Children with Autism Spectrum Disorder
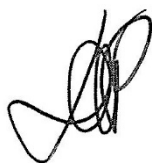
Lauren Alese Parsons

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Author's 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 Number #HR04/2015

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Abstract

Pragmatic language difficulties are a cardinal feature of autism that can affect the quality of children's social interactions and therefore the development and maintenance of friendships. To date, pragmatic language interventions have focused on remediating disordered language skills, tending to overlook how children use targeted skills in daily social interactions. The International Framework for Functioning, Disability and Health (ICF) supports the development of interventions that target an individual's functioning taking into account contextual factors. Functioning in relation to pragmatics includes the use of pragmatics in naturalistic social interactions, yet few interventions for school-aged children with autism (aged 6-11 years) target and evaluate pragmatic language in this way. Following the United Kingdom Medical Research Council guidelines for developing and evaluating complex interventions, this research aimed to evaluate the feasibility, appropriateness and effectiveness of a peer-mediated, play-based pragmatic language intervention for children with autism. The intervention utilised video modelling in combination with peer and therapist modelling to improve children's pragmatic language during peer-peer play. Parents were trained in intervention techniques and facilitated home-based intervention components.

The peer-mediated play-based intervention was evaluated through three distinct research phases. Phase 1 (Chapter 2) identified the evidence base for existing pragmatic language interventions for children with autism. Phase 2 (Chapter 3) was a pilot study that informed Phase 3 (Chapters 4-6), a randomised controlled trial.

Phase 1 (Chapter 2), a systematic review and meta-analysis, was conducted to understand how interventions have targeted pragmatic language in children with autism (aged 0-18 years), the aspects of pragmatic language targeted by those interventions, the magnitude of intervention effects, and factors that mediate intervention effects. The systematic review identified 22 studies reporting on randomised controlled trials of 20 different pragmatic language interventions for children with autism. A meta-analysis assessed the effectiveness of 15 interventions and explored mediators of intervention effects. Some promising approaches were evident, and active

inclusion of both the child and a parent in interventions significantly moderated intervention effects. The current evidence base for long-term maintenance of intervention effects is limited, and the evaluation of generalisation of benefits across varied social contexts is lacking.

Phase 2 (Chapter 3), a pilot study, tested the peer-mediated, play-based intervention with children with autism to: 1) establish feasible outcome measures for evaluating intervention effects in larger trials, and 2) to evaluate the intervention's appropriateness for children with autism and their families. Ten children with autism, their typically-develop peers, and parents participated in the 10-week intervention. Three measures of pragmatics were administered pre-, post- and 2-months following the intervention to understand the most feasible assessments to administer in a larger trial, and to determine if the measures were sensitive to change. Interviews were conducted with parents of children with autism at 2-month follow-up. A significant effect of time was detected for two of the pragmatic language measures; one observational measure that assessed children's *performance* of pragmatic language skills, and one standardised assessment task administered to children that assessed children's *capacity* for pragmatic language skills. These measures were deemed the most suitable for use in a larger trial with robust methodology. One overarching theme of *changing perspectives* emerged from the parent interviews, reflecting parents' new perceptions of their child's abilities and strategies to support their peer interactions, and children's new understandings of ways to promote positive social interactions with a peer. Five subthemes were embedded within the overarching theme. *Motivators:* parents and children alike were motivated to engage in the intervention because of the play-based approach. *Benefits:* children with autism, playmates and parents benefitted from learning new roles within the social play interactions of the children with autism. *Active ingredients:* parents associated specific aspects of the intervention with positive change. *Playmates:* parents noted the advantages of inviting siblings as peers and ways to augment peer inclusion in the intervention. *Logistics:* the burden of participation on families was minimal and intervention strategies were easily adopted in the home. Themes emerging from the parent interviewed attested to the appropriateness of the intervention.

Phase 3, a randomised controlled trial, evaluated the intervention's effectiveness for children with autism and their playmates and established a way to predict children who are most or least likely to benefit. Children with autism and their typically-developing playmates were randomised to an intervention-first group ($n = 35$) or a waitlist-first comparison group ($n = 36$). Intervention-first participants attended 10 weekly intervention sessions, while waitlist-first participants waited for 10 weeks before also commencing the intervention. The Pragmatics Observational Measure (POM-2) and Social Emotional Evaluation (SEE) measured children's (children with autism and peers) pragmatic language performance and capacity respectively pre-, post- and 3-months following the intervention. In addition, the observational measure (POM-2) was administered twice at follow-up: once in the clinic and once in the homes of children with autism.

The outcomes for children with autism who participated in Phase 3 are described on Chapter 4. The change in overall pragmatic language performance (POM-2) of children with autism in the intervention-first group was significantly greater than the waitlist-first group during their waiting period, expressly in skills related to nonverbal communication. Changes in pragmatic language capacity (SEE) were not greater for intervention-first than waitlist-first participants. Pre-, post- and 3-month follow-up pragmatic language scores for children with autism in both groups were combined to assess the main effect of time. A significant effect of time was detected, with significant increases between pre-post and pre-follow-up assessments, indicating children with autism maintained gains in pragmatic language to follow-up. Skill generalisation between the clinic and homes of children with autism was confirmed by comparing the POM-2 observations of children in both settings at follow-up. Moderators of pragmatic language change were explored; receptive syntax moderated children's pragmatic language performance (POM-2) across the study, while receptive syntax and expressive vocabulary moderated pragmatic language capacity (SEE) scores.

Pragmatic language outcomes for typically-developing playmates were explored in Chapter 5. Intervention-first playmates did not make significantly greater gains in pragmatic language (POM-2 and SEE) than the waitlisted-first playmates. Pre-, post- and follow-up pragmatic

language scores for playmates in both groups were also combined to evaluate the main effect time. As was the case for children with autism, a significant effect of time was detected, with significant increases between pre-post and pre-follow-up assessments. Contrary to children with autism, the relationship between the children (i.e., sibling or non-sibling) moderated the pragmatic language performance (POM-2) of playmates during play-based interactions. Similar to children with autism, expressive vocabulary scores moderated playmate's pragmatic language capacity (SEE).

Chapter 6 examined the child-factors that discriminated children with autism within the sample who received the largest effects following the intervention. Children's data from Phases 2 and 3 were combined for this chapter. Pre-intervention variables related to language abilities and emotional and behavioural problems were used in the analysis to determine the child-factors that predicted those children with autism who benefited most from this intervention. Separation anxiety and language scores pertaining to the use of context, nonverbal communication, coherence and expressive vocabulary were significant predictors of children with large intervention effects. The study produced two of algorithms for use that predicted children most likely to receive a large intervention effect after participating in the intervention. The algorithms were integrated into a software application for use by therapists to predict children within their clinics who may be the most suitable candidates for the intervention.

The results across the three phases demonstrated that this intervention is appropriate and effective for improving the pragmatic language performance of children with autism during play-based social interactions with a typically-developing peer. The intervention addressed all elements of the ICF, and the naturalistic, practice-based nature of the intervention was a novel approach to pragmatic language intervention for this age group. The constellation of techniques utilised in the intervention was suitable for use by clinicians to target a breadth of pragmatic language skills. The performance focus of the intervention facilitated change in pragmatic language during peer-peer play within the clinic setting, and assisted generalisation of pragmatic skills to play interactions at home. Future research directions for this play-based intervention include: a) further refinement to increase intervention effects for verbal communication skills;

b) translation for use with other clinical populations; c) exploring alternative methods for delivery or playmate enrolment; d) evaluation of generalisation to other contexts and playmates; e) assessment of outcomes related to friendship development and maintenance; and f) the development and evaluation of clinician training.

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Heartfelt thanks go to my parents for instilling in me the personal qualities I needed to complete this process. Mum, as my very first teacher you showed me how to become a life-long learner and to enjoy the challenge of solving difficult problems. Dad, you saw me begin my candidature and it breaks my heart that you aren't here to see me finish. You cheered me on from the sidelines through all of my endeavours with great pride; I know that this would be no different.

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Dedication

To Eve and Alice - stay curious.

List of Publications

This doctoral thesis consists of the following publications:

1. Parsons, L., Cordier, R., Munro, N., Joosten, A., & Speyer, R. (2017). A systematic review of pragmatic language interventions for children with autism spectrum disorder. *PloS One, 12*(4), e0172242. doi:10.1371/journal.pone.0172242.

2. Parsons, L., Cordier, R., Munro, N., & Joosten, A. (2018). The feasibility and appropriateness of a peer-to-peer, play-based intervention for improving pragmatic language in children with autism spectrum disorder. *International Journal of Speech-Language Pathology*. doi: 10.1080/17549507.2018.1492630.

3. Parsons, L., Cordier, R., Munro, N., & Joosten, A. (2018). A randomised controlled trial of a play-based, peer-mediated pragmatic language intervention for children with autism. *Manuscript submitted for publication*.

4. Parsons, L., Cordier, R., Munro, N., & Joosten, A. (2018). Peer's pragmatic language outcomes following a peer-mediated intervention for children with autism: A randomised controlled trial. *Manuscript submitted for publication*

5. Parsons, L., Cordier, R., Munro, N., & Joosten, A. (2018). A play-based, peer-mediated pragmatic language intervention for school-aged children on the autism spectrum: Predicting who benefits most. *Manuscript submitted for publication.*

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Statement of Contributors

Supervisors:

- Associate Professor Reinie Cordier

- Associate Professor Natalie Munro

- Associate Professor Annette Joosten

Statistician:

- Dr Richard Parsons

Research Assistance:

Professor Renee Speyer who assisted with the systematic database search; Belinda Cuomo who assisted with abstract screening and methodological quality ratings; Dr Sarah Wilkes-Gillan and Gabrielle Barnes who completed blinded observational ratings of pragmatic language; Greg Lynn and Timothy Parkin who transcribed audio recordings of interviews.

Co-Researcher:

Cally Kent who also coordinated data collection and conducted the intervention.

Signed: Lauren Parsons   Date: 22/02/2019

Signed: Reinie Cordier   Date: 22/02/2019

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List of Abbreviations

CCBRS   Conners Comprehensive Behaviour Rating Scale

CCC   Children's Communication Checklist

CONSORT   Consolidated Standards of Reporting Trials

DSM   Diagnostic and Statistical Manual of Mental Disorders

EVT   Expressive Vocabulary Test

ICF   International Classification of Functioning, Disability and Health

IQR   Interquartile Range

Med   Median

MnSq   Mean Square

POM   Pragmatics Observational Measure

PRISMA   Preferred Reporting Items for Systematic Reviews and Meta-Analyses

RCT   Randomised Controlled Trial

SD   Standard deviation

SEE   Social Emotional Evaluation

TACL   Test for Auditory Comprehension of Language

TIDieR   Template for Intervention Description and Replication

UKMRC   United Kingdom Medical Research Council

Explanation of Terms

The terminology used to describe autism is a topic of discussion amongst the community, but there is no current consensus. Throughout this thesis 'person first' language will be used when referring to individuals with a diagnosis of Autism Spectrum Disorder (e.g., child with autism). Person first language recognises a person's diagnosis is but a single characteristic rather than the defining feature of that person (Foreman, 2005). A recent survey of autism community members determined person first terms were endorsed by a majority of professionals in the community (Kenny et al., 2016), and was therefore deemed appropriate for this research given the readership of this thesis and its constituent journal manuscripts. The term *autism* is used in preference of autism spectrum disorder in recognition that individuals with autism view autism as a difference rather than a disorder (Kenny et al., 2016).

The terms *pragmatic language* and *pragmatics* are used interchangeably in this thesis to refer to behaviours related to the communicative, social and emotional aspects of social language. This definition was adopted in recognition of a growing body of literature and, thus, a deepening understanding of connections between pragmatic language, social cognition and emotional understanding (e.g., Fujiki, Brinton, & Clarke, 2002; Matthews, Biney, & Abbot-Smith, 2018; St Clair, Pickles, Durkin, & Conti-Ramsden, 2011).

The term *structural language* is used to refer to the language domains of phonology, morphology, syntax and semantics. These domains are conflated for the purpose of this thesis as they broadly refer to the structured, rule-based, content of communication. The term is used to differentiate these domains from pragmatic language which is predominantly related to the use of language to communicate rather than language content and form.

Foreman, P. (2005). Language and disability. *Journal of Intellectual and Developmental Disability, 30*(1), 57-59.

Fujiki, M., Brinton, B., & Clarke, D. (2002). Emotion regulation in children with specific language impairment. *Language, Speech, and Hearing Services in Schools, 33*(2), 102-111.

Kenny, L., Hattersley, C., Molins, B., Buckley, C., Povey, C., & Pellicano, E. (2016). Which terms should be used to describe autism? Perspectives from the UK autism community. *Autism, 20*(4), 442-462.

Matthews, D., Biney, H., & Abbot-Smith, K. (2018). Individual differences in children's pragmatic ability: A review of associations with formal language, social cognition, and executive functions. *Language Learning and Development, 14*(3), 186-223.

Chapter 1   Introduction

I commenced a Doctor of Philosophy (Occupational Therapy) to learn innovative and evidence-based ways to deliver speech and language interventions for children with autism. I was passionate about finding ways to deliver interventions that would be of benefit to these children, not just in the clinical setting, but in their daily lives. After working as a speech pathologist for a decade, I was very comfortable delivering interventions for children that targeted structural language (e.g., phonology, morphology, syntax, semantics). However, I wondered whether the interventions I was implementing were having a true effect on reducing the children's communication difficulties in the real world, away from the tables and chairs of the clinic room. Children were improving in the language activities they practised with me in a carefully controlled setting, but did these improvements translate into a better quality of communication in their interactions with family, peers, or teachers? I thought this question was especially critical for targeting the social communication difficulties experienced by children with autism. The instructional approach to pragmatic language intervention (i.e., building up children's knowledge of pragmatic language rules), which is conventional practice for most clinicians, did not seem sufficient to effect change in pragmatic language in daily life. Parents would tell me that their child 'knew the rules' but did not know how to 'follow them' in real social interactions, and this was especially true for children with autism. I could see a need for an intervention approach that bridged the gap between a child's knowledge about language rules, their capacity for using language, and the way they performed those language skills to participate in daily social situations.

The International Classification for Functioning, Disability and Health (ICF) was endorsed by The World Health Organization (WHO) member states in 2001, I had just commenced my undergraduate speech pathology degree. I learnt how the framework guided speech pathologists to implement interventions that built children's capacity for specific language skills, which had been usual practice to date, and extend goals to how those skills are performed in natural communicative interactions. However, during my training and after graduating, when it came to

pragmatic language interventions, I could see a discord between the interventions I knew I should be implementing based on this training, and the interventions that were within my clinical toolkit. Nearly two decades after the publication of the ICF, Westby (2018) pointed out that the majority of speech pathology interventions continued to focus on the discrete language skills a child was able to demonstrate under structured conditions.

I could see a clear need for pragmatic language interventions that considered children's communicative interactions in their daily lives with their usual social partners, in natural contexts, away from the structured practice conditions of the clinic. This motivated me to look outside my own profession to learn ways that other clinical processionals conceptualised and addressed the social difficulties experienced by children with autism. The primary goal of occupational therapy is to enable individuals to engage in meaningful activities. As such, the intervention principles used in occupational therapy seemed a fitting genesis to begin learning innovative ways to implement a pragmatic language intervention that impacted on how children with autism engage in daily social interactions. My PhD research has therefore centred on adapting a peer-mediated, play-based intervention, that originated in occupational therapy literature, and evaluating its feasibility, appropriateness and effectiveness as a pragmatic language intervention for children with autism.

Within this Introduction chapter I will explain the framework that guided this research, the definition of pragmatic language adopted for this thesis, and the pragmatic language difficulties associated with autism. Next, I will highlight the limitations within current pragmatic language intervention and the need for a complex intervention to address these limitations. Finally, I will describe the guidelines that informed the methodology of this research and the approach, principles and techniques utilised within the complex intervention, which, in turn, were evaluated through this thesis. I will conclude this chapter by stating an outline of the thesis and the aims of the research.

1.1 International Classification of Functioning Disability and Health as a framework for pragmatic language intervention

Speech pathologists play an important role in enhancing the social functioning of children with autism, as pragmatic language "…stands at the intersection of language and social skills…" (Volden, Coolican, Garon, White, & Bryson, 2009, p. 391). The ICF defines functioning as a complex interaction between an individual's health condition and the contexts in which they perform tasks (Figure 1.1). Disability can be caused by the features of a health condition (i.e., disability occurs when impairments in Body Functions and Structure lead to limitations in Activities and Participation restrictions), but disability is also a socially created construct and not a feature of the individual (i.e., Environmental Factors and Personal Factors can act as barriers or facilitators to functioning). Therefore, when planning an intervention to address the social functioning of children with autism, clinicians need to address: 1) the child's capacity for pragmatic language (Activity); 2) how children use pragmatic language in natural social contexts with important social partners (Performance), and 3) the places where those social interactions take place (Environmental Factors). At the same time, clinicians need to consider other Personal Factors (e.g., demographic factors, developmental, psychological or cognitive skills) that can facilitate or hamper therapeutic outcomes, as these will assist in tailoring interventions to the benefit of each individual child. Capitalisation of core ICF related terms will be used throughout this thesis to illuminate references to relevant elements of the ICF framework.
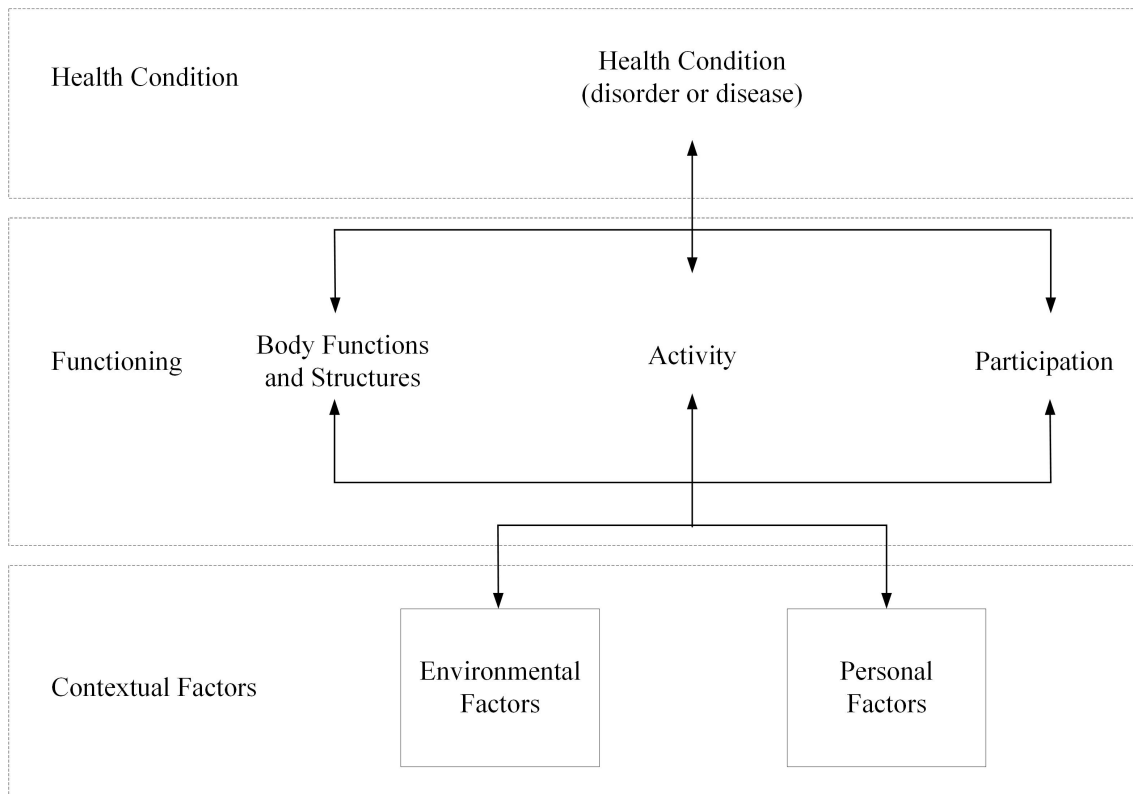
Figure 1.1. Interaction between functioning, health condition and contextual factors as conceptualised by the *International Classification of Functioning, Disability and Health* (World Health Organization, 2001).

In the area of language disorders, speech pathologists have traditionally implemented interventions centred around the remediation of disordered language skills (Activity level goals), while performance in everyday situations (Participation) and the contextual factors (Environmental and Personal Factors) that impact on daily functioning are often overlooked (Westby, 2018; Westby & Washington, 2017). This narrow approach to intervention is especially problematic for pragmatic language interventions, as it likely means that those interventions may not realise their core purpose, that is, to improve communication quality in the daily social interactions of the children who receive these interventions. Furthermore, pragmatic language interventions that have a strong capacity-building focus are likely to be of limited benefit to children with autism, as a common limitation of psychosocial interventions for children with autism is a lack of skill generalisation (Rao, Beidel, & Murray, 2008). As such, interventions that focus solely on capacity building are less likely to facilitate generalisation than interventions that also focus on Performance, Environmental and Personal Factors.

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There is a need for pragmatic language interventions to go beyond targeting children's capacity for pragmatic language and consider all components of functioning laid out in the ICF framework (e.g., also address how children use pragmatic language in naturalistic social interactions). To promote positive interactions with others and to be considerate towards others so that they have their own needs met, children must appropriately interpret social situations and the intentions of others. The integration of communication, socioemotional and cognitive skills is required so that children can join social interactions, continue those interactions in a cooperative manner, negotiate to have their own needs met, and resolve any conflicts that might evolve. Furthermore, children with autism require pragmatic language interventions that facilitate the generalisation of targeted skills beyond the clinical setting and into their daily social environments. Clinicians are therefore challenged to implement sophisticated pragmatic language interventions that: 1) enhance children's skills in important social activities, 2) improve children's ability to generalise skills to key social partners, and 3) consider the activities in which they engage and the environments where those activities occur.

1.2   Pragmatic language

When considering the development of a pragmatic language intervention, I needed to clearly understand and define the skills encompassed by the language domain of pragmatics. Pragmatic language is a complex, multifaceted construct that has been difficult to define and operationalise (Ariel, 2010). The concept of pragmatic language gained momentum in the literature in the 1970s and 1980s. Within linguistics, communicative phenomena were identified that could not be explained by the structural composition of language (i.e., syntax, semantics). Theorists identified problems with utterances that could not be explained by errors in syntax or semantics, and so the communicative functions of language, and differences between what is said (i.e., superficial meaning of language) and what is meant (i.e., how a spoken message should be interpreted) required development (e.g., Green, 1982; Grice, 1975; Kuno & Kaburaki, 1977; Lakoff, 1977). In a seminal text book on pragmatics, Levinson (1983) defined pragmatics as "…the study of language usage" (p. 6) but conceded the definition lacked specificity. Prutting and Kirchner (1987) identified further problems with regards to a lack of consensus around a

paradigm from which to view pragmatics. Since the 1980s, researchers have attempted to organise and operationalise pragmatics for clinical and research purposes; however, a lack of a theoretical consensus has led to great variability in the ways pragmatic language is defined and assessments and interventions are conceptualised (Adams, 2002; Camarata & Gibson, 1999).

More recently there has been an increased focus in the literature on the links between pragmatic language, and social and emotional understanding. Pragmatic language difficulties in childhood have been significantly associated with emotional problems and difficulties with peer relationships; a link that is unique to the domain of pragmatics and not apparent for structural language domains (e.g., semantics, syntax; St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). A significant inverse relationship between pragmatic ability and anxiety problems has been identified for children with autism, such that children with high anxiety scores tend to have lower pragmatic language abilities (Rodas, Eisenhower, & Blacher, 2017). There are also consistent associations within the literature between pragmatics and mentalising (i.e., skills encompassing "…children's understanding of themselves and others as mental beings who are guided by their attentional states, beliefs, desires, intentions, emotions, interests, and perspectives."; Matthews, Biney, & Abbot-Smith, 2018, p. 192). However, the current evidence for this association is broad and further investigation is required to link specific aspects of mentalising to specific aspects of pragmatics.

The ongoing exploration of connections between pragmatics and socioemotional understanding has resulted in some researchers adopting a definition of pragmatics that spans beyond the communicative aspects of social language, to also include communication behaviours related to social and emotional understanding (Adams, Baxendale, Lloyd, & Aldred, 2005; Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014). Similarly, this thesis adopts a definition of pragmatic language which encompasses the communicative, social and emotional aspects of social language. Cordier et al. (2014) operationalised this definition for school-aged children (5-11 years) through the development of the Pragmatics Observational Measure (POM) and later the POM-2 (Cordier et al., 2018). The measure conceptualises pragmatic language as comprised of verbal and nonverbal elements, and operationalises communication behaviours related to:

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- the appropriate introduction of suitable conversation topics;

- responding to the communication of others with contingent utterances that build on the topic;

- maintaining and changing topics appropriately

- effectively repairing conversation breakdowns;

- the use and interpretation of gesture, facial expressions, body posture and distance to promote social interactions;

- perspective taking;

- recognising and responding to the emotional state of another;

- regulating one's own emotions and behaviours;

- adapting language and behaviours to the social situation;

- maintaining engagement in a social interaction that is mutually beneficial; and

- employing ways to express emotions and resolve disagreements so that a positive interaction is maintained.

Pragmatic language difficulties have been identified in the language profile of children with a range of developmental disorders, but is receiving increased recognition in the most recent edition of the Diagnostic and Statistical Manual or Mental Disorders (DSM-5; American Psychiatric Association, 2013), which identifies pragmatic language difficulties as a cardinal feature of autism. Therefore, there is an urgent need for pragmatic language interventions that can target this core characteristic in the language profile of children on the autism spectrum.

1.2.1   Pragmatic language and Autism Spectrum Disorder

Autism is a neurodevelopmental disorder characterised by two key symptoms: difficulty with social communication and social interaction that persists across contexts, and restricted repetitive behaviours, interests or activities (American Psychiatric Association, 2013). The symptoms of autism are present during early development, and persist through childhood, adolescence and adulthood. Autism can co-occur with other psychiatric or developmental difficulties. For example, an estimated 70% of children with autism have at least one comorbid

psychiatric disorder (e.g., social anxiety, Attention Deficit Hyperactivity Disorder [ADHD], Oppositional Defiant Disorder), and 41% have two or more comorbid conditions (Simonoff et al., 2008). Approximately 50-70% of individuals with autism have an intellectual disability (Matson & Shoemaker, 2009). With regards to language, difficulties with pragmatic language are recognised as a hallmark within the communication profile of children autism, while difficulties within the structural domains of language are variable (Bishop, 2014).

Difficulties in the language domain of pragmatics are a fundamental feature of autism, and the differences in the social communication skills of children with autism and their typically developing peers have been documented for some time now. Compared with typically developing children and children with specific language impairment (SLI), children with autism tend to initiate verbal interaction and respond to questions with less frequency, and rarely use gestures (Bartak, Rutter, & Cox, 1975). Many studies have focused on the children's difficulties expressing emotions, and recognising and responding to the emotional states of others (Begeer, Koot, Rieffe, Terwogt, & Stegge, 2008). Also identified in the literature is the use of a narrowed range of communicative acts (Ziatas, Durkin, & Pratt, 2003) and difficulty judging how much information is appropriate to provide in utterances during social interactions (Tager-Flusberg, Paul, & Lord, 2005). These pragmatic language difficulties continue into adulthood; adults with autism attribute a sense of discomfort participating in social interactions to difficulties understanding implied meanings, interpreting and using non-verbal cues, making socioemotional inferences, and producing impromptu responses (Müller, Schuler, & Yates, 2008). While this list of difficulties is by no means exhaustive, it attests to the pervasive and lasting nature of pragmatic language difficulties for individuals with autism. All domains of pragmatics are impacted (i.e., introduction and responsiveness, nonverbal communication, social-emotional attunement, executive function, negotiation), so it is imperative that interventions for children with autism can address this broad range of skills.

1.3 Current approaches to pragmatic language intervention

The development of pragmatic language interventions is in its infancy. A systematic review of pragmatic language interventions for children (5-11 years) with SLI identified only eight

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studies, all classified as being at the 'exploratory' research stage. The authors concluded that while the interventions reviewed showed promise, efficacy had not been established through rigorous research methodology (Gerber, Brice, Capone, Fujiki, & Timler, 2012). Procedures within the interventions reviewed by Gerber et al. (2012) included parent training, meta-pragmatic discussions, role-play and modelling. However, the authors noted that the drill-like procedures that were commonly implemented within interventions for structural language (i.e., syntax, semantics, phonology) might be limited in effectiveness, as they were unlikely to achieve the functional goal of changing children's communication across social activities, contexts and communicative partners. Drill-like procedures can target specific, discrete pragmatic language skills in controlled activities; however, new intervention procedures would be required for pragmatic language interventions to reach full potential, by targeting children's Participation in naturalistic social interactions and Environmental Factors.

Due consideration of selecting an appropriate intervention activity context within which children practise pragmatic language skills is crucial for an intervention to have a true functional impact on children's social communication. Carefully selected contexts allow interventions to target all the key components of functioning identified by the ICF (i.e., Activity, Participation, Environmental Factors). Importantly for children with autism, Timler, Vogler-Elias, and McGill (2007) identified that the intervention context can also influence generalisation of skills to authentic social interactions. They also note that including a combination of contexts within an intervention will likely have the greatest impact on generalising skills to genuine peer-peer interactions.

In addition to the context of intervention delivery, Timler et al. (2007) identified three empirically supported approaches that promote the generalisation of social communication skills to peer-interactions interventions: 1) a system of least prompts; 2) peer-peer practice, and 3) strategies to promote self-monitoring. Through a system of least prompts, clinicians progress down a hierarchy of highly supportive to less supportive prompts, as children become increasingly independent in their execution of targeted communication skills. Practise during peer-peer interactions that mimic children's interactions in daily-life can promote

generalisation. Using this approach, clinicians should choose an authentic, age-appropriate social activity in which peer-peer practice can occur. Lastly, self-monitoring is required to promote generalisation. Essential for the development of self-monitoring is knowing that a target skill has been executed and that it has been executed appropriately. Therefore, clinicians should provide children with age-appropriate definitions of target skills and examples of the skills within interventions. The need to include self-monitoring strategies during pragmatic language interventions is also emphasised by Lockton, Adams, and Collins (2016), who found that many children with pragmatic language impairments were able to demonstrate an understanding of pragmatic language rules (i.e., capacity for pragmatic language), yet violated those same rules in naturalistic social interactions.

Jointly, the conclusions drawn by Timler et al. (2007), Gerber et al. (2012) and Lockton et al. (2016) support the need for the development of a pragmatic language intervention for children with autism that includes procedures outside conventional practice in the field of speech pathology (e.g., drill-like practice of discrete skills in controlled activities), to ensure all elements of the ICF are integrated into intervention procedures so that skill performance in naturalistic social interactions is both enhanced and generalised between contexts.

1.4 Development and evaluation of complex interventions

Clearly, a complex intervention is required to target the broad range of pragmatic language skills relevant to school-aged children with autism in such a way that all domains of functioning are included (i.e., Activity and Participation), in addition to contextual factors (Environment and Personal Factors) and procedures that promote generalisation. According to the United Kingdom Medical Research Council (UKMRC), features of complex interventions include: multiple active agents; multiple outcomes; targeting multiple difficult behaviours of the recipient; the use of a range of expert clinical skills (Craig et al., 2008). In addition, complex interventions often target multiple groups and involve a degree of tailoring or flexibility.

The UKMRC published guidelines for the development and evaluation of complex interventions in 2000, that was updated in 2008 (Craig et al., 2008). The guide identifies a four-

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stage approach for researchers to ensure appropriate methods are implemented for what is a complicated, multifaceted process (Figure 1.2). Adhering to the phases ensures researchers undergo a systematic approach to intervention development using theory and the existing evidence-base. To refine the intervention and evaluation process, researchers should conduct pilot studies to gain clarity around uncertainties within the design of the intervention and the research. A definitive evaluation of efficacy should also be followed by dissemination of the results and followed-up with further research on the implementation process.

Development Identify existing evidence Identify and develop theory Model process and outcomes	**Feasibility and piloting** Examine uncertainties identified during development Testing acceptability and procedures Estimate sample size, recruitment and retention
Implementation Dissemination of results Surveillance and monitoring Long term follow-up	**Evaluation** Assess effectiveness using experimental approach Identify factors associated with variation in outcomes Assess cost effectiveness

Figure 1.2. Phases of complex intervention development and evaluation described by (Craig et al., 2008).

While there is an imperative for evidence of an intervention's effectiveness, Evans (2003) also identified that a sole focus on efficacy provides only limited evidence for an intervention, and researchers should also gather evidence of feasibility and appropriateness. Feasibility refers to the impact of an intervention on the provider and the resources required for successful implementation and appropriateness refers to whether an intervention is acceptable to its recipients (Evans, 2003).

1.5   A new approach to pragmatic language intervention

This research followed the phases outlined in the UKMRC guideline to develop and evaluated a complex intervention for targeting pragmatic language in children with autism. The intervention principles afforded children a naturalistic social context in which to practise new pragmatic

language skills, the approach incorporated an important social partner through peer-mediation, and the techniques encouraged learning, self-monitoring and generalisation.

1.5.1 Development: Identifying theory

A play-based, peer-mediated intervention was developed and evaluated to improve the playfulness skills of children with ADHD. The intervention is based on the premise that play is a natural context for the development of social interaction skills, and a model that proposed children with ADHD have difficulties with play due to the symptomology associated with ADHD (Cordier, Bundy, Hocking, & Einfeld, 2009). The conceptual model, which underpins the social difficulties that children with ADHD experience, informed four principles indicating the intervention should: 1) capture children's intrinsic motivation to play; 2) include a typically-developing peer to encourage social play skills and friendship development; 3) promote parent involvement, and 4) include therapist-modelling to support cooperative play between children. Using these principles, a clinic-based intervention was developed, incorporating video-feedback and feed-forward techniques, peer-mediated play sessions within the clinic utilising peer and therapist modelling, and parent-mediated peer-peer play at home (Cordier et al., 2009). The intervention was trialled with children with ADHD, and was effective for improving children's playfulness, particularly in areas related to empathy (Wilkes-Gillan, Bundy, Cordier, Lincoln, & Chen, 2016).

Children with autism also demonstrate delayed and aberrant development in social play skills (Jordan, 2003), so Henning, Cordier, Wilkes-Gillan, and Falkmer (2016) adapted the intervention for children with autism, aged 4-11 years. Henning et al. (2016) adjusted the intervention model developed by Cordier et al. (2009) for children with ADHD and the recommendations within the literature for psychosocial interventions for children with autism. To make it suitable for children with autism, Henning et al. (2016) adapted and expanded on the intervention principles to include: 1) creating a safe environment that enables children to self-regulate and not become overwhelmed by sensory stimuli; 2) using the context of play and toys that meet the child's interests to capture the child's intrinsic motivation to play; 3) using video-modelling to promote the development of empathy; 4) including a familiar playmate to facilitate

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ongoing social interactions and friendship; 5) including therapist modelling in the play to support cooperative play between children; 6) adapting the language used within the intervention to accommodate children with structural language difficulties; and 7) actively involving parents so that children's development is supported following the intervention.

1.5.1.1 Integrating play and pragmatic language

Play is an essential childhood activity, and the context for the development and mutual reinforcement of cognitive, language, social and emotional skills (Parham, 2008). Much like pragmatic language theorists, play theorists have struggled to reach a consensus definition of play. Widely accepted characteristics of play include active and voluntary engagement, an absence of external goals, and pleasure and enjoyment (Jordan, 2003). This intervention is based on a model of play that contains four elements: intrinsic motivation, internal control, freedom to suspend reality, and framing (Bundy, 2004; Cordier et al., 2009). Play within the context of this intervention is therefore a transaction between an individual and the environment that is intrinsically motivating (i.e., the activity itself is the motivation for engagement), internally controlled (i.e., the individual decides their own actions and impact upon the activity), with the freedom to suspend reality (i.e., the usual constraints of reality do not apply). Crucial to this research project, play also includes the fourth element of 'framing', defined as the giving and receiving of social cues about how to interact (Bundy, 2004). Bundy (2004) defines framing as the use of easily recognisable verbal and nonverbal cues (e.g., facial expressions, body postures), and responding to the verbal and nonverbal cues of others. This play element of framing situates pragmatic language centrally within the core definition of play and pinpoints the intersection between pragmatic language and play; arguably the most important social context for language acquisition during childhood. Given there is a strong association between social play skills and pragmatic language skills, engagement in play presents as an age-appropriate social context to promote the use of pragmatic language skill performance during an intervention of school-aged children.

The use of peer-peer play as the context for the development of pragmatic language skills also ensures that the Participation element of the ICF is included within intervention procedures, as

participation in an authentic social interaction with a genuine social partner can be incorporated into the intervention. If the peers included in the intervention are known to the child with autism and have regular contact, they can be an active facilitator of generalisation, as children continue to interact in environments away from the clinic (Timler et al., 2007).

1.5.1.2   Peer-mediated practise

In this intervention, children with autism invited a typically-developing peer to attend weekly clinic sessions as a playmate. Similar aged peers become an increasingly important part of a school-aged child's social interactions, connecting children to a broader social world outside of their family (Cordier et al., 2009; Cordier, Bundy, Hocking, & Einfeld, 2010; Gifford-Smith & Brownell, 2003; Stocker & Dunn, 1990). The inclusion of a peer within a pragmatic language intervention facilitates the transactional nature of social-play (i.e., peer to peer interaction) as the mechanism through which pragmatic language can be addressed within the intervention. Peers also represent an important element of Participation within the ICF; a peer is required for children with autism to engage in social play in daily life.

Peers acted as a model of targeted pragmatic language skills for children with autism during play. As described by Timler et al. (2007), the inclusion of peer-peer interactions within an intervention can also act as a conduit to generalisation, as the interactions within the intervention mimic children's interactions in daily-life. Importantly for children with autism, emerging literature suggests that in addition to promoting generalisation, the inclusion of typically developing peers in interventions also aids in skill maintenance (Watkins et al., 2015). Peers are also trained in pragmatic language strategies to engage their peer with autism in a social play interaction and to maintain that interaction, by participating in video-feedback and -feedforward with the therapist.

1.5.1.3   Video self-modelling: video-feedback and -feedforward techniques

Each session within the intervention commenced with video-modelling, in conjunction with a therapist leading a discussion about targeted pragmatic language skills. Video-modelling techniques use video footage as demonstrative models of targeted skills. This intervention

utilised video self-modelling, a specific form of video-modelling, in the form of video-feedback and -feedforward. Children viewed edited video clips of their own play sessions and the therapist guided a discussion with the children about the observed skills using age-appropriate language (video-feedback). After viewing the feedback, the therapist verbally presented children with some achievable target skills for that day's play session (feedforward). Feedforward provides the opportunity for mental rehearsal of pragmatic language skills in a new sequence or social context (Dowrick, 1999).

Social learning theory predicts that by viewing themselves successfully performing targeted skills, or parts of a targeted skill, children will be motivated to perform those skills successfully again (Dowrick, 1999). Importantly for pragmatic language intervention, Timler et al. (2007) also note that video-modelling can promote the self-monitoring required to support generalisation. By viewing themselves as a model, children learn to monitor their own pragmatic language in a 'post hoc' fashion first, and then progress to monitor their own performance 'in real time'. For children with autism, video-modelling techniques have been associated with improvements in social communication, skill maintenance following intervention, and generalisation (Bellini & Akullian, 2007).

1.5.1.4 Therapist modelling techniques

The role of the therapist within the intervention was to facilitate and promote a cooperative and reciprocal play interaction between the child with autism and their peer. As the context for practise within the intervention was child-led free play, the therapist did not control or lead the activity, as is convention in many speech pathology interventions. This was an important distinction to make in the context of this intervention; if a therapist began to direct the interaction, the play elements of intrinsic motivation and internal control would be compromised and the interaction was at risk of becoming non-play. Instead, the therapist took on the role of a playmate to model the targeted pragmatic language skills, model supportive strategies to their typically-developing peer, and facilitate the interaction to ensure it remains play. Different to most existing pragmatic language interventions, this intervention required therapists to implement intervention strategies as dictated by the play; spontaneously and

unscripted. Similar to a system of least prompts, support from the clinician was graded. As children demonstrated improved performance of targeted pragmatic language skills during the intervention period, the therapist began to withdraw themselves from the play interactions by spending less time in the playroom. This aspect of the intervention allowed dyads to become more independent in their social interactions, with the ultimate aim of promoting continued participation in peer-peer play away from the clinic and to facilitate generalisation to new environments.

1.5.1.5 Parent involvement

The final component of the intervention was parent involvement. Parents are a crucial part of a child's home environment and their role within this intervention was to promote the generalisation of pragmatic language skills between the clinic and home environments. Parents attended weekly intervention sessions to observe children's play and therapist modelling on a screen from an adjacent room. Once the therapist withdrew from the playroom, they discussed intervention strategies with parents for implementation at home.

Parents were provided with a manual to read and a series of pre-recorded videos of fictional characters to view with their child between clinic sessions. The manual contained ten modules, each focussing on social play and communication skills that are challenging for children with social difficulties (e.g., initiating and maintaining interactions, nonverbal communication, perspective taking, problem solving and negotiation). The modules defined the target skills for parents, explained why they are important at home and at school, and described strategies parents can use to support their child's social play. A series of short (6-8 minute) pre-recorded videos accompanied the modules. The videos acted as a metaphor for the social play and communication difficulties children might experience. The fictional characters within the videos engaged in social-play activities that breakdown and then modelled strategies to repair the breakdowns with the assistance of three superheroes. Parents read one module within the manual per week and viewed one video per week with their child. Using the manual, parents facilitated a discussion with their child about the pragmatic language skills relevant to each

video. The video series provided children with a further opportunity to view models of targeted pragmatic language skills.

Parents also facilitated a weekly play-date in the home, involving their child with autism and their playmate. Prior to the playdate, parents prepared their child for the play-date by providing reminders about the pragmatic language targets practised within he clinic and proved feedback once the playdate was over. Through the play-date, children were afforded an opportunity to practise targeted skills in an environment away from the clinic, thus incorporating an important element of functioning (Environmental Factors) to promote generalisation.

1.5.2 Development: adapting the intervention processes for children with autism

After adapting the intervention principles and structure, Henning et al. (2016) piloted the play-based, peer-mediated intervention with children with autism. A multiple case study experimental design involving five children with autism and their five typically developing peer playmates, aged 4-11 years, was conducted. Playfulness was the outcome of interest, and results were mixed. There was an intervention effect for two children with autism, but a questionable effect for the other three children. Important to progressing the development of the intervention for children with autism, Henning et al. (2016) made a number of recommendations for the continued refinement and implementation of the intervention:

1. Playmates require careful selection;
2. Young playmates (5 years) are not ideal playmates as they tended to engage in less cooperative play and struggled with the cognitive demands of the intervention;
3. Parent perspectives of the intervention require formal evaluation; and
4. A protocol for evaluating generalisation of skills to children's home environment requires consideration to ensure children feel at ease while researchers visit their homes to observe their play.

Building on the work by Henning et al. (2016), this PhD project investigated whether this complex intervention is a feasible, appropriate and effective approach to pragmatic language

intervention for children with autism. The play-based approach to intervention and the techniques included have the potential to address the identified limitations of existing approaches to pragmatic language intervention.

1.6   Research aim

The overarching aim of this research was to further adapt and evaluate this play-based intervention for children with autism aged 6-11 years. Guided by the UKMRC framework for complex intervention development and evaluation (Craig et al., 2008), this research evaluated the feasibility, appropriateness and effectiveness of the intervention as a pragmatic language intervention.

1.7   Thesis outline

This thesis contains two traditional thesis chapters; Chapter 1, this Introduction, and Chapter 7 Discussion and Conclusion. These traditional chapters bookend five chapters presented as peer-reviewed journal manuscripts. Chapter 2 (Research Phase 1) continues to describe the development of the intervention by identifying the current evidence base for pragmatic language interventions for children with autism. Chapter 3 (Research Phase 2) establishes the feasibility and appropriateness of the intervention for children with autism and their families, and informs Research Phase 3 (Chapters 4, 5 and 6), an evaluation of intervention effectiveness and factors associated with variation in outcomes. Chapter 7, the Discussion and Conclusion, contains the primary lessons learned through the research and future research directions for the play-based intervention. References are provided at the end of each chapter. Chapters 2 and 3 have been published and Chapters 4-6 are currently under review. The chapters and manuscripts contained within this thesis are outlined in Figure 1.3.
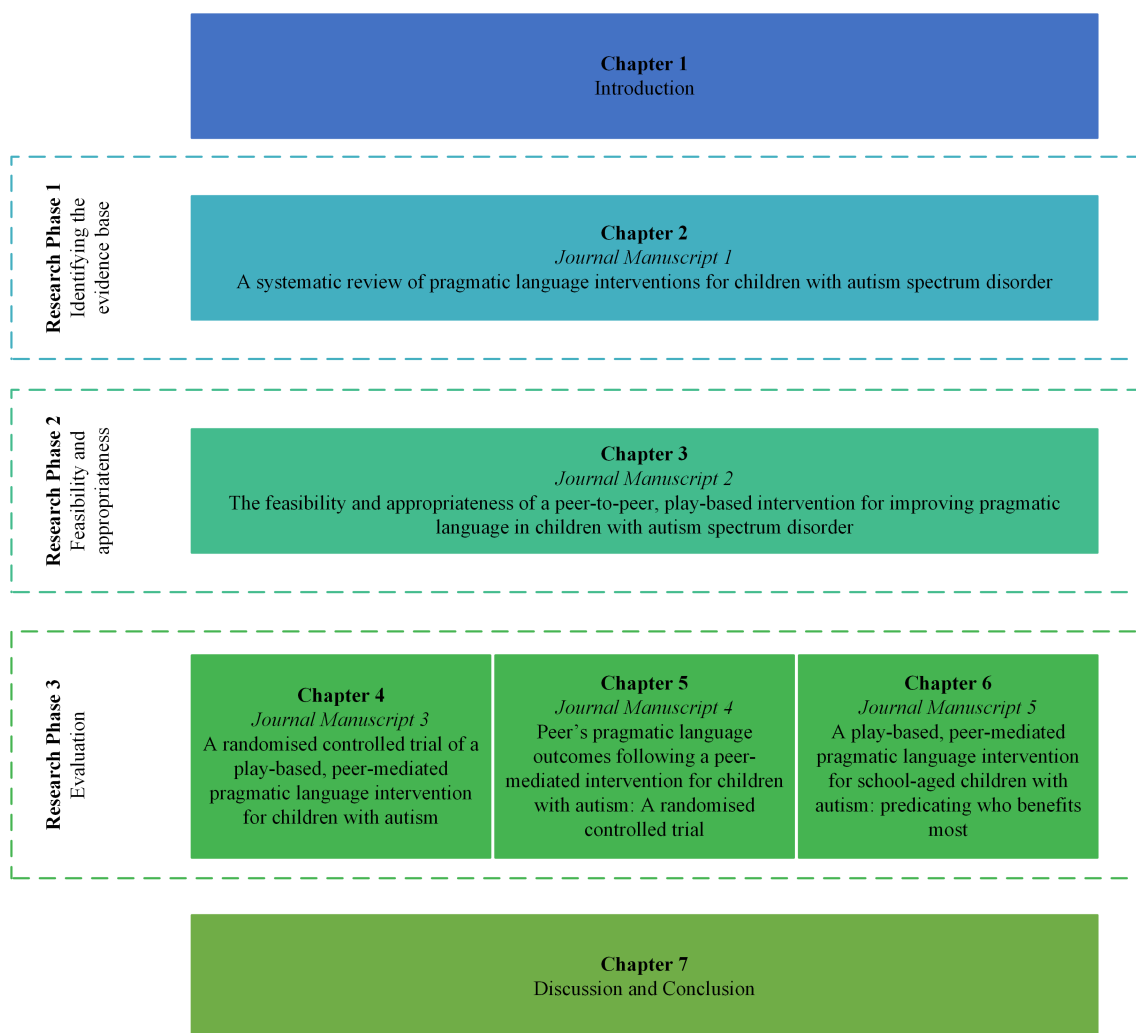
Figure 1.3. Thesis chapter outline

1.7.1   Research Phase 1: Identifying the evidence base

Craig et al. (2008) state that prior to evaluating the effectiveness of a complex intervention, the intervention must be developed to a point where it can be reasonably expected have a measurable intervention effect that is statistically and clinically significant. The theory and principles underlying the intervention have been developed and identified by Cordier et al. (2009) and Henning et al. (2016), and through section 1.5.1 of this Introduction Chapter. Henning et al. (2016), also began modelling the process of implementing the intervention with children with autism, making recommendations to increase the likelihood of success of the intervention in future phases of development and evaluation.

The first phase of this research completed the development phase of the UKMRC framework by identifying the evidence base. Chapter 2, a systematic review and meta-analysis, aimed to collate and understand the current evidence for pragmatic language interventions for children with autism. Specific research questions that guided this phase were:

1. What are the features of current pragmatic language interventions for children with autism?

2. What is the methodological quality of the studies investigating the effectiveness of those intervention?

3. Does intervention effect vary by the features of the interventions (e.g., setting of delivery, the person of focus, or the mode of delivery)?

4. Are current pragmatic language interventions more effective than no intervention or usual treatment practices?

5. Do the aforementioned intervention characteristics, child age, or type of outcome measure used mediate the effect of current pragmatic language interventions?

1.7.2 Research Phase 2: Feasibility and appropriateness

The second phase this research progressed the intervention into the feasibility and piloting phase of the UKMRC guidelines for complex intervention development and evaluation. The study aimed to optimise the intervention as a pragmatic language intervention for children with autism. In doing this, the feasibility of pragmatic language outcome measures was assessed and the appropriateness of the intervention for children with autism and their families was evaluated. Specific research questions guiding this phase were:

1. Which pragmatic language outcome measures are the most feasible to administer and most likely to detect an intervention effect in a larger trial?

2. Is a 10-week, clinic-based intervention an appropriate approach to delivering the play-based intervention for children with autism and their families?

1.7.3 Research Phase 3: Evaluation

The final phase of the research addressed the evaluation phase of the UKMRC guidelines and compromised three studies. These studies aimed to examine the effectiveness of the play-based

intervention as a pragmatic language intervention for children with autism following a randomised controlled trial. The first study, Chapter 4, evaluated the effectiveness of the intervention for improving the pragmatic language of children with autism. Research questions that guided this study were:

1. Is a play-based, peer-mediated intervention effective for improving the pragmatic language of children with autism during play with a typically developing peer?
2. Are intervention effects maintained at 3-month follow-up?
3. Do children with autism generalise pragmatic language skills between the clinic and home environments?
4. What factors moderate the intervention effect for children with autism who participate in the intervention?

The second study within Phase 3, Chapter 5, evaluated the pragmatic language outcomes for the typically-developing peers involved in the intervention. Similar to the evaluation of outcomes for children with autism, the research questions that guided this phase were:

1. Is a play-based, peer-mediated intervention effective for improving the pragmatic language of the typically developing peers who attend the intervention?
2. Are intervention effects for peers maintained 3-months following the intervention?
3. Following the intervention, do peers demonstrate the same levels of pragmatic language performance in the clinic and homes of their peers with autism?
4. What factors moderate the intervention effect for peers who participate in the intervention?

The final study in this thesis, Chapter 6, investigated factors associated with variation in children's outcomes by establishing the characteristics of children with autism who received the greatest benefits from the intervention. The specific research question that guided this study was:

1. What are the individual characteristics of the children with autism who benefit most from the play-based, peer-mediated pragmatic language intervention?

1.7.4　　　　　　　**Discussion and Conclusion**

The final chapter of this thesis (Chapter 7) provides a synthesis of the research findings framed through the lens of the ICF. Future research directions are discussed for this intervention and pragmatic language interventions for children with autism more generally. Strengths and limitations of the research are identified along with implications for clinical practice.

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Chapter 2   Systematic Review and Meta-analysis
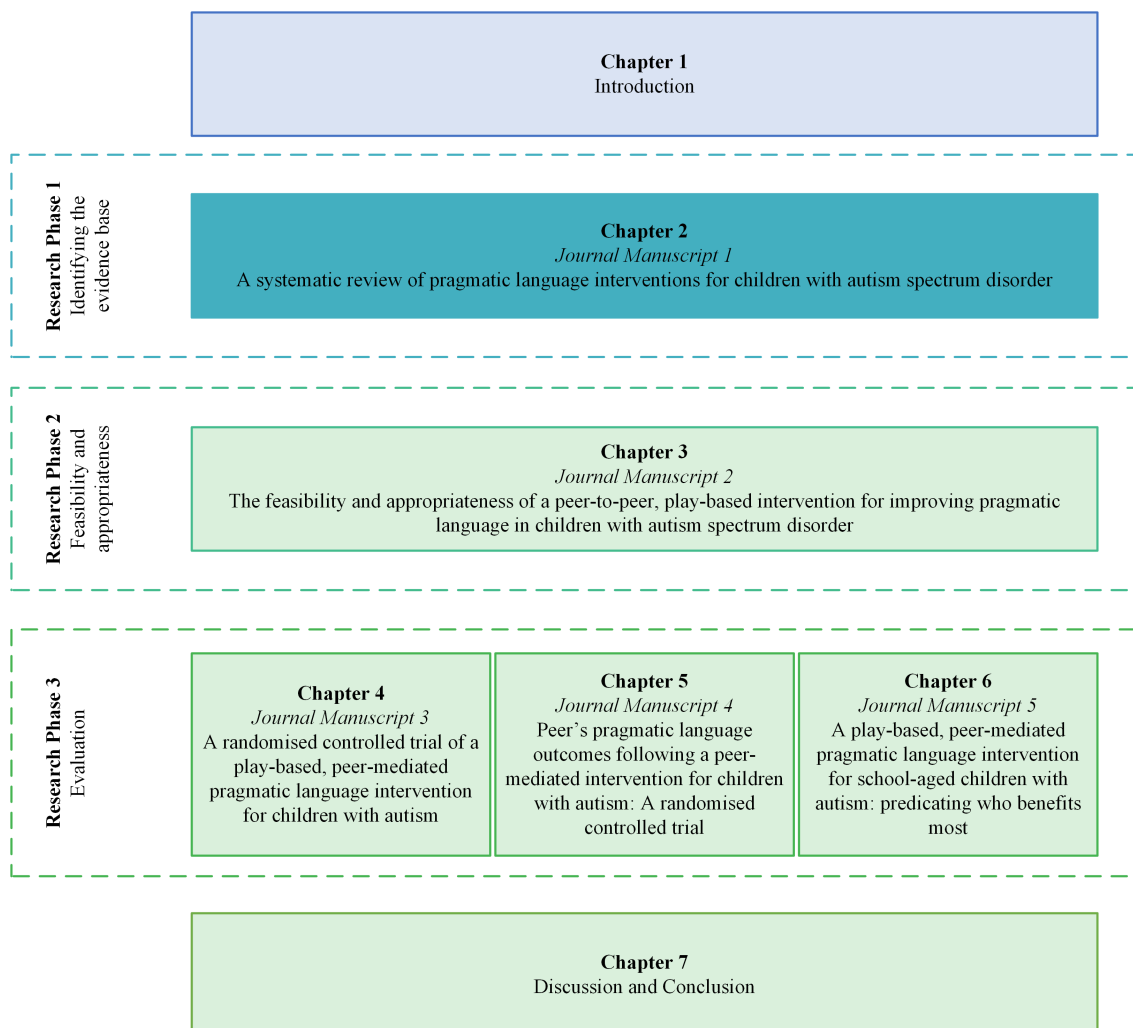
This chapter details Phase 1 of the research: identifying the evidence base. The UKMRC guidelines highlight the importance of identifying the existing evidence base for similar interventions to understand what has already been done, what procedures are effective, and gaps that new interventions need to address. A systematic literature review of randomised controlled trials (RCTs) of existing pragmatic language interventions for children with autism was conducted to complete this aspect of intervention development. RCTs provide the highest possible level of evidence for a single study of an intervention (Level II evidence), so the decision was made to only review interventions at this stage of development (National Health and Medical Research Council, 1999).

The review described current interventions in relation to the skills targeted, the people targeted, procedures for delivering the interventions and the environments in which the interventions are delivered. The review also described study design, outcome measures used, the findings of each study, and an appraisal of the quality of research methodology for each study. The meta-analysis compared intervention effects between intervention approaches, and the intervention characteristics that mediated intervention effects were assessed by grouping studies according to aspects of the interventions (e.g., setting of delivery, the person of focus, or the mode of delivery) for meta-regression.

Journal Manuscript 1

A systematic review of pragmatic language interventions for children with autism spectrum disorder

Lauren Parsons[1*], Reinie Cordier[1], Natalie Munro[1, 2], Annette Joosten[1], Renée Speyer[3]

[1] School of Occupational Therapy and Social Work, Curtin University, Perth, WA, Australia

[2] Faculty of Health Sciences, The University of Sydney, Sydney, NSW, Australia

[3] College of Healthcare Sciences, James Cook University, Townsville, QLD, Australia

*Corresponding author

Email: lauren.parsons@curtin.edu.au (LP)

2.1   Abstract

There is a need for evidence-based interventions for children with autism spectrum disorder to limit the life-long, psychosocial impact of pragmatic language impairments. This systematic review identified 22 studies reporting on 20 pragmatic language interventions for children with ASD aged 0-18 years. The characteristics of each study, components of the interventions, and the methodological quality of each study were reviewed. Meta-analysis was conducted to assess the effectiveness of 15 interventions. Results revealed some promising approaches, indicating that active inclusion of the child and parent in the intervention was a significant mediator of intervention effect. Participant age, therapy setting or modality were not significant mediators between the interventions and measures of pragmatic language. The long-term effects of these interventions and the generalisation of learning to new contexts is largely unknown. Implications for clinical practice and directions for future research are discussed.

2.2   Introduction

A core characteristic of autism spectrum disorder is a deficiency in social communication and interaction. A wide range of verbal language abilities are reported in individuals with autism, but a striking feature about their language profile is a universal impairment in pragmatic language (Paul & Norbury, 2012). This review will focus on interventions that target the pragmatic aspect of language. Early definitions of pragmatic language refer to the use of language in context; encompassing the verbal, paralinguistic and non-verbal aspects of language (Prutting & Kirchner, 1987). Contemporary definitions have expanded beyond just communicative functions to include behaviour that includes social, emotional, and communicative aspects of language (Adams, Baxendale, Lloyd, & Aldred, 2005). This expansion reflects an understanding that pragmatic language, social skills and emotional understanding are interconnected, and this definition of pragmatic language will be used for this review. While this definition encompasses pragmatics en masse, one of the challenges for a systematic review on pragmatic language interventions for children with autism is identifying the skills of pragmatics that are actually targeted. The following sections therefore provide a brief summary of pragmatic language development, the skills identified as problematic in children with autism and a framework for classifying interventions.

Pragmatic language behaviours emerge during the prelinguisitic phase of language development. Early language is typically characterised by a combination of gestures, vocalisations, and simple phonetic forms (Snow, Pan, Imbens-Bailey, & Herman, 1996). While linguistically simple, these acts are social in nature and are interpreted by adults as communicative in intent, leading to descriptions of children as 'pragmatically precocious' (Snow et al., 1996). Further, joint attention acts as a scaffold for the development of social communication (Snow et al., 1996). Children with autism display a lack of joint attention that begins in infancy, and therefore display developmental differences in related communicative acts, such as the use and comprehension of gestures, and attention to a social partner and a shared topic (joint engagement) (Mundy, Sigman, & Kasari, 1990). Further, approximately 30% of individuals with autism develop only minimal verbal communication (Tager-Flusberg & Kasari, 2013), so interventions that target these early, preverbal stages of pragmatic language are

developmentally important for children with autism as they can enhance future language and social development (Bono, Daley, & Sigman, 2004).

During typical development, a range of communicative acts emerge and continue to develop as structural language develops, conversational topic maintenance emerges in interactions with adults, and the appropriateness of responses increases (Paul & Norbury, 2012; Snow et al., 1996). The communicative, social and emotional aspects of pragmatic language have recently been described in 27 observable communicative behaviours, classified into five domains relevant for children aged 5-11 years (Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014). The domains are: 1) Introduction and responsiveness (the ability to introduce communication and be responsive to the communication of others); 2) Non-verbal communication (the use and understanding of gestures, facial expressions, body postures and proximity between speakers); 3) Social-emotional attunement (interpreting the emotional reactions of others and demonstrating appropriate responses); 4) Executive function (attending to interactions and flexibility in planning communicative content) ; and 5) Negotiation (cooperating and negotiating appropriately with communicative partners). For children with autism who develop verbal language, previously described pragmatic difficulties persist and further pragmatic language deficits evolve, including fewer and often unskilled attempts at initiating communication, narrower ranges of communication acts, and difficulties producing novel language (Aldred, Green, & Adams, 2004).

Documentation about the typical progression of pragmatic language into adolescence is scarce. However, mastery of earlier emerging conversational skills such as cohesion, appropriate referencing, and providing adequate responses is reported, along with an equal distribution of conversational burden, and an ability to adapt speaking style to one's conversational partner or context (Ciccia & Turkstra, 2002). Despite the limited knowledge on what is typical in adolescence, some differences in pragmatic language competence in individuals with autism have been reported, such as poor conversational topic management, the contribution of irrelevant information to conversations, unusual prosody, reduced reciprocity and responses to partner cues, and inappropriate eye-gaze (Paul, Orlovski, Marcinko, & Volkmar, 2009).

In summary, deficits in pragmatic language affect individuals with autism throughout childhood necessitating effective, evidence-based interventions that can minimise the isolating, and long-term impacts of pragmatic language difficulties. Two studies have reported increased feelings of loneliness and poorer friendship quality in children and adolescents with autism when compared to typically developing peers as a result of reduced pragmatic language skills (Bauminger & Kasari, 2000; Locke, Ishijima, Kasari, & London, 2010). Long-term outcomes have been studied in a sample of adults identified during childhood as having either a pragmatic language impairment (PLI) or autism (Whitehouse, Watt, Line, & Bishop, 2009). Participants with autism were found to have substantial pragmatic difficulties that persisted into adulthood, and the quality of social relationships were poor for both adults with autism and PLI. No participant in the autism group reported any close friendships or romantic relationships.

A recent review of 26 spoken language intervention studies for children with ASD found a small effect on structural language competence (Hampton & Kaiser, 2016), but to date there is no review of interventions that target pragmatic language in children and adolescents with autism. The purpose of this study is to conduct a systematic review and meta-analysis of pragmatic language interventions for children with autism. The review will describe the studies reporting on pragmatic language interventions for children with autism and the characteristics of the included interventions, and evaluate the methodological quality of the included studies. A meta-analysis will be conducted to answer the following research questions: 1) do different settings (i.e., home, clinic, or school), person(s) of focus (i.e., child, parent, or both), or intervention modalities (i.e., individual, group, or both) produce different intervention effects?; 2) are pragmatic language interventions more effective than no treatment or usual treatment practices?; and 3) do participant age, type of outcome measure, or the aforementioned intervention characteristics mediate intervention effect?

**2.3	Methods**

The PRISMA statement guided the methodology and reporting of this systematic review and the review was registered with the PROSPERO register of systematic reviews (registration number CRD42015029161). A completed PRISMA checklist is provided in Appendix B.

**2.3.1	Information Sources**

A comprehensive literature search was initially conducted using subject headings and free-text strings across five electronic databases on April 8, 2015. An updated free-text search of the same databases was conducted on May 14, 2016 to capture any new papers published since the original search. The databases searched were: CINAHL, Embase, Eric, PsychINFO and PubMed. A Google Scholar search was also conducted on November 26, 2015, and a search within autism focused journals was conducted on November 30, 2015 in order to identify any additional articles. The speechBITE website (www.speechbite.com), a database of intervention studies in the field of speech pathology created and maintained by an advisory committee based in the Discipline of Speech Pathology at The University of Sydney, was searched for interventions pertaining to pragmatics/social communication for children in the ASD population. Evidence-based Practice Briefs published on SpeechandLanguage.com (www.speechandlanguage.com/ebp-briefs) were searched. SpeechandLanguage.com is a professional development focused site for speech pathologists maintained by Pearson. Finally, reference lists of included articles were searched to identify additional studies.

**2.3.2	Search Strategy**

In searching electronic databases two search categories were combined: 1) fields in language studies (pragmatics, social language, social communication, paralinguistics, nonverbal communication, prosody, social behaviour, social skills, communication, communication disorders, child language, verbal behaviour, language, language tests, language therapy, language development disorders, speech therapy) and 2) disorder (autism, autism spectrum disorder, autistic disorder, pervasive developmental-disorder not otherwise specified, Asperger syndrome, Rett syndrome, child disintegrative disorder). As no database contained a subject heading related to pragmatic language,

more general terms in the field of language and social skills were included in an attempt to capture all literature on the subject; thus casting a wide net. Limitations were applied for participant age (0-18 years), and English language. Free text searches were also conducted in all databases for papers published between April 8, 2014 and May 14, 2016. The full search strategy, including subject headings, free-text and limitations for each database is provided in Appendix C.

2.3.3   Eligibility Criteria

As pragmatic language difficulties present at a very young age in children with ASD and persist into adulthood, it is necessary for therapists to provide pragmatic language interventions to children throughout their development. This review will therefore assess the range of interventions available to address pragmatic language difficulties through childhood and adolescence. In order to classify pragmatic language skills for the purpose of this review, the five domains of Introduction and Responsiveness, Non-verbal Communication, Social-emotional Attunement, Executive Function and Negotiation are used as a framework (Cordier et al., 2014). While the pragmatic language behaviours that these domains encompass are indented for children aged 5-11 years, the pragmatic behaviours of early intentional communication observed in children younger than five years are nonetheless subsumed within the domains (e.g., uses and responds to a variety of gestures, initiates verbal communication, responds to the communication or others). This was deemed the most appropriate contemporary framework to utilise in the absence of a pragmatic language classification system that adopts a developmental approach.

To be included in the review, articles were required to meet the following criteria: 1) participants were children (aged 0-18 years) with a primary diagnosis of autism (including Asperger syndrome, or PDD-NOS for children diagnosed prior to the Diagnostic and Statistical Manual of Mental Disorders (DSM) - Fifth Edition), with or without an intellectual disability; 2) treatment focused on preverbal pragmatic language behaviours or at least one of the behaviours broadly encompassed by the pragmatic language domains of pragmatic language domains of Introduction and Responsiveness, Non-verbal Communication, Social-emotional Attunement, Executive Function and Negotiation; 3) studies included a control group with random assignment to groups; 4) treatment outcomes measured

at least one of the skills encompassed by the definition of pragmatic language adopted for this review. Only papers published in English in peer reviewed journals were considered for this review. Pharmacological interventions were excluded. Outcome measurements of autism symptom severity were not considered assessments of pragmatic language for the purpose of this review. These criteria were used in order to identify all randomised controlled trials of pragmatic language interventions for children with ASD.

2.3.4 Systematic Review

2.3.4.1 Methodological Quality

The Standard Quality Assessment criteria for evaluating primary research papers from a variety of fields (Kmet checklist) was used to assess the methodological quality of the included studies (Kmet, Lee, & Cook, 2004). The 14-item checklist utilises a 3-point, ordinal scale (0 = no, 1 = partial, 2 = yes), giving a systematic and quantifiable means for assessing the quality of studies of a variety of research designs (Kmet et al., 2004). Checklist items assess the sampling strategy, participant characteristics described, sample size calculations, sample size collection, description and justification of analytic methods, result reporting, controls for confounding variables, and whether conclusions drawn reflect results reported. An overall quality percentage score can be calculated by dividing the total score rated by the maximum possible score, and studies were then classified based on that score. The following convention was used for the classification of methodological quality (Lee, Packer, Tang, & Girdler, 2008; Millard, Elliott, & Girdler, 2013): a score of >80% was considered strong quality, a score of 70-79% was considered good quality, 50-69% was considered fair quality and <50% was considered to have poor methodological quality.

2.3.4.2 Data Collection Process

Comprehensive forms were developed in order to extract relevant data from the included studies. Data on study characteristics were extracted for the following categories: participant diagnosis, control group, age range (mean and standard deviation), study eligibility criteria, treatment condition, outcome measures and treatment outcomes. Extraction of data pertaining to intervention components

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was guided by the TIDieR Checklist, a 12-item checklist that guides the reporting of intervention studies so that procedures can be replicated by other researchers and clinicians in the field (Hoffmann et al., 2014). Data were extracted for skill(s) targeted, materials and procedures, interventionists, duration and setting/mode of delivery, tailoring/modifications, methods of blinding and randomisation. Data relating to methodological quality were extracted in accordance with the Kmet checklist.

2.3.4.3 Data Items, Risk of Bias and Synthesis of Results

All abstracts were reviewed by one researcher for inclusion, and a second researcher reviewed a randomly selected 40% of the abstracts to ensure accuracy in study selection for the review. The same assessors also rated the extracted data pertaining to methodological quality of all included studies using the Kmet checklist. Interrater reliability between the two independent assessors was established for both the abstract selection and Kmet ratings of each included study. The likelihood of bias was reduced in the extraction of data and in ratings of study quality for this review, as none of the reviewers have any affiliations with any of the authors of the included studies. Data was synthesised and summarised into a number of categories including study design, participant characteristics, inclusion criteria, treatment components and outcomes, and methodological quality. Treatment effectiveness was assessed using significance values and effect sizes of the main pragmatic language outcome measure.

2.3.5 Meta-Analysis

Subsampling was chosen as the predominant analytic technique for this review, as the small number of included studies limited the viability of meta-regression using multiple covariates. Data was extracted from the included studies to measure the overall effect of pragmatic language interventions for children with autism, and treatment effect as a function of the following intervention characteristics: 1) setting (i.e., home, school or clinic); 2) focus of the intervention (i.e., child, parent and child, parent only), and; 3) the mode of delivery (i.e., individual or group). An analysis of the interventions based on the pragmatic language skills targeted was considered; however, grouping

interventions in this way would cause a comparison of a large number of small groups, thus limiting the conclusions that could been drawn from the results.

Meta-regression was conducted to determine whether participant age, type of outcome measure, or any of the three aforementioned intervention components mediated intervention effect. The study sample size (17) allowed for multivariate analysis involving up to two covariates without compromising power (Hedges & Pigott, 2004), so one multivariate model addressed the interaction between participant age and mode of intervention delivery. This model was selected as participant age potentially confounded the results of the subgroup analysis pertaining to mode. Lastly, between-groups analyses assessed the difference in post-intervention social communication competence of those who received a pragmatic language intervention and their comparison controls who were groups by condition type (i.e., no treatment, treatment as usual, or an alternative treatment).

To compare effect sizes, pre- and post- means, standard deviations, and sample sizes were extracted. If the data required for meta-analysis calculations was not reported, attempts were made to contact authors in order to request the desired data. In cases where more than one paper reported on the same study sample, the paper reporting an outcome measure that evaluated the greatest number of pragmatic language skills covered by the definition adopted for this review was chosen for the analysis. Studies reporting on follow-up data only were also excluded. When multiple outcome measures of social communication were reported for one intervention, the measure that evaluated the greatest number of pragmatic language skills was extracted for analysis. If a single outcome measure could not be chosen, then means for multiple measures of pragmatic language were averaged and pooled standard deviations were calculated for the meta-analysis.

Extracted means, standard deviations, and sample sizes for pre- and post- measures were entered into Comprehensive Meta-Analysis, Version 3.3.070. A random effects model was used to generate effect sizes as the included studies are not likely to have the same true effect due to the variability in the sampling, intervention characteristics, skills targeted, participant characteristics and outcome measures utilised.

Heterogeneity was estimated via two methods. The Q statistic determines the spread of all effect sizes around the mean effect size. As Q can be poor at detecting heterogeneity in analyses with low power, I^2 was also examined (Higgins, Thompson, Deeks, & Altman, 2003). The I^2 statistic estimates the ratio of true variance to total variance. For all sub-group analyses the Hedges g formula for standardised mean difference (SMD) with a confidence interval of 95% was used to report effect sizes. Using Cohen's d convention for interpretation, an effect size of ≤0.2 reflects negligible difference, between ≥ 0.2 and ≤ 0.49 was considered as small; between ≥ 0.5 and ≤ 0.79 was considered as moderate; and ≥ 0.8 was considered as large (Cohen, 1988).

Given that studies that report large and significant treatment effects are more likely to be selected for publication, it is possible that some low-effect or non-significant interventions are missing from the meta-analysis. The presence of publication bias was assessed using classic fail-safe N. The test calculates the number of additional studies that, if added to the analysis, would nullify the measured effect (N). If N is large it can be considered unlikely that there would be so many unpublished low-effect studies and it can be assumed that the meta-analysis is not compromised by publication bias.

2.4   Results

2.4.1   Study Selection

A total of 2,909 papers were identified through the initial subject heading and free text searches across the following databases: CINAHL, Embase, Eric, PsychINFO and PubMed. A further 29 records were identified via Google Scholar, autism specific journals, speechBITE, and SpeechandLanguage.com. These 2,938 studies were screened for duplicate titles and abstracts and 840 duplicated records were removed. The updated database search added a further 793 unique abstracts for screening. Two reviewers rated abstracts for inclusion. The first author assessed all 2,891 eligible abstracts against the inclusion criteria, with a randomly selected 40% of the studies assessed by a second rater for inter-rater reliability. The agreement between raters measured by Weighted Kappa was 0.84 (95%CI: 0.66 - 1.00). There were only three abstracts in the random selection on which the raters did not agree, so all three records were included for further full text screening.

After assessing abstracts on the criteria for inclusion a total of 36 studies were identified. Full text records were accessed via Curtin University and the University of Sydney libraries to further determine whether the studies met the criteria for inclusion in this review. Of these 36 studies, seven were not randomised controlled trials, five did not have an outcome measurement that assessed pragmatic language, two did not include participants with autism, and one was not published in a peer reviewed journal (Figure 2.1). References for the 15 studies excluded and reasons for exclusion are presented in Table 2.1. A total of 21 papers, reporting on 18 different intervention studies were selected for inclusion based on the inclusion criteria (Figure 2.1). All of the included studies used a randomised controlled design, included participants aged 0-18 years with a diagnosis of autism, and performed an intervention that aimed to improve any of the pragmatic language skills incorporated by the definition of pragmatic language adopted for this review.
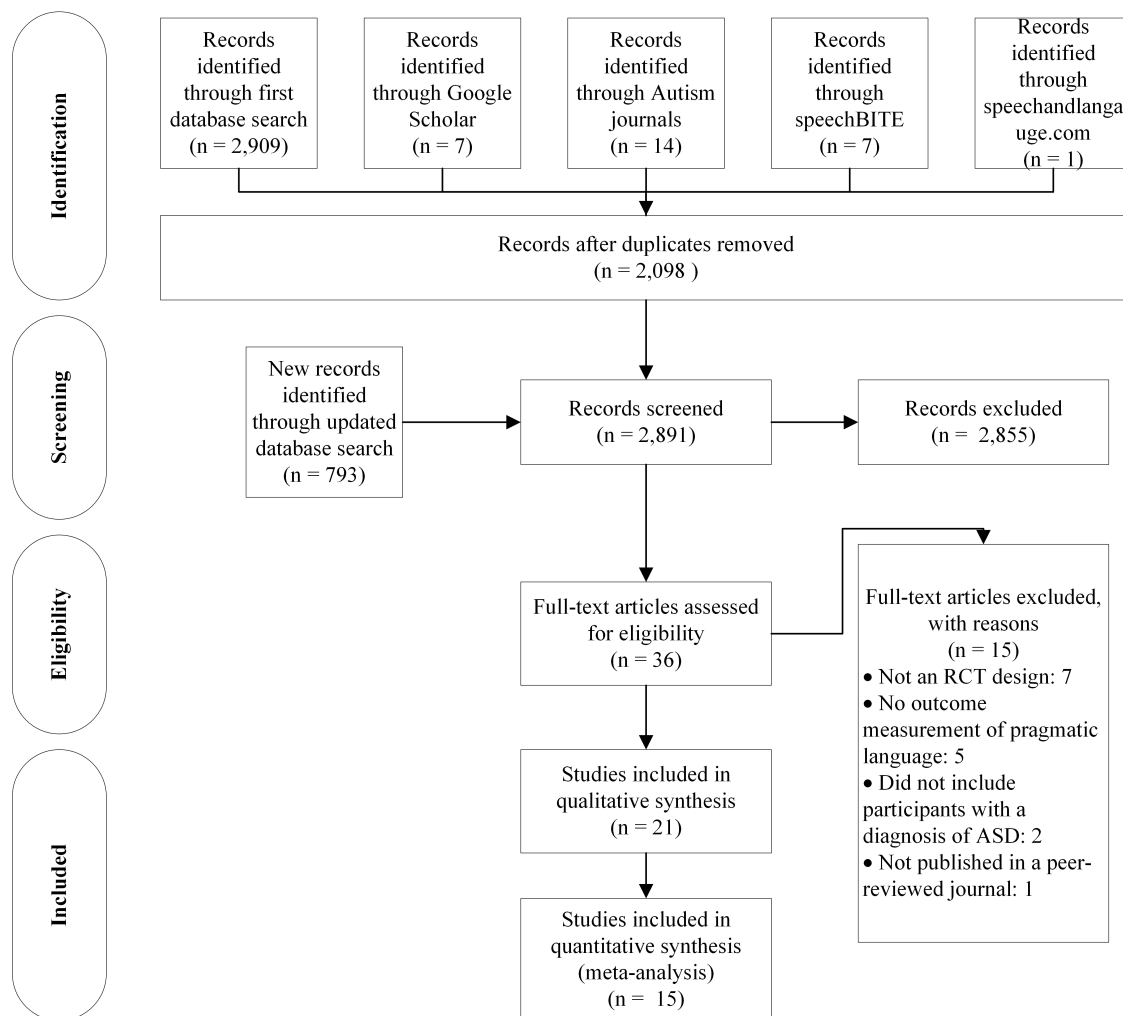
Figure 2.1. Study flow diagram.

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Table 2.1. Excluded studies with reasons for exclusion

Study	Reason for exclusion
Gattino, dos Santos Riesgo, Longo, Loguercio Leite, and Faccini (2011)	No outcome measurement that assessed pragmatic language
Ichikawa et al. (2013)	No outcome measurement that assessed pragmatic language
Kasari, Rotheram-Fuller, Locke, and Gulsrud (2012)	No outcome measurement that assessed pragmatic language
Lerner and Mikami (2012)	No outcome measurement that assessed pragmatic language
Wong and Kwan (2010)	No outcome measurement that assessed pragmatic language
Houghton, Schuchard, Lewis, and Thompson (2013)	Not a randomised controlled trial
McFadden, Kamps, and Heitzman-Powell (2014)	Not a randomised controlled trial
McMahon, Vismara, and Solomon (2013)	Not a randomised controlled trial
Oosterling et al. (2010)	Not a randomised controlled trial
Radley, Ford, Battaglia, and McHugh (2014)	Not a randomised controlled trial
Shire et al. (2014)	Not a randomised controlled trial
Wetherby et al. (2014)	Not a randomised controlled trial
Adams et al. (2012)	Participants did not have a core diagnosis of ASD
Kamps et al. (2014)	Participants did not have a core diagnosis of ASD
Donaldson (2015)	Not published in a peer reviewed journal

2.4.2 Description of Studies

Tables 2.2-2.5 include a detailed description of the included studies. Data points were collected and synthesised as follows: Intervention studies for improving pragmatic language in children with autism (Table 2.2), intervention components (Table 2.3), pragmatic language skills targeted (Table 2.4), and the methodological quality of included studies (Table 2.5).

2.4.2.1 Study Participants

The 21 studies that met the eligibility criteria included 925 participants aged between 21 months and 14 years of age. Of the 21 included studies, 11 studies included preschool aged children (younger than

5 years), and 10 studies included primary/elementary school aged children (aged between 5 and 12 years inclusive). None of the included studies targeted children aged 13-18 years.

All intervention and control group participants had received a diagnosis of autism in accordance with the DSM-IV or DSM-5 prior to being included in all studies. No study included control groups from different clinical populations or typically developing children. Autism diagnosis was confirmed in 20 studies by administering standardised assessments of autism symptomology to participants, and one study confirmed diagnosis via diagnostic documentation from qualified community clinicians (Lopata et al., 2010). The absence of an intellectual disability or another neurological or developmental disability was a criterion for inclusion for 12 studies. Of these 12 studies, nine assessed cognitive capacity for inclusion using a standardised assessment appropriate for the age of the included participants, and the remaining three utilised parent report as the children were too young to undertake formal IQ testing (i.e., under 6 years of age). Three studies required that participants demonstrate age appropriate expressive or receptive language prior to inclusion (Lopata, Thomeer, Rodgers, Donnelly, & McDonald, 2016; Lopata et al., 2010; Thomeer et al., 2015). Treatment group sample sizes ranged from five to 59, with nine of the papers reporting calculations of power to determine an appropriate sample size. Further details on participant characteristics are summarised in Table 2.2.

Table 2.2. Characteristics of included studies

Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
The Junior Detective Program (TJDP): Emotion recognition through gesture, posture, prosody; Initiating and maintaining a conversation	Beaumont and Sofronoff (2008) Australia	Treatment: 26 / Control: 23	9.64 ± 1.21 / 9.81 ± 1.26	Inclusion: Autism diagnosis, Short form WISC-III score ≥85, Aged 7 ½-11 years	Assessment of Perception of Emotion from Facial Expression / Assessment of Perception of Emotion from Posture Cues	Significant improvement in both groups. No significant difference between groups. / Significant improvement in both groups. No significant difference between groups.
Milton & Ethel Harris Research Initiative (MEHRI) treatment: Engage in conversations or proto-conversations; Use ideas and language functionally	Casenhiser, Shanker, and Stieben (2013) Canada	Treatment: 25 / Control :26	3.54 ± 0.73 / 3.87 ± 0.69	Inclusion: Autism diagnosis; Chronological age 24-59 months	mCBRS: Initiation of Joint Attention subscale	Improvements made by intervention group were significantly higher than controls.
	Casenhiser, Binns, McGill, Morderer, and Shanker (2015) Canada	See Casenhiser et al. (2013)	See Casenhiser et al. (2013)	See Casenhiser et al. (2013)	25-min child-parent play session coded for response types (response to comments, obligatory responses, and contingent responses) / 25-min child-parent play session coded for communicative acts (commenting, labelling, responding, directing,	Treatment group made significantly greater increase in use of obligatory and contingent responses. No significant difference between groups in production or responses to comments. / Post-hoc analysis showed significant time x group interactions for: commenting, labelling, sharing, obtaining

Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
					information, rejecting or protesting, social conventions and routines, spontaneous social expressions)	
Building Blocks program – home based (HB): Functional communication	Roberts et al. (2011) Australia	HB: 27	3.45 (range 2.2 – 4.95)	Inclusion: Autism diagnosis; Pre-school aged at start of program; Able to access centre for treatment	The Pragmatics Profile	Statistically significant changes pre to post intervention in all groups. No statistically significant differences in changes made between-groups.
Building Blocks program – centre based (CB): Functional communication		CB: 29	3.59 (range 2.2 – 5)			
		Control: 28	3.64 (range 2.3 – 5.0)			
Social Emotional NeuroScience Endocrinology (SENSE) Theater: Engage in directed communication; Use gestures and nonverbal communication in directed ways; Empathic responding	Corbett et al. (2015) USA	Treatment: 17	11.27 ± 2.51	Inclusion: Autism diagnosis; WASI score ≥70	SRS - Social Communication Scale	Significant difference measured between groups post treatment and at two month follow up.
		Control: 13	10.74 ± 1.89			
Social Skills Group Intervention – High	DeRosier, Swick,	Treatment: 27	10.2 ± 1.3	Inclusion: Autism diagnosis; Aged 8-12 years; WISC-IV verbal IQ	SRS - Social Communication Scale	Significant treatment effect.

Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
Functioning Autism (S.S.GRIN-HFA): Non-verbal communication; Listening skills to effectively facilitate conversation	Davis, McMillen, and Matthews (2011) USA	Control: 28	9.9 ± 1.1	score ≥85. Exclusion: CBCL T-score >70		
FindMe App: Attending to people; Following social cues	Fletcher-Watson et al. (2015) Scotland	Treatment: 27	4.12 ± 0.91	Inclusion: Diagnosis of autism or on the waitlist for diagnosis; Aged <6 years at intake; Met Autism 'cut-off' on social-communication algorithm of ADOS; Absence of neurological disorder; English speaking parents	Brief observation of social communication change (BOSCC) – Social Communication Scale	Not measured immediately following intervention. No significant difference between changes made by both groups at 6 month follow up.
		Control: 27	4.16 ± 1.1		CSBS-DP – Social Composite	No statistically significant difference found in change scores between groups baseline to post, or baseline to 6 month follow-up.
Therapeutic Horse Riding: Joint attention; Nonverbal communication	Gabriels et al. (2015) USA	Treatment: 58	10.5 ± 3.2	Inclusion: Aged 6-16 years; Autism diagnosis; SCQ score ≥15; Met clinical cut-off for autism on ADOS; Irritability and Stereotypy subscales of the ABC-C combined score ≥11; Leiter-R nonverbal IQ standard score ≥40. Exclusion: Previously identified genetic disorder of a phenotype similar to autism; History of medical or behavioural issues; History of animal abuse or phobia of horses; >	SRS - Social Communication Scale	Significantly greater improvement made by treatment group
		Control: 58	10.0 ± 2.7			

Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
				2 hours of equine assisted therapy within the past 6 months; Weight exceeding the riding centre's policies		
FaceSay: Responding to joint attention	Hopkins et al. (2011) USA	Treatment LFA: 11	10.31 ± 3.31	Not specified	Two five-minute observations of the children at school recess. Interactions coded for positive, negative and low-level initiations of social behaviour as per Hauck, Fein, Waterhouse, and Feinstein (1995)	Significant difference in total score, and negative interactions score between LFA groups and HFA groups following intervention.

No significant difference in Positive Interactions or Low-level Interactions scores between LFA groups and HFA groups following intervention. |
| | | Treatment: HFA: 13 | 10.57 ± 3.2 | | | |
| | | Control: LFA: 14 | 10.05 ± 2.30 | | Emotion recognition of photographs and schematic drawings | Significant difference between change scores in LFA groups for total and photos only scores.

Significant difference between change scores in HFA groups for all scores (total, photos only and drawings only). |
		Control: HFA: 11	9.85 ± 2.87			
Modified JASPER Intervention – Teacher delivered: Initiation of Joint attention (point, show give)	Kaale, Smith, and Sponheim (2012) Norway	Treatment: 32	4.06 ± 0.69	Inclusion: Autism diagnosis; Chronological age 24-60 months; Attendance in preschool. Exclusion: CNS disorders; Non-Norwegian speaking parents	Frequency of JA initiation during ESCS	No significant difference between groups difference in changes measured.
		Control: 27	4.19 ± 0.69		Frequency of JA initiation during teacher-child play	Significant between groups difference in changes measured.

Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
					Frequency of JA initiation during mother-child play	No significant difference between groups difference in changes measured.
					Duration of JE during teacher-child play	No significant difference between groups difference in changes measured.
					Duration of JE during mother-child play	Significant between groups difference in changes measured.
	Kaale, Fagerland, Martinsen, and Smith (2014) Norway	See Kaale et al. (2012)	See Kaale et al. (2012)	See Kaale et al. (2012)	Frequency of JA initiation during ESCS	No significant between groups difference in changes between baseline and 12 month follow-up.
					Frequency of JA initiation during teacher-child play	Significant between groups difference in changes from baseline to 12 month follow up.
					Frequency of JA initiation during mother-child play	No significant between groups difference in changes between baseline and 12 month follow-up.
					Duration of JE during teacher-child play	No significant between groups difference in changes between baseline and 12 month follow-up.

Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
					Duration of JE during mother-child play	Significant between groups difference in changes from baseline to 12 month follow up.
JASPER Intervention: Initiations of joint attention (point, show, give); Response to joint attention	Kasari, Freeman, and Paparella (2006) USA	Treatment: 20 Symbolic play: 21 Control: 17	3.6 ± 0.59 3.5 ± 0.58 3.5 ± 0.41	Not specified	Initiation of Joint Attention (showing, coordinated joint looks, pointing, giving) during ESCS 15-minute caregiver-child interaction coded for joint attention skills: child's frequency of joint attention skills (e.g., coordinated looks, pointing, and showing); time spent jointly engaged and interactive around objects; who initiated joint engagement (parent or child)	Treatment and Symbolic play groups showed greater improvement in showing than control group. No significant difference in showing between treatment and symbolic play groups. All groups showed significant improvement in coordinated joint looks. No significant differences noted in pointing or giving. Treatment and Symbolic play groups showed significantly greater gains than the control group in coordinated joint looks. No significant difference in coordinated joint looks between treatment and Symbolic play groups. All groups showed significant improvement in pointing. Significant interaction effects found for pointing and showing (p<0.05). Treatment group showed significantly greater

Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
						gains than the control group in child initiated joint attention. No differences were found in mother initiated joint engagement.
	Lawton and Kasari (2012) USA	See Kasari et al. (2006)	See Kasari et al. (2006)	See Kasari et al. (2006)	Shared positive affect during joint attention	No significant difference between treatment and Symbolic play groups at post, 6-month follow-up or 12-month follow-up.
					Shared positive affect with utterances during joint attention	No significant difference between treatment and Symbolic play groups at post, 6-month follow-up or 12-month follow-up.
Modified JASPER Intervention – Parent-child dyad focused: Initiating joint engagement; Initiating communication	Kasari, Gulsrud, Wong, Kwon, and Locke (2010) USA	Treatment: 19 Control: 19	2.53 ± 0.08 2.61 ± 0.07	Inclusion: Aged <36 months; Meets autism diagnostic criteria; No additional syndromes	15 minute caregiver-child interaction coded for joint attention (initiations and responses)	Significantly greater gains in responsiveness to joint attention for the treatment group (p<0.05). No significant differences measured in initiations of joint attention.

Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
					15 minute caregiver-child interaction coded for engagement states (unengaged/other engagement, object engagement, joint engagement)	Treatment group made significant reductions in time spent in object engagement compared to the controls (p<0.01). Treatment group made significant increases in time spent jointly engaged compared to controls (p<0.05). No significant difference between groups in unengaged/other engagement states.
JASPER – **Caregiver Education Module:** Joint engagement with caregiver	Kasari et al. (2014) USA	Treatment: 48 at exit, 44 at follow-up Control: 59 at exit, 51 at follow-up	3.5 ± .83 3.57 ± .85	Inclusion: Autism diagnosis; "Low-resourced family"; Aged between 2 and 5 years; Mullen mental age >12 months.	ESCS – Initiation of joint attention skills 10 minute caregiver-child interaction coded for time spent jointly engaged	Both groups showed significant improvements immediately following intervention period (p<0.001). Gains for CMM group significantly greater than CEM group following intervention period (p=0.05). Effect of treatment maintained for both groups at 12 week follow-up (p=0.05). Both groups showed significant improvements immediately following intervention period (p<0.001). Gains for CMM group significantly greater than CEM group following

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Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
						intervention period (p<0.003). Treatment effect maintained for CMM group at 12-week follow-up (p=0.02), but not the CEM group.
Improvisational music therapy: Joint attention behaviours (eye-contact, turn taking)	Kim, Wigram, and Gold (2008) Korea	Group one: 5 Group two: 5	All participants: 4.27 ± 1.0	Inclusion: Autism diagnosis	ESCS	Significant time x group interaction, with greater gains made post music therapy compared to post play sessions.
SummerMAX + Mind Reading: Social-communication; Face-emotion recognition	Lopata, Thomeer, Rodgers, Donnelly, and McDonald (2016) USA	Treatment: 18 Control: 18	8.83 ± 1.47 8.83 ± 1.50	Inclusion: Autism diagnosis; WISC-IV short form IQ >70; WISC-IV VCI or PRI ≥80; Expressive or receptive language on the CASL ≥ 80	Cambridge Mindreading Face-Voice Battery for Children (CAM-C)

Emotion Recognition Display Survey (ERDS)

Social Emotional Evaluation | Significant time x treatment condition effect favouring SummerMAX + Mind Reading group for Faces score only.

Statistically significant changes measured in all groups. No statistically significant differences in changes made between-groups.

Statistically significant changes in Receptive scores measured in all groups. No statistically significant differences in changes made between-groups. |
| **Skillstreaming:** Face-emotion recognition | Lopata et al. (2010) USA | Treatment: 18 Control: 18 | 9.39 ± 1.72 9.56 ± 1.54 | Inclusion: High-functioning autism diagnosis; WISC-IV short form IQ >70; WISC-IV VCI or PRI ≥80; | DANVA2 | ANCOVA results became non-significant after application of Bonferroni correction. |

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Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
				Expressive or receptive language on the CASL ≥80		
Emotion Recognition Training: Emotion recognition through facial expression	Ryan and Charragain (2010) Ireland	Treatment: 20 Control: 10	9.25 ± 1.83 10.58 ± 2.08	Inclusion: Not specified. Exclusion: ERT score <80%; Difficulty with comprehension of emotion labels	ERT	Improvements made by the treatment group were significantly larger than those of the controls. Gains were maintained at 3 month follow-up for 25 participants measured.
Seaver-NETT: Nonverbal communication; Emotion recognition	Soorya et al. (2015) USA	Treatment: 35 Control: 34	10.05 ± 1.27 9.87 ± 1.32	Inclusion: Autism diagnosis; Aged 8-11 years; Verbal IQ score >70. Exclusion: Commencement of psychiatric medication 30 days prior to screening; Known gross structural abnormalities of the brain; Active seizure disorder; Aggression towards others	Social behaviour composite comprised of the following: SRS, CCC-2, and Griffith Empathy Measure	Statistically significant improvements following intervention compared to the control group. No significant in improvements measured between groups at 12-week follow-up.
Mind Reading: Facial expression decoding; Prosody decoding	Thomeer et al. (2015) USA	Treatment: 22 Control: 21	8.57 ± 1.16 8.86 ± 1.39	Inclusion: Autism diagnosis; WISC-IV short form IQ >70; WISC-IV VCI or PRI ≥80; CASL short form expressive or receptive score ≥80	Cambridge Mindreading Face-Voice Battery for Children (CAM-C) Emotion Recognition Display Survey (ERDS)	Intervention group had significantly higher Face and Voice scores than controls at post-test and 5-week follow-up. Intervention group had significantly higher Expressive scores than controls at post-test, and significantly higher Expressive and Receptive scores at 5-week follow-up.

Treatment/Target Skills	Reference, Location	Participant groups (N)	Age Years (Mean ± SD)	Inclusion/Exclusion Criteria	Pragmatic Language Outcome Measure	Treatment Outcome
					SRS	Intervention group had significantly lower scores (i.e. fewer symptoms) than controls at 5-week follow-up but not post-test.

Note. RCT = Randomised Controlled Trial, WISC-III = Wechsler Intelligence Scale for Children (Third Edition), mCBRS = Modified Child Behavior Rating Scale, PLS = Preschool Language Scale IV, CASL = Comprehensive Assessment of Spoken Language, MLUm = Mean Length of Utterance in morphemes, WASI = , SRS = , ABAS = , NEPSY = A Developmental NEuroPSYchological Assessment, MFI = Memory for Faces Immediate, MFD = Memory for Faces Delayed, TOM = Theory of Mind, WISC-IV = Wechsler Intelligence Scale for Children (Fourth Edition), SRS = Social Responsiveness Scale, ESCS = Early Social Communication Scales, ADOS = Autism Diagnostic Observation Schedule, CSBS-DP = Communication and Symbolic Behavior Scales – Developmental Profile, SCQ = Social Communication Questionnaire, ABC-C = Aberrant Behavior Checklist–Community, DANVA-2 = Diagnostic Analysis of Nonverbal Accuracy (Second Edition), ERT = Emotion Recognition Test, CCC-2 = Children's Communication Checklist (Second Edition), SCERTS = Social Communication, Emotional Regulation, Transactional Supports, MSEL = Mullen Scale of Early Learning.

2.4.2.2   Outcome Measures

The method of outcome data collection varied across the 21 papers. Behavioural observation was the most common method of pragmatic language skill measurement, with 11 reports utilising this approach. Behavioural observations typically involved recording the child interacting in a social context (e.g., playing with a parent, interacting in the playground), and coding the footage for pragmatic language behaviours of interest. Parent report measures were administered in six studies. These measures required parents to complete a standardised questionnaire about their child's social communication competence. One study utilised both observational and parent report measures (Fletcher-Watson et al., 2015). Standardised lab tasks assessing emotion recognition were administered to study participants in five studies. Specific assessments and methods for collection are described in Table 2.2.

Pragmatic language skills measured by these assessments varied greatly across studies. Of the 11 papers that included behavioural observations, eight studies collected data pertaining to initiations of joint attention, three measured joint engagement, three measured responsiveness to another's communicative attempts, one measured verbal initiations, one measured frequency of requests, and one coded communicative acts. The five studies that administered assessments directly to participants all measured emotion recognition via non-verbal cues such as facial expression, posture, gesture or prosody. All parent report surveys measured capacity for reciprocal social communication.

2.4.2.3   Results Reported

Pre-post data were reported in 20 papers, with Kaale et al. (2014) reporting on the 12-month follow-up data from the study originally reported by Kaale et al. (2012). Follow-up data were presented in nine papers, with time frames ranging from 5-weeks to 12-months post cessation of intervention. Lawton and Kasari (2012) reported on results collected from the same sample following the same course of intervention as Kasari et al. (2006), but using an alternative outcome measure at four time points: pre, post, 6-month follow-up and 12-month follow-up. Casenhiser et al. (2013) and Casenhiser et al. (2015) also reported results from the same intervention study, with the latter presenting a re-

analysis of the video data collected for an alternative purpose. The treatment outcome(s) for each study is presented in Table 2.2.

2.4.3   Interventions

A detailed description of each intervention is provided in Table 2.3. Twenty different intervention programs were reported across the 21 studies, although four were various modifications of the Joint Attention, Symbolic Play and Engagement Regulation (JASPER) intervention initially reported by Kasari et al. (2006). Originally a clinic-based, therapist facilitated, individual, child-focused intervention for joint attention skills, JASPER approach was first modified to include a focus on the parent-child dyad (Kasari et al., 2010). It was later trialed as a teacher delivered, school-based intervention (Kaale et al., 2014; Kaale et al., 2012). Most recently JASPER was implemented via two models of parent delivered intervention: 1) Caregiver Mediated Model (CMM); and 2) Caregiver Education Model (CEM) (Kasari et al., 2014). Education of the parent was the focus of these approaches, with CMM being delivered by the therapist to both the child and parent in a one-on-one setting at home, and CEM delivered in a group setting with parents only. Additionally, Lopata et al. (2016) studied a treatment protocol which combines the intervention approaches reported on by Lopata et al. (2010) and Thomeer et al. (2015).

The mode of delivery and focus subject of the interventions varied across the studies. Pragmatic language skills were targeted in a group setting in nine intervention protocols. Of those nine approaches, five were child directed interventions, one focused on educating parents (Kasari et al., 2014), and three focused on both the children and parents. An individual approach to intervention was taken in 11 studies, of which seven were child focused. The remaining four individual interventions focused on the child and the parent through direct intervention of the therapist with the child, along with training parents in therapeutic techniques to support their child. A combination of group and individual activities were employed in two interventions and both of these focused on the children only (Beaumont & Sofronoff, 2008; Soorya et al., 2015).

Clinics were the setting for 15 of the interventions, and five of these also included out of session practice either at home or in the community. All clinic-based interventions were facilitated by a therapist trained in the particular intervention program, with one also utilising the parent as an interventionist while completing computer-based activities (Beaumont & Sofronoff, 2008), and one including the use of typically developing peers in the group intervention (Corbett et al., 2015). Three interventions were implemented in the child's home and these were all facilitated by a trained therapist. The child's school was the setting for two interventions, with one being a therapist facilitated computer-based intervention (Hopkins et al., 2011) and the other being facilitated by teachers who were trained in the intervention procedures by therapists (Kaale et al., 2014; Kaale et al., 2012).

Interventions varied in frequency (i.e., the number of times the intervention is provided per day or per week) and total intervention duration (i.e., the time period over which the intervention is presented). The shortest intervention was the Emotion Recognition Intervention (Ryan & Charragain, 2010) which was conducted over four weeks; totalling four hours of intervention. The longest intervention was the MEHRI treatment (Casenhiser et al., 2015; Casenhiser et al., 2013) implemented over 12 months, totalling 104 clinic hours and 1,092 home-based hours. Eight of the interventions had a total duration of 10-15 weeks, with the most frequently occurring duration being 12 weeks. Eight interventions were implemented in fewer than 10 weeks, and four interventions lasted 26 weeks or more. The intervention with the lowest intensity was the improvisational music therapy (Kim et al., 2008), which required 30 minutes of intervention per week. The most intense intervention was Skillstreatming and SummerMAX + Mind Reading which involved five daily 70-minute treatment 'cycles', five days per week for five weeks, equating to 29 intervention hours per week (Lopata et al., 2016). The most common session frequency was weekly, with 11 interventions running weekly sessions with the interventionist. Only two studies reported an expected frequency for home-practice between sessions, and both interventions required daily practice. Five interventions ran on at least a daily basis, with a modified JASPER intervention occurring twice daily (Kaale et al., 2014; Kaale et al., 2012) and Skillstreatming and SummerMAX + Mind occurring five times daily (Lopata et al.,

2010). The least frequently occurring intervention sessions occurred in the Building Blocks program – home-based (Roberts et al., 2011), with the clinician visiting the participant's home every other week; no specific practice between sessions were described.

A synthesis of the pragmatic language skills targeted by each intervention is provided in Table 2.4. The most frequently targeted skill was nonverbal communication with 14 interventions focusing on the use and interpretation of gesture, facial expressions and/or tone of voice. Introduction and responsiveness was the target of 10 interventions, 10 interventions also targeted preverbal social communication behaviours, and 4 interventions targeted social emotional attunement. No one intervention reported targeting all pragmatic language skills adopted for this review, and no intervention targeted the skills of executive function or negotiation.

Table 2.3 Pragmatic language intervention characteristics

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
TJDP (Beaumont & Sofronoff, 2008) Emotion recognition through gesture, posture, prosody Initiating and maintaining a conversation	Parents trained in use of TJDP (computer game facilitating practice in decoding emotions from non-verbal cues, and selecting appropriate reactions). Parent facilitates child's use of TJDP. Children participate in group activities to generalise TJDP content and learn additional social and problem-solving skills. Parents attend concurrent training in skills that children are learning. Detection of emotions via non-verbal cues, practice of relaxation techniques, 'play dates' with peers and completion of 'Secret Agent Journal' completed at home. Token economy used in session to reward appropriate behaviour and completion of home practice.	*Therapist:* Postgraduate clinical psychology and counselling students, and the chief investigator; *Parent*	*14 hours + home practice:* 1 x 2-hour clinic session/week for 7 weeks. *Clinic:* computer program, group therapy (3 children and 2 therapists), parent training; *Home:* home practice	None described.
MEHRI Treatment (Casenhiser, Binns, McGill, Morderer, & Shanker, 2015; Casenhiser, Shanker, & Stieben, 2013)	No description of intervention materials or techniques provided. Therapists coached families on how best to facilitate interaction and communication with their child. First hour spent with one therapist, then 15-20 minute break for child while therapist	*Therapists:* speech pathologists and occupational therapists	*104 hours in clinic; 1095 hours at home:* 1 x 2-hour clinic session/week for 12 months; 3 home practice hours/day. *Clinic:*	Each child assessed by therapist and strategies appropriate for the individual child and family identified to address strengths and challenges. Intervention

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Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
Engage in conversations or proto-conversations; Use ideas and language functionally	consulted with parent regarding the therapy. Final hour spent with a second therapist. Caregiver spends 3 hours per day interacting with child away from clinic, and met with therapist to discuss progress and review videotapes child-caregiver play sessions every 8 weeks.		one-on-one therapy; *Home*: parent interaction with child at home	identifies 5 developmental capacities and therapists attempt to ensure children are functioning adequately at lower capacities before targeting later capacities.
Building Blocks program - centre based (Roberts et al., 2011); Functional communication	Therapists facilitated manualised intervention with children. Session procedures or focus skills not described. Therapeutic techniques included direct intervention and less directed routines. Parent meetings operated concurrently, allowing parents to meet with professionals and other parents, and to form a support network. Topics included positive behaviour support, communication, self-help issues, school options, specialist services, and sensory issues.	*Therapists*: teachers, speech pathologists, occupational therapists, psychologists	*80 hours for child; 120 hours for parent*: 1 x 2-hour clinic session/week for 40 weeks; 1 x 3-hour parent sessions/week for 40 weeks. *Clinic*: Group therapy (4-6 children) and parent training	Therapists worked with children to address individual needs. Parent training topics which were prioritised according to individual interests and needs.
Building Blocks program - home based (Roberts et al., 2011)	Therapists visited family home to implement intervention with the child, and work with parent(s) to develop skills in working with their child.	*Therapists*: teachers, speech pathologists,	*40 hours*: 1 x 2-hour home visit/fortnight for 20 fortnights. *Home*: one-on-one therapy	Programs individualised following consultations with

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
Functional communication	Focusing on play and natural routines, therapist model skills, give constructive feedback, and discuss issues immediate to the needs of the family. Therapist visits to the pre-school/day-care to observe the child and provide strategies to staff to support skill generalisation.	occupational therapists, psychologists		parents and other professionals involved in the child's program.
SENSE Theater (Corbett et al., 2015) Engage in directed communication Use gestures and nonverbal communication in directed ways Empathic responding	Therapists and peer actors attended 2 days of training in intervention. SENSE Theatre program is manualised. Sessions initially comprised of theatrical games and role- playing exercises. A 45-minute play was introduced in session 3, and participants rehearsed their roles with their peers (learning lines, songs and choreography, character development) for the remaining 7 weeks. Video footage of target behaviours, role-plays and songs acted out by peers viewed by participants as homework. Two public performances of the play given at the end of intervention period.	*Peer:* Typically developing (TD) child of same gender and similar age to participant. *Therapist:* Qualifications not specified	*40 hours in clinic; 17.5 hours at home:* 1 x 4-hour clinic sessions/week for 10 weeks; 1 x 15-minute home practice sessions/day for 10 weeks. *Clinic:* group therapy (17 children with autism, 23 TD peers); *Home:* home practice	Roles in the play were assigned based on individual factors such as age, verbal ability, interests, and talents.

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
S.S.GRIN-HFA (DeRosier, Swick, Davis, McMillen, & Matthews, 2011) Non-verbal communication Listening skills to effectively facilitate conversation	Therapists facilitated therapy sessions with participants using a combination of didactic instruction and active practice (e.g. role-play, hands-on activities). Session content divided into 3 modules (5 sessions per module) covering communication, working with others and friendship skills. Parents attended sessions 1, 5, 10 and 15, facilitated home practice, and supported the participant in community based activities.	*Therapist:* Trained in S.S.GRIN-HFA by program developers. Qualifications not specified. *Parent*	*15 hours + home practice:* 1 x 60-minute clinic session/week for 15 weeks; Time for home and community practice not specified. *Clinic:* Group therapy (2 therapists, 27 children); *Home:* Community based practice	None described.
FindMe App (Fletcher-Watson et al., 2015) Attending to people Following social cues	Parents provided with iPad and written instructions dealing with working the iPad and basic troubleshooting. Children used iPad app at home under the guidance of their parents. Activities comprised two parts: Part 1) child identifies the person on the screen; Part 2) child identifies the object that the character on the screen is attending to by following the character's eye gaze and pointing.	*Parent*	*30-40 hours:* 1 x 5 minute iPad session/day for 6 months or; 3-4 x 10 minute iPad sessions/ week for 6 months. *Home:* iPad App	Levels in the app increased in complexity as children progressed: Part 1) more distractors on screen, some that move; Part 2) character moved to looking only
Therapeutic horse riding (Gabriels et al., 2015)	Lessons comprised two parts: 1) therapeutic riding skills; 2) horsemanship skills. A consistent lesson	*Therapist*	*7.5 hours:* 10 x 45 minute sessions/ week for 10 weeks.	None described.

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
Joint attention Nonverbal communication	routine followed: put on riding helmet, wait on bench, mount horse, riding activities, dismount horse, groom horse, and put away equipment.	Certified therapeutic riding instructor	*Clinic:* Therapeutic horse riding groups (2-4 children and 1 volunteer per child)	
FaceSay (Hopkins et al., 2011) Responding to joint attention	Therapists trained children in the use of computer hardware and FaceSay computer program for 2 sessions, then facilitated children's use of the program. Three games from FaceSay program used: 1) Amazing Gazing: touch object on the screen that an avatar is looking at; 2) Band Aid Clinic: select the 'band aid' that would fit over the distorted part of an avatar's face to make it whole; 3) Follow the Leader: identify whether two facial expressions are the same or different.	*Therapist:* Investigators; qualifications not specified	*2-5 hours:* 2 x 10-25 minute sessions/week for 6 weeks; *School:* Computer program	Levels in games increased in complexity as children progressed: more distractors on screen, child is asked to manipulate facial expressions to match a target.
JA Intervention (JASPER) (Kasari, Freeman, & Paparella, 2006; Lawton & Kasari, 2012) Initiations of joint attention (point, show, give)	Therapists were trained in manualised intervention techniques prior to commencement. Sessions began with 5-8 minutes of discrete trial training to prime for target treatment goal at a table. Therapist then used prompting and reinforcement in naturally	*Therapist:* educational psychology students	*12.5-15 hours:* 1 x 30-minute clinic session/day for 5-6 weeks. *Clinic:* One-on-one therapy	Individual child goals determined by outcomes of ESCS, Structured Play Assessment and parent-child interaction. Mastery of goals reached when child

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
Response to joint attention	occurring opportunities to shape targeted skill during semi-structured floor session.			demonstrated the goal in 3 different ways at least 3 times at the table and on the floor.
Modified JASPER Intervention – Parent-child dyad focused (Kasari, Gulsrud, Wong, Kwon, & Locke, 2010) Initiating joint engagement Initiating communication	Therapists facilitated intervention sessions with parent-child dyads using play routines. Session structure: Part 1) 30 mins of direct instruction, modelling, guided practice, and feedback by therapist; Part 2) 10 mins of caregiver practicing techniques learnt. Handouts for caregivers summarizing intervention objectives.	*Therapist:* educational psychology students	*18 hours:* 3 x 45-minute clinic sessions/week for 8 weeks. *Clinic:* One-on-one therapy	Beginning point and modules individualised and determined by interaction in initial parent-child session.
Modified JASPER Intervention – Teacher delivered (Kaale, Fagerland, Martinsen, & Smith, 2014; Kaale, Smith, & Sponheim, 2012) Initiation of Joint attention (point, show give)	A modification of previously manualised treatment (see JASPER (Kasari et al., 2006)). Therapists attended workshop and 5 rehearsal seminars to learn intervention techniques. Therapists then trained teachers in intervention techniques. Teachers facilitated sessions with participants and therapists provided weekly supervision to teachers. Sessions structure: Part 1) 5 mins adult-lead priming for the targeted JA-skill, via toy presentation, prompting, exaggeration of shared interest; Part 2) 15 mins	*Teacher;* *Therapist:* Child and Adolescent Mental Health Clinic counsellors (no qualifications described)	*27 hours:* 2 x 20 minute sessions/day for 8 weeks. *School:* One-on-one therapy	None described.

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
	child-lead floor play focusing on generalisation by following the child's lead, creating play routines, talking about what the child was doing, prompts and responses to JA-skills.			
JASPER – Caregiver Mediated Model (Kasari et al., 2014) Joint engagement with caregiver	Therapists followed manualised intervention aiming to establish didactic engagement between child and caregiver during three home routines (play and two other every day activities). Therapists coached parents in setting up the learning environment, modelling and prompting for joint attention, expanding play and using developmentally appropriate language. A new strategy introduced each week. Handouts provided to parents each week.	*Therapist:* Qualifications not specified	*24 hours:* 2 x 1-hour home sessions/week for 12 weeks. *Home:* One-on-one therapy	None described.
JASPER – Caregiver Education Model (Kasari et al., 2014) Joint engagement with caregiver	Parents attended training in manualised intervention. Material covered similar to Caregiver Mediated Model (see Kasari, 2014 above) with a focus on behaviour management, developing routines and teaching communication. Weekly handouts provided to parents.	*Therapist:* Qualifications not specified	*24 hours:* 1 x 2 hours session/week for 12 weeks. *Clinic:* Parent group training	None described.

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
Improvisational music therapy (Kim, Wigram, & Gold, 2008) Joint attention behaviours (eye-contact, turn taking)	Semi-flexible treatment manual developed. Instruments available included piano, cymbals, drums, xylophone, harp, bells and shakers, horns and whistles. Session structure: Part 1) 15 mins undirected child-led activity with therapist supporting and elaborating on child's play; Part 2) 15 mins directed activity with therapist modelling turn-taking activities within child's focus and interest.	*Therapist:* music therapists, play therapists, music therapy students	*6 hours:* 1 x 30 minute sessions/week for 12 weeks. *Clinic:* One-on-one therapy	None described.
SummerMAX + Mind Reading (MR) computer program (Lopata, Thomeer, Rodgers, Donnelly, & McDonald, 2016) Social-communication Face-emotion recognition	See Skillstreaming for description of session structure and parent component. MR was implemented in addition to Skillstreaming 3 sessions per week, and replaced the emotion recognition instruction typically implemented in Skillstreaming.	*Therapist:* Graduate and undergraduate students (discipline not specified)	*145 hours for child; 7.5 hours for parent:* 5 x 70 minute treatment cycles, 5 days per week, for 5 weeks; 1 x 90 minute parent training sessions/ week for 5 weeks. *Clinic:* Group therapy (6 children and 3 therapists)	See Skillstreaming and MR
Skillstreaming (Lopata et al., 2010)	Manualised intervention. Session structure: Part 1) 20 mins instruction in target skill; 2) 50 mins	*Therapist:* education and	*145 hours for child; 7.5 hours for parent:* 5 x 70 minute treatment	Social skills were taught in a progression from basic to more

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
Face-emotion recognition	therapeutic activity. To conclude, each child discussed the social skills they used to complete the activity. Activities provided practice in and reinforced identifying and interpreting idioms, multiple meanings of common language, identifying facial features, positions and physiological reactions that characterise different emotions. Skills targeted via direct instruction, modelling, role-playing, feedback, and transfer of learning. A concurrent parent training group focused on increasing understanding of autism and the intervention techniques.	psychology students	cycles, 5 days per week, for 5 weeks; 1 x 90 minute parent training sessions/ week for 5 weeks. *Clinic:* Group therapy (6 children and 3 therapists) and parent training.	complex. The same skills were taught to all participants; however, skills were tailored to participant age so that target skills reflected of social situations/demands encountered by children of various ages. Progression of face-emotion recognition activities: 1) identification of facial expressions in pictures; 2) examination of other children's expressions during activities; 3) identification of physiological reactions associated with different facial expressions. Individualised daily contract of 2–3 targets not covered in the curriculum.
Emotion recognition training (Ryan & Charragain, 2010)	Therapists facilitated intervention sessions. Sessions comprised of direct instruction on components of six		*4 hours:* 1 x 1-hour clinic sessions/week for 4 weeks.	None described.

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
Emotion recognition through facial expression	target facial expressions, and practice opportunities (e.g. role play, drawing, matching games). Workbooks completed as homework following sessions 1-3. Parents encouraged to assist with homework and attend information evening on therapeutic techniques.	*Therapist:* Qualifications not specified	*Clinic:* one-on-one therapy; *Home:* home practice	
Seaver-NETT (Soorya et al., 2015) Nonverbal communication Emotion recognition	Treatment facilitated manualised intervention. Session structure: Part 1) 15 mins free-play/snack time; Part 2) 60 mins instruction; part 3) 15 min wrap-up time. Instruction followed a modular cognitive behavioural intervention-based curriculum via didactic instruction, reinforcement activities, visual supports, skills practice and a token economy for reinforcement. Parent training ran concurrently with group therapy sessions, covering treatment rational, homework review and discussion.	*Therapist:* Clinical psychologist and therapy assistants	*18 hours for child; 6 hours for parent:* 1 x 90-minute clinic session/week for 12 weeks; 1 x 30-minute parent sessions/week for 12 weeks. *Clinic:* group therapy (4-6 children, 2-3 interventionists) and parent training	Consideration for individualisation described in reference to manual content, but procedures not specified.
Mind Reading (MR) computer program (Thomeer et al., 2015)	Therapists attended 8 hours of training in intervention protocol, and were required to pass exam. Session structure: 1) MR training: audio-visual stimuli of voices and faces teach children to	*Therapist:* education and psychology students	*36 hours:* 2 x 90-minute clinic sessions/week for 12 weeks. *Clinic:* computer program, one-on-one in vivo rehearsal trials.	None described.

Intervention/Pragmatic Language Skills Targeted	Procedure	Interventionists	Duration and Setting/Mode of delivery	Tailoring/Modifications
	recognise 412 simple and complex emotions through observation of emotion expressions, structured lessons, quizzes, 'games' for additional practice, and rewards; 2) in vivo rehearsal trials presented at 5 intervals during sessions provide additional practice at decoding and encoding target expressions ono-on-one with a therapist; 3) a 'points' system to rewarded behaviour and decoding/encoding skills.			

Table 2.4. Pragmatic language skills targeted by included interventions

Intervention	Pragmatic language skills					
	Preverbal pragmatic language	Introduction and responsiveness	Nonverbal comm.	Social Emotional attunement	Executive Function	Negotiation
TJDP (Beaumont & Sofronoff, 2008)		◆	◆			
MEHRI Treatment (Casenhiser, Binns, McGill, Morderer, & Shanker, 2015; Casenhiser, Shanker, & Stieben, 2013)	◆	◆		◆		
SENSE Theater (Corbett et al., 2015)		◆	◆	◆		
S.S.GRIN-HFA (DeRosier, Swick, Davis, McMillen, & Matthews, 2011)		◆	◆	◆		
FindMe App (Fletcher-Watson et al., 2015)	◆		◆			
Therapeutic Horse-riding (Gabriels et al., 2015)	◆		◆			
FaceSay (Hopkins et al., 2011)	◆	◆				
JA Intervention (JASPER) (Kasari, Freeman, & Paparella, 2006; Lawton & Kasari, 2012)	◆	◆	◆			
Modified JASPER Intervention – Parent-child dyad focused (Kasari, Gulsrud, Wong, Kwon, & Locke, 2010)	◆	◆	◆			
Modified JASPER Intervention – Teacher delivered (Kaale, Fagerland, Martinsen, & Smith, 2014; Kaale, Smith, & Sponheim, 2012)	◆	◆	◆			
JASPER – Caregiver Mediated Model (Kasari et al., 2014)	◆			◆		
JASPER – Caregiver Education Model (Kasari et al., 2014)	◆			◆		

Intervention	Pragmatic language skills			Social Emotional attunement	Executive Function	Negotiation
	Preverbal pragmatic language	Introduction and responsiveness	Nonverbal comm.			
Improvisational music therapy (Kim, Wigram, & Gold, 2008)	◆		◆	◆		
SummerMAX + MR (Lopata, Thomeer, Rodgers, Donnelly, & McDonald, 2016)			◆			
Skillstreaming (Lopata et al., 2010)			◆			
Building Blocks program - center based (Roberts et al., 2011)		◆				
Building Blocks program - home based (Roberts et al., 2011)		◆				
Emotion recognition training (Ryan & Charragain, 2010)			◆			
Seaver-NETT (Soorya et al., 2015)			◆			
Mind Reading (MR) computer program (Thomeer et al., 2015)			◆			

2.4.4 Control Groups

All participants included in control groups had a diagnosis of autism. Seven studies assigned control participants to waitlisted control groups who served as a no-treatment comparison during the intervention phase of the project then went on the receive the intervention at a later stage. Control participants in five studies attended clinic sessions at the same frequency as the intervention group, but participated in activities that were hypothesised not to treat the targeted skill set (e.g., computer-based drawing activity, facilitated play with toys). Control groups in nine studies were assigned to a treatment as usual group where the 'usual treatment' reflected typical intervention practice in the setting in which the study was set (e.g., typical preschool program, an alternative social skills program with differing intervention practices (DeRosier et al., 2011; Kaale et al., 2012)).

2.4.5 Methodological Quality

A description of the methodological quality and Kmet ratings of the included studies is provided in Table 2.5. One study, reporting on the effectiveness of SummerMAX + Mind Reading (Lopata et al., 2016), was rated as having strong methodological quality using the Kmet checklist. Good methodological quality was measured in 8 of the papers. One of these reported on results of The Junior Detective Program (Beaumont & Sofronoff, 2008), one reported on the MEHRI treatment (Casenhiser et al., 2013), three reported on different adaptations of JASPER (Kaale et al., 2014; Kaale et al., 2012; Kasari et al., 2010), one reported on Skillstreaming (Lopata et al., 2010), one reported on the Seaver-NETT program (Soorya et al., 2015), and one reported on the Mind Reading computer program (Thomeer et al., 2015). Adequate methodological quality was rated in 9 papers, and the remaining 2 were rated as having poor methodological quality.

2.4.6 Risk of bias in studies

All studies reported randomisation of participants to groups, and 10 detailed the procedures for random allocation in detail. The remaining 11 studies did not report on the generation of the allocation of participants to groups and so the risk of bias in these studies is unclear. All included studies were at risk of bias due to challenges in blinding of participants, their families and those involved in

administering the interventions; an acknowledged difficulty in designing clinical intervention research (Gluud, 2006). However, blinding of outcome measurements was reported in eight studies that utilised observational measures of pragmatic language (Casenhiser et al., 2015; Casenhiser et al., 2013; Kaale et al., 2014; Kaale et al., 2012; Kasari et al., 2006; Kasari et al., 2010; Kasari et al., 2014; Kim et al., 2008). In these studies, video recorded observations were coded and rated by independent researchers unaware of the participants' group allocation or time in the study when the observations were collected. Raters in three of the studies were also blind to the purpose of the study (Kaale et al., 2014; Kaale et al., 2012; Kasari et al., 2006). Two further studies reported observational measures of pragmatic language, but it is not clear whether observers were blinded (Hopkins et al., 2011; Lawton & Kasari, 2012). The risk of bias in the outcome measurements of all other studies is either evident or unknown. The researchers either administered assessments directly to the child, or collected information via parent survey and are at risk of bias due to unclear reports of blinding for child directed assessments, and an inability to blind parent-rated outcome measurements.

Sample size calculations were reported and an appropriate sample size was used in 9 studies, leaving the risk of bias unclear in the remaining 12 studies. A potential invested interest bias was apparent in a number of studies, with authors having conducted previous research on the same topic, or being involved in the development of the intervention protocol being investigated (Beaumont & Sofronoff, 2008; Kasari et al., 2006; Kasari et al., 2010; Kasari et al., 2014; Lawton & Kasari, 2012; Lopata et al., 2016; Lopata et al., 2010; Thomeer et al., 2015).

The fail-safe N calculated during meta-analysis was 108, meaning as many nil effect studies would need to have been conducted and not published in order to negate the observed effect of the included studies. Such a large N-value indicates a low risk of publication bias.

Table2.5. Methodological quality of included studies

Study	Treatment	Control	Randomisation	Blinding	Methodological Quality
Beaumont and Sofronoff (2008)	TJDP: Child focused, computer based activities with small group therapy	Wait-listed control	Randomisation reported but procedure not described.	No blinding of participants or investigators reported.	Good quality: 75%
Casenhiser, Shanker, and Stieben (2013)	MEHRI Treatment: Parent and child focused, social-interaction based therapy	Community treatment control	Randomisation stratified by age, language and cognition level at entry. Random number generator used to assign participants to groups following screening.	No blinding of participants or therapists reported. Coding of interactions completed by independent coders who were blind to intervention group. Blinding to testing time not reported.	Good quality: 75%
Casenhiser, Binns, McGill, Morderer, and Shanker (2015)	MEHRI Treatment: Parent and child focused, social-interaction based therapy	Community treatment control	Randomisation stratified by age, language and cognition level at entry. Random number generator used to assign participants to groups following screening.	No blinding of participants or therapists reported. Coding of communication acts completed by independent coders, with videos numbered to disguise group assignment and testing time.	Adequate quality: 64%
Corbett et al. (2015)	SENSE Theater: Child focused, theatre based group therapy	Wait-listed control	Randomisation reported but procedure not described.	No blinding of participants or investigators reported.	Adequate quality: 61%
DeRosier, Swick, Davis, McMillen, and Matthews (2011)	S.S.GRIN-HFA: Child focused, cognitive behavioural and social learning based group therapy adapted to focus on social challenges pertinent in autism	Child focused, cognitive behavioural and social learning based group therapy	Randomisation reported but procedure not described.	No blinding of participants or investigators reported.	Adequate quality: 57%
Fletcher-Watson et al. (2015)	FindMe App: Child focused iPad app	Treatment as usual control	Randomisation stratified by ADOS social communication score. Block randomisation with varying and	Baseline assessments administered and scored by first author prior to group allocation. Participants and	Adequate quality: 68%

Study	Treatment	Control	Randomisation	Blinding	Methodological Quality
			randomly ordered block size produced by independent researcher.	investigators not blinded to group allocation. Post-assessments were parent report measures and therefore not blinded. Coding of videos for follow-up assessment completed by independent rater, blind to group allocation.	
Gabriels et al. (2015)	Therapeutic Horse-riding: Child focused, therapeutic horse riding intervention	Barn activities	Stratified by nonverbal IQ by project's statistician using size 4 block randomisation.	Ratings of social communication completed by caregiver and therefore unblinded. Blinding of therapists and participants not reported.	Adequate quality: 64%
Hopkins et al. (2011)	FaceSay: Child focused, computer based intervention	Computer based drawing program	Randomisation reported but procedure not described.	No blinding of participants or investigators reported for pragmatic language outcome measures.	Poor quality: 46%
Kaale, Smith, and Sponheim (2012)	Modified JASPER Intervention – Teacher delivered: Teacher delivered, child focused, joint attention intervention	Ordinary pre-school program	Randomisation conducted by the first author following baseline assessment. The list, generated by an independent statistician, contained random blocks of four for each study site and was not stratified. The list was generated so as to ensure equal distribution of participants to both the intervention and control group at each recruitment site.	Participants and investigators blind to treatment group at baseline assessment. Video coding for social communication outcomes completed by research assistants blinded to study purpose, group allocation and testing time.	Good quality: 79%

Study	Treatment	Control	Randomisation	Blinding	Methodological Quality
Kaale, Fagerland, Martinsen, and Smith (2014)	Modified JASPER Intervention – Teacher delivered: Teacher delivered, child focused, joint attention intervention	Ordinary pre-school program	Randomisation reported but procedure not described.	Blinding of participants and therapists not reported. Video coding for social communication outcomes completed by research assistants blinded to study purpose, group allocation and testing time. All other assessments administered by independent researchers, blind to group allocation.	Good quality: 79%
Kasari, Freeman, and Paparella (2006)	JA Intervention (JASPER): Therapist delivered, child focused, joint attention intervention	Treatment as usual control	Randomisation of participants to groups reported but procedure not described. Randomisation of therapists to treatment procedure and child reported but procedure not described.	Blinding of participants and therapists not reported. Staff in the intervention setting were independent of the research staff and blind to the study hypotheses. Video coding for social communication outcomes completed by independent coders blinded to group allocation. Screening assessments administered by independent researchers, blind to study purpose and hypotheses.	Adequate quality: 61%
Lawton and Kasari (2012)	JA Intervention (JASPER): Therapist delivered, child focused, joint attention intervention	Treatment as usual control	Randomisation of participants to groups reported but procedure not described.	Blinding of participants, therapists and video coders not reported. Screening assessments administered by independent researchers, blind to group allocation.	Adequate quality: 57%

Study	Treatment	Control	Randomisation	Blinding	Methodological Quality
Kasari, Gulsrud, Wong, Kwon, and Locke (2010)	Modified JASPER Intervention – Parent-child dyad focused: Therapist delivered, parent focused, joint attention intervention	Wait-listed control	Random numbers method used to randomise participants to condition.	Blinding of participants and therapists not reported. Video coding for social communication outcomes completed by independent coders blinded to group allocation and testing time.	Good quality: 71%
Kasari et al. (2014)	JASPER – Caregiver Education Model: Caregiver group training, joint attention intervention	Treatment as usual	Randomisation of participants to groups conducted by independent data centre, but procedure not described.	Blinding of participants and therapists not reported. Assessments administered at all time points by examiners blind to treatment condition and study hypotheses. Analysis conducted by independent data centre. Video coding for social communication outcomes completed by independent coders blinded to group allocation.	Adequate quality: 68%
Kim, Wigram, and Gold (2008)	Improvisational music therapy: Therapist delivered, child focused, improvisational music therapy	Play sessions	Randomisation of participants to groups reported but procedure not described.	Blinding of participants and therapists not reported. Video coding for social communication outcomes completed by independent coders blinded to treatment condition.	Poor quality: 36%
Lopata et al. (2010)	Skillsstreaming: Therapist delivered, child focused, social skills group therapy	Wait-listed control	Randomisation stratified on age, gender and ethnicity. One researcher randomly assigned numbers to participants, and a second researcher used a table of	No blinding of participants, therapist or testers reported.	Good quality: 75%

Study	Treatment	Control	Randomisation	Blinding	Methodological Quality
			random numbers to assign numerically identified children		
Lopata, Thomeer, Rodgers, Donnelly, and McDonald (2016)	SummerMAX + MR: Therapist and computer delivered, child focused, group therapy	Therapist delivered, child focused, group therapy	Randomisation of participants to groups conducted using an online random number generator	Researchers and participants unaware of treatment allocation at baseline assessment. Post-assessments conducted by researchers blind to study hypothesis. Binding of therapists not reported.	Strong quality: 82%
Roberts et al. (2011)	Building Blocks program - home based: therapist delivered, child and parent focused, home based therapy. Building Blocks program - center based: Therapist delivered playgroup and parent training.	Wait-listed control	Randomisation completed using computer generated random number tables.	No blinding of participants, therapist or testers reported.	Adequate quality: 68%
Ryan and Charragain (2010)	Emotion recognition training: Therapist delivered, child focused, emotion recognition therapy.	Wait-listed control	Randomisation of participants to groups reported but procedure not described.	Blinding of participants and therapists not reported. Post-measures administered by psychologist who was blinded to pre-scores. Not reported whether tester was blind to treatment allocations as well.	Adequate quality: 57%
Soorya et al. (2015)	Seaver-NETT: Therapist delivered, child focused, group	Facilitated play sessions	Participants randomised by computer generated randomisation	Ratings of social communication completed by caregiver and therefore unblinded. Blinding of	Good quality: 75%

Study	Treatment	Control	Randomisation	Blinding	Methodological Quality
	intervention with concurrent parent training.		in blocks of 10-12 over 7 recruitment phases	therapists and participants not reported.	
Thomeer et al. (2015)	Mind Reading (MR) computer program: Child focused, computer based intervention with in vivo rehearsal trials.	Wait-listed control	Participants randomised to groups using online number generator.	Blinding of participants and therapists not reported. No description provided as to who administered primary measurements of social communication, and no report of tester blinding. Secondary measurement of social communication was completed by parents via questionnaire, and parents could not be blinded to treatment condition.	Good quality: 68%

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2.4.7 Effects of interventions: Meta-analysis results

Fifteen of the 21 studies were included in the meta-analysis. Three studies (DeRosier et al., 2011; Kim et al., 2008; Thomeer et al., 2015) could not be included in the analysis as the data required for calculations were not reported. The authors were contacted to collect the required data needed for the meta-analysis, but none of the authors responded to the requests. A further two studies were excluded (Casenhiser et al., 2013; Kasari et al., 2006), as they reported on the same sample as two other studies (Casenhiser et al., 2015; Lawton & Kasari, 2012), but used outcome measures that evaluated a narrower range of pragmatic language skills. One final study was excluded as it reported on 12-month follow up data only (Kaale et al., 2014). Seven studies measured social communication using more than one instrument. A single outcome measure was extracted for inclusion in the analysis from four of these studies, as the measure chosen was likely to reflect a more comprehensive suite of pragmatic language skill than the others reported (Kasari et al., 2010; Kasari et al., 2014; Lawton & Kasari, 2012; Lopata et al., 2016). The remaining three articles reported two or more similar measurements of a single pragmatic language construct (Beaumont & Sofronoff, 2008; Casenhiser et al., 2015; Kaale et al., 2012), so the mean scores were averaged and pooled standard deviations were calculated for each study for use in the analysis. There were 17 participant samples across the 15 included studies, as two studies contained two intervention groups (Fletcher-Watson et al., 2015; Roberts et al., 2011).

Overall treatment effects were calculated for pragmatic language interventions on pre-post outcome measures. Sub-group analysis was conducted to compare the effect as a function of three intervention characteristics: 1) setting (i.e., clinic, home, school), intervention focus (i.e., child focused, parent focused, or both), and mode of delivery (i.e., group interventions, one-on-one interventions or both). Further analysis was conducted to detect whether participant age, outcome measure type, intervention setting, focus or mode of delivery mediated intervention effect. Between groups analysis was also conducted to compare post-intervention scores with control groups, grouped by control condition type. Three control condition types were included: 1) waitlisted control groups where participants served as an untreated comparison group who eventually went on to receive the intervention; 2) treatment as usual control groups where participants received interventions typically prescribed in the

clinic or school in which the intervention was set; and 3) alternative treatment controls where participants attended the clinical setting but participated in an activity that reflected the intervention approach without the activity that was thought to be the agent of change.

2.4.7.1   Overall effect of pragmatic language interventions

Effect sizes ranged from 0.162 to 1.288 in the pre-post intervention within groups analysis, as shown in Figure 2.2. Of the 17 intervention groups sampled, 24% produced a large effect, 29% proceed a medium effect, and 29% produced a small effect. An effect size < 0.2 was measured in 18% of the intervention groups. A small but significant post-intervention between-groups total effect size was found, favouring pragmatic language interventions for children with autism ($z(17) = 2.889$, $p = 0.004$, Hedge's $g = 0.274$, 95%CI = 0.088 – 0.460). The overall intervention effect was moderate ($z(17) = 6.642$, $p < 0.001$, Hedge's $g = 0.500$, 95%CI = 0.352 – 0.647). The between-study heterogeneity was not significant ($Q(16) = 19.413$, $p = 0.248$), and 17.570% of true variability (I^2) could be explained by individual study characteristics. Following the subgroup analysis of intervention characteristics meta-regression analysis was performed to further explain variability in the results.

Study name	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Beaumont & Sofronoff 2008	0.653	0.281	0.079	0.103	1.203	2.328	0.020
Casenhiser et al. 2015	0.861	0.291	0.085	0.290	1.432	2.954	0.003
Corbett et al. 2015	0.296	0.337	0.113	-0.364	0.956	0.879	0.379
Fletcher-Watson et al. 2015	0.178	0.269	0.072	-0.349	0.704	0.661	0.509
Gabriels et al. 2015	0.695	0.192	0.037	0.320	1.071	3.627	0.000
Hopkins et al. 2011 [HFA]	0.540	0.387	0.150	-0.219	1.298	1.394	0.163
Hopkins et al. 2011 [LFA]	0.449	0.416	0.173	-0.365	1.264	1.081	0.280
Kaale et al. 2012	0.326	0.243	0.059	-0.150	0.803	1.342	0.180
Kasari 2010	0.700	0.328	0.107	0.058	1.342	2.136	0.033
Kasari et al. 2014	0.066	0.195	0.038	-0.315	0.448	0.341	0.733
Lawton et al. 2012	0.293	0.312	0.097	-0.318	0.904	0.941	0.347
Lopata et al. 2010	0.552	0.332	0.110	-0.099	1.203	1.661	0.097
Lopata et al. 2016	0.162	0.326	0.107	-0.478	0.802	0.495	0.621
Roberts et al. 2011 [A]	0.661	0.276	0.076	0.121	1.202	2.400	0.016
Roberts et al. 2011 [B]	0.809	0.270	0.073	0.280	1.337	2.998	0.003
Ryan 2010	1.288	0.342	0.117	0.618	1.958	3.769	0.000
Soorya et al. 2015	0.353	0.238	0.057	-0.114	0.820	1.483	0.138
	0.500	0.075	0.006	0.352	0.647	6.642	0.000

Favours Pre-Intervention   Favours Post-Intervention

Figure 2.2 Within intervention group pre-post meta-analysis.
Note. Hedge's *g* interpreted as per Cohen's *d* conventions: ≤ 0.2 = negligible difference, 0.2- 0.49 = small, 0.5 - 0.79 = moderate, ≥ 0.8 = large.

2.4.7.2   Effect size as a function of intervention characteristics

Figures 2.3 to 2.5 indicate the effect sizes of pragmatic language interventions grouped by setting, focus and mode of delivery respectively. Interventions set in the clinic demonstrated a significant, moderate effect size ($z(12) = 5.758$, p < 0.001, Hedge's g = 0.535, 95%CI = 0.353 – 0.718), which was the largest effect size calculated as a function of setting. Interventions set in the school were approaching significance, with a small effect ($z(3) = 1.925$, $p = 0.054$, Hedge's g = 0.408, 95%CI = - 0.007 – 0.824), and interventions set in the home did not have a significant effect on improving pragmatic language skills when compared to the other settings ($z(2) = 1.846$, $p = 0.065$). However, these results should be interpreted with caution as only two studies were set in the home and just one at school compared to 12 in the clinic setting group. Approaches that integrated a caregiver into the program via education and/or coaching in intervention techniques demonstrated a significant, moderate-large effect ($z(4) = 5.265$, $p < 0.001$, Hedge's g = 0.760, 95%CI = 0.477 – 1.043), while the intervention that focused on parent education only had no significant impact on the pragmatic language skills of children with autism ($z(1) = 0.341$, $p = 0.733$). The majority of studies focused on administering the intervention directly to the children with autism, and these interventions demonstrated a significant, moderate effect ($z(12) = 5.842$, $p < 0.001$, Hedge's g = 0.482, 95%CI = 0.320 – 0.644). Again, caution is required in interpreting these results as there is only one study in the parent focused group, and 12 and 4 in the child focused and combined child and parent focused groups respectively. Whether interventions were administered to a group, the individual or both, effects were significant and moderate in size. Group interventions produced the largest effect of the three modalities ($z(5) = 3.811$, $p < 0.001$, Hedge's g = 0.553, 95%CI = 0.269 – 0.838).

2.4.7.3   Factors mediating intervention effect

No differences were detected in outcomes as a result of participant age or method of pragmatic language measurement (i.e., parent report, observation, or lab task). The analysis of intervention characteristics indicated that intervention setting and mode were not significant mediators of intervention effect. However, intervention focus (e.g. child, parent or child and parent) was found to be a significant mediator of pragmatic language outcomes ($F(2) = 4.17$, $p = 0.0381$), accounting for

all of the between-study variance in the model ($R^2 = 100\%$). Lastly, as there was a concordance between increased age and receiving intervention in a group, participant age was examined in relation to mode. This did not produce a significant result, indicating age did not mediate the effect of mode of delivery (i.e., individual, group, or both).

Study name	Group by Comparison	Comparison	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Beaumont & Sofronoff 2008	Clinic	Clinic	0.653	0.281	0.079	0.103	1.203	2.328	0.020
Casenhiser et al. 2015	Clinic	Clinic	0.861	0.291	0.085	0.290	1.432	2.954	0.003
Corbett et al. 2015	Clinic	Clinic	0.296	0.337	0.113	-0.364	0.956	0.879	0.379
Gabriels et al. 2015	Clinic	Clinic	0.695	0.192	0.037	0.320	1.071	3.627	0.000
Kasari 2010	Clinic	Clinic	0.700	0.328	0.107	0.058	1.342	2.136	0.033
Kasari et al. 2014	Clinic	Clinic	0.066	0.195	0.038	-0.315	0.448	0.341	0.733
Lawton et al. 2012	Clinic	Clinic	0.293	0.312	0.097	-0.318	0.904	0.941	0.347
Lopata et al. 2010	Clinic	Clinic	0.552	0.332	0.110	-0.099	1.203	1.661	0.097
Lopata et al. 2016	Clinic	Clinic	0.162	0.326	0.107	-0.478	0.802	0.495	0.621
Roberts et al. 2011 [B]	Clinic	Clinic	0.809	0.270	0.073	0.280	1.337	2.998	0.003
Ryan 2010	Clinic	Clinic	1.288	0.342	0.117	0.618	1.958	3.769	0.000
Soorya et al. 2015	Clinic	Clinic	0.353	0.238	0.057	-0.114	0.820	1.483	0.138
	Clinic		0.535	0.093	0.009	0.353	0.718	5.758	0.000
Fletcher-Watson et al. 2015	Home	Home	0.178	0.269	0.072	-0.349	0.704	0.661	0.509
Roberts et al. 2011 [A]	Home	Home	0.661	0.276	0.076	0.121	1.202	2.400	0.016
	Home		0.415	0.225	0.051	-0.026	0.856	1.846	0.065
Hopkins et al. 2011 [HFA]	School	School	0.540	0.387	0.150	-0.219	1.298	1.394	0.163
Hopkins et al. 2011 [LFA]	School	School	0.449	0.416	0.173	-0.365	1.264	1.081	0.280
Kaale et al. 2012	School	School	0.326	0.243	0.059	-0.150	0.803	1.342	0.180
	School		0.408	0.212	0.045	-0.007	0.824	1.925	0.054
	Overall		0.502	0.080	0.006	0.346	0.658	6.309	0.000

Hedges's g and 95% CI

-3.00   -1.50   0.00   1.50   3.00

Favours Pre-Intervention   Favours Post-Intervention

Figure 2.3. Within intervention group pre- post- meta-analysis, grouped by setting.
Note. Hedge's *g* interpreted as per Cohen's *d* conventions: ≤0.2 = negligible difference, 0.2- 0.49 = small, 0.5 - 0.79 = moderate, ≥ 0.8 = large. Clinic: participants attended the interventionists premises; Home: clinicians visited participant's home OR parents administered intervention at home; School: intervention was carried out at the participants' school outside of the normal curriculum.

Study name	Group by Comparison	Comparison	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Beaumont & Sofronoff 2008	Child	Child	0.653	0.281	0.079	0.103	1.203	2.328	0.020
Corbett et al. 2015	Child	Child	0.296	0.337	0.113	-0.364	0.956	0.879	0.379
Fletcher-Watson et al. 2015	Child	Child	0.178	0.269	0.072	-0.349	0.704	0.661	0.509
Gabriels et al. 2015	Child	Child	0.695	0.192	0.037	0.320	1.071	3.627	0.000
Hopkins et al. 2011 [HFA]	Child	Child	0.540	0.387	0.150	-0.219	1.298	1.394	0.163
Hopkins et al. 2011 [LFA]	Child	Child	0.449	0.416	0.173	-0.365	1.264	1.081	0.280
Kaale et al. 2012	Child	Child	0.326	0.243	0.059	-0.150	0.803	1.342	0.180
Lawton et al. 2012	Child	Child	0.293	0.312	0.097	-0.318	0.904	0.941	0.347
Lopata et al. 2010	Child	Child	0.552	0.332	0.110	-0.099	1.203	1.661	0.097
Lopata et al. 2016	Child	Child	0.162	0.326	0.107	-0.478	0.802	0.495	0.621
Ryan 2010	Child	Child	1.288	0.342	0.117	0.618	1.958	3.769	0.000
Soorya et al. 2015	Child	Child	0.353	0.238	0.057	-0.114	0.820	1.483	0.138
	Child		0.482	0.083	0.007	0.320	0.644	5.842	0.000
Casenhiser et al. 2015	Child and Parent	Child and Parent	0.861	0.291	0.085	0.290	1.432	2.954	0.003
Kasari 2010	Child and Parent	Child and Parent	0.700	0.328	0.107	0.058	1.342	2.136	0.033
Roberts et al. 2011 [A]	Child and Parent	Child and Parent	0.661	0.276	0.076	0.121	1.202	2.400	0.016
Roberts et al. 2011 [B]	Child and Parent	Child and Parent	0.809	0.270	0.073	0.280	1.337	2.998	0.003
	Child and Parent		0.760	0.144	0.021	0.477	1.043	5.265	0.000
Kasari et al. 2014	Parent	Parent	0.066	0.195	0.038	-0.315	0.448	0.341	0.733
	Parent		0.066	0.195	0.038	-0.315	0.448	0.341	0.733
	Overall		0.459	0.169	0.029	0.128	0.790	2.717	0.007

Figure 2.4. Within intervention group pre- post- intervention meta-analysis, grouped by therapy focus.
Note. Hedge's *g* interpreted as per Cohen's *d* conventions: ≤0.2 = negligible difference, 0.2- 0.49 = small, 0.5 - 0.79 = moderate, ≥ 0.8 = large. Child: interventions were administered to the participants only either in groups or individually; Child and parents: parent training and//or education were integrated into intervention sessions either concurrently with the child/ren or in separate sessions; Parent: sessions only involved parent education.

Study name	Group by Comparison	Comparison	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Beaumont & Sofronoff 2008	Both	Both	0.653	0.281	0.079	0.103	1.203	2.328	0.020
Soorya et al. 2015	Both	Both	0.353	0.238	0.057	-0.114	0.820	1.483	0.138
	Both		0.486	0.217	0.047	0.062	0.910	2.244	0.025
Corbett et al. 2015	Group	Group	0.296	0.337	0.113	-0.364	0.956	0.879	0.379
Gabriels et al. 2015	Group	Group	0.695	0.192	0.037	0.320	1.071	3.627	0.000
Lopata et al. 2010	Group	Group	0.552	0.332	0.110	-0.099	1.203	1.661	0.097
Lopata et al. 2016	Group	Group	0.162	0.326	0.107	-0.478	0.802	0.495	0.621
Roberts et al. 2011 [B]	Group	Group	0.809	0.270	0.073	0.280	1.337	2.998	0.003
	Group		0.553	0.145	0.021	0.269	0.838	3.811	0.000
Casenhiser et al. 2015	Individual	Individual	0.861	0.291	0.085	0.290	1.432	2.954	0.003
Fletcher-Watson et al. 2015	Individual	Individual	0.178	0.269	0.072	-0.349	0.704	0.661	0.509
Hopkins et al. 2011 [HFA]	Individual	Individual	0.540	0.387	0.150	-0.219	1.298	1.394	0.163
Hopkins et al. 2011 [LFA]	Individual	Individual	0.449	0.416	0.173	-0.365	1.264	1.081	0.280
Kaale et al. 2012	Individual	Individual	0.326	0.243	0.059	-0.150	0.803	1.342	0.180
Kasari 2010	Individual	Individual	0.700	0.328	0.107	0.058	1.342	2.136	0.033
Kasari et al. 2014	Individual	Individual	0.066	0.195	0.038	-0.315	0.448	0.341	0.733
Lawton et al. 2012	Individual	Individual	0.293	0.312	0.097	-0.318	0.904	0.941	0.347
Roberts et al. 2011 [A]	Individual	Individual	0.661	0.276	0.076	0.121	1.202	2.400	0.016
Ryan 2010	Individual	Individual	1.288	0.342	0.117	0.618	1.958	3.769	0.000
	Individual		0.479	0.106	0.011	0.271	0.687	4.508	0.000
	Overall		0.502	0.080	0.006	0.346	0.659	6.301	0.000

Figure 2.5. Within intervention group pre- post- treatment meta-analysis, grouped by mode.
Note. Hedge's *g* interpreted as per Cohen's *d* conventions: ≤0.2 = negligible difference, 0.2- 0.49 = small, 0.5 - 0.79 = moderate, ≥ 0.8 = large. Individual: interventions were administered in a one-on-one setting; Group: interventions were administered to participants in small groups; Both: sessions were comprised of individual and group aspects.

2.4.7.4 Effect of pragmatic language interventions compared with comparison groups

As shown in Figure 2.6, pragmatic language interventions for children with autism showed a moderate, significant effect when compared to the waitlisted control group ($z(7) = 2.780$, $p = 0.005$, Hedge's $g = 0.5.18$, 95%CI $= 0.153 – 0.883$). Customised pragmatic language interventions did not have a significant effect when compared to an alternative treatment ($z(5) = 1.560$, $p = 0.119$) or treatment as usual ($z(5) = 0.222$, $p = 0.824$). Effect size of intervention compared to waitlisted controls was similar to that of the overall pre-post results for all interventions.

Study name	Group by Comparison	Comparison	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Gabriels et al. 2015	Alternative treatment	Alternative treatment	0.333	0.186	0.035	-0.031	0.697	1.791	0.073
Hopkins et al. 2011 [HFA]	Alternative treatment	Alternative treatment	1.430	0.446	0.199	0.556	2.305	3.206	0.001
Hopkins et al. 2011 [LFA]	Alternative treatment	Alternative treatment	0.567	0.398	0.158	-0.213	1.346	1.425	0.154
Kasari et al. 2014	Alternative treatment	Alternative treatment	-0.525	0.191	0.037	-0.900	-0.150	-2.742	0.006
Soorya et al. 2015	Alternative treatment	Alternative treatment	0.476	0.242	0.058	0.002	0.949	1.970	0.049
	Alternative treatment		0.329	0.211	0.044	-0.084	0.742	1.560	0.119
Casenhiser et al. 2015	Treatment as usual	Treatment as usual	0.506	0.280	0.079	-0.043	1.056	1.806	0.071
Fletcher-Watson et al. 2015	Treatment as usual	Treatment as usual	0.000	0.268	0.072	-0.526	0.526	0.000	1.000
Kaale et al. 2012	Treatment as usual	Treatment as usual	0.032	0.255	0.065	-0.467	0.531	0.126	0.900
Lawton et al. 2012	Treatment as usual	Treatment as usual	0.042	0.328	0.108	-0.601	0.685	0.127	0.899
Lopata et al. 2016	Treatment as usual	Treatment as usual	-0.394	0.329	0.108	-1.039	0.251	-1.196	0.232
	Treatment as usual		0.047	0.213	0.045	-0.370	0.465	0.222	0.824
Beaumont & Sofronoff 2008	Waitlisted Control	Waitlisted Control	0.119	0.282	0.079	-0.434	0.671	0.421	0.674
Corbett et al. 2015	Waitlisted Control	Waitlisted Control	0.833	0.374	0.140	0.100	1.567	2.227	0.026
Kasari 2010	Waitlisted Control	Waitlisted Control	0.851	0.332	0.110	0.199	1.502	2.560	0.010
Lopata et al. 2010	Waitlisted Control	Waitlisted Control	0.441	0.330	0.109	-0.206	1.087	1.335	0.182
Roberts et al. 2011 [A]	Waitlisted Control	Waitlisted Control	0.042	0.264	0.070	-0.475	0.559	0.158	0.874
Roberts et al. 2011 [B]	Waitlisted Control	Waitlisted Control	0.485	0.272	0.074	-0.049	1.019	1.781	0.075
Ryan 2010	Waitlisted Control	Waitlisted Control	1.117	0.382	0.146	0.367	1.866	2.921	0.003
	Waitlisted Control		0.518	0.186	0.035	0.153	0.883	2.780	0.005
	Overall		0.309	0.161	0.026	-0.007	0.624	1.918	0.055

Figure 2.6. Between intervention groups post-score meta-analysis, grouped by control group type.
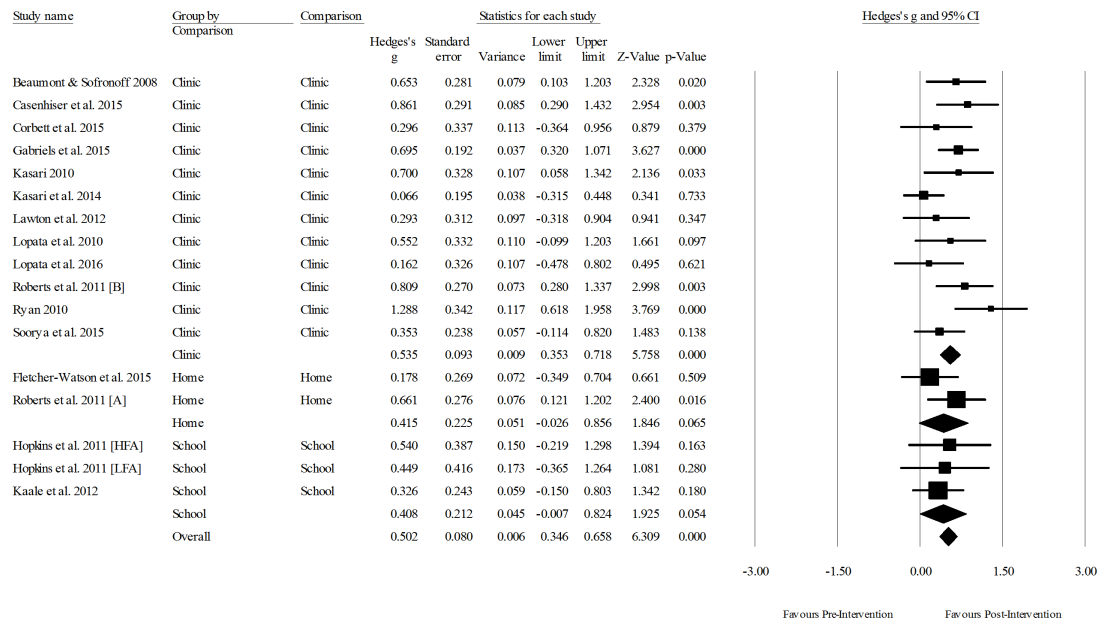*Note.* Hedge's *g* interpreted as per Cohen's *d* conventions: ≤0.2 = negligible difference, 0.2- 0.49 = small, 0.5 - 0.79 = moderate, ≥ 0.8 = large. Alternative treatment: control groups attended an activity that reflected aspects of the intervention without the components thought to be crucial in improving pragmatic language; Treatment as usual: control groups received the intervention or education program typically administered in the intervention setting; Waitlisted control: control groups served as an untreated comparison.

2.5 Discussion

This study aimed to review and analyse the evidence-base for interventions to improve pragmatic language skills in children with autism. Using procedures as outlined by the PRISMA statement (Liberati et al., 1999), a systematic review and meta-analysis of RCT studies were conducted.

Participants in all 21 included papers were of pre-school or elementary/primary school age. Associations between early intervention for children with autism and reduced symptom severity in the long term are widely accepted. Similarly, gestural non-verbal joint attention has been shown to be predictive of later language acquisition in children with autism (Mundy et al., 1990). As such, providing effective interventions for early developing pragmatic language skills to verbal and minimally verbal pre-school aged children is likely to have a crucial impact on future social and linguistic development. The two interventions producing a large effect on pragmatic language for the 0-5 year age group were clinic-based approaches that focused on developing functional language use (Casenhiser et al., 2015; Casenhiser et al., 2013; Roberts et al., 2011). Other interventions for this age group targeted giving and responding to non-verbal communication acts to engage in joint attention with a social partner, produced negligible to moderate effect sizes, indicating a need for further development and investigation of these interventions.

Interventions for children aged 6-12 years broadly targeted children without any comorbid language or neurodevelopmental disorders. A similar gap is highlighted in the broader language and communication intervention literature for minimally verbal children with autism in this age group (Tager-Flusberg & Kasari, 2013). Studies of older children, like those included in this review, focus on verbal children and it is suggested that adapting interventions designed for younger children with autism could provide potential intervention approaches for older, minimally verbal children with autism (Tager-Flusberg & Kasari, 2013). Given the large effect of interventions such as Building Blocks in targeting pragmatic language in under five year olds (Roberts et al., 2011), adaptations of these approaches may be a viable option for further investigation for minimally verbal older children with autism. Randomised controlled trials assessing pragmatic language outcomes following the introduction of an alternative support for the production of language (e.g., Picture Exchange Communication System (PECS), or the use of speech production applications/devices), of which this review found none, could also provide future evidence for interventions appropriate to this population.

This review did not find any evidence for any effective pragmatic language interventions for adolescents with autism, highlighting a gap in the continuity of effective interventions for individuals

with autism as their social environment evolves and becomes more complex. A more multifaceted set of pragmatic language skills is required as children continue to develop from early childhood into adolescence and adulthood. Pragmatic language interventions that recognise the increasing complexity of social interactions would aid in the reduction of the long-term psychosocial impacts that these deficits can have on the development of quality relationships (Whitehouse et al., 2009), which in turn can reduce social exclusion and promote resilience (Gerenberg, 2006).

Intervention was provided in a group setting in 13 of the studies. At an aggregate level, the group interventions were significantly more effective than individually focused interventions, but by a small magnitude. Interestingly, a majority (80%) of the group-based interventions were also focused on the older age cohort (6-12 years), potentially mediating the sub-group analysis by mode. However, the results of the meta-regression indicate that interventions delivered at different ages resulted in similar outcomes. The notion that group interventions have a greater impact than individual approaches is reflected in the results of one included study that found a group intervention produced a large effect size, compared to the moderate effect produced by same intervention, but implemented in a one-on-one setting (Roberts et al., 2011). This highlights the need for further investigation as to the ideal setting for pragmatic language interventions and the factors that mediate change. Individual interventions could potentially be enhanced through the inclusion of techniques used in the group interventions, but a knowledge gap is evident in the included studies as to the factors that may have mediated the changes measured in each intervention. Data from much larger participant samples than those included in this review would need to be collected in order to reliably analyse mediating and moderating factors. However, if the mediating and moderating factors that positively influence intervention outcomes were known then those factors that had largest influence on change could be incorporated into individual interventions in order to enhance their effectiveness.

Notably, groups were comprised exclusively of peers with autism in all interventions, with the exception of SENSE Theater which included typically developing peers (Corbett et al., 2015). This is contrasted by a systematic review of peer-mediated interventions for children with autism, in which a majority of studies (34 of the 42) included peers without a disability (Chan et al., 2009). There is

emerging literature suggesting that the use of typically developing peers in group interventions increases the social interactions of children and adolescents with autism, and aid in skill maintenance and generalisation in the long term (Watkins et al., 2015). It is possible then, that the inclusion of typically developing peers has the potential to further increase the effectiveness of the group interventions included in this review; clearly this is an avenue worth exploring.

Skill generalisation is a continuing problem for social interaction interventions for children with autism (Rao, Beidel, & Murray, 2008). Decontextualised learning has been identified as a barrier to generalisation in other social skill interventions for children with autism and recommendations such as home-based practice, parent involvement in therapy, and practice with a variety of people and settings have been made to aid generalisation (Kransy, Williams, Provencal, & Ozonoff, 2002; Spence, 2003; Williams White, Keonig, & Scahill, 2007). A majority of included pragmatic language interventions (71%) included in this review were set in the clinic and approximately half of the interventions (11) included strategies for generalisation, such as the involvement of parents in interventions and the inclusion of out-of-session practice. The clinic was found to be the most effective setting when compared to home or school, and even though strategies to enhance skill generalisation were included in most of the clinic-based interventions, little is known about whether these strategies were effective. Outcome measurement often assessed pragmatic language in the context in which the intervention was administered or via a decontextualised assessment instrument, so conclusions cannot be drawn as to the generalisability of skills following these interventions. This highlights the need for researchers to consider including assessments in their investigations that capture behavioural observations of pragmatic language skills in varying contexts. Additionally, clinic-based interventions can be inaccessible to some families because of financial or logistical limitations, and there can be a limited availability of therapists in some locations, particularly in rural settings. These factors highlight the need for further development and research to enhance the effectiveness of school-based interventions, or programs that increase the effectiveness of parents as interventionists in the home.

This review found that the person(s) of treatment focus was the only variable identified as being a significant mediating factor in the meta-regression. Interventions that focused on treating the child as well as coaching parents in intervention techniques produced the greatest effect, with some of these interventions occurring in the home, and others occurring in the clinic. These results are mirrored in a recent review of spoken language interventions for children with autism. The review found approaches that included both the clinician and parent in the delivery of therapy produced a significant, moderate effect in comparison to approaches delivered by the clinician or parent only (Hampton & Kaiser, 2016). Results from both reviews are in contrast to the findings of a review of parent-mediated interventions for children with autism. Specifically, the review of parent-mediated interventions found mixed results as to the effectiveness of such approaches in improving language and social communication in young children with autism (Oono, Honey, & McConachie, 2013). However, the importance of including parents in interventions for children with autism is also recognised in the same review due to a caregiver's capacity to provide intervention early, and across a variety of environments and people.

Interestingly, one intervention included in this systematic review, investigated the effectiveness of parent training seminars without the child being present (Kasari et al., 2014). That study produced a negligible effect in comparison to other interventions that were delivered directly to the child or child-parent dyad (see Figure 2.4). If parents are to implement interventions in the home to enhance treatment efficacy, then generic training seminars may not be the ideal approach. Clinicians should also observe the parent-child interaction in order to customise training to the family, and provide parents with specific feedback on progress. The rationale provided by the authors for studying a caregiver-training only intervention was to provide assistance to *low resourced* families who might not otherwise be able to access intervention services. Given the negligible effect of this delivery model, further investigation of caregiver-training approaches is needed. Establishing the appropriate balance between the clinician and parent components of interventions could increase effectiveness and accessibility to services. Clearly, there is a need for further research in the area of parent-

mediated interventions for improving pragmatic language in order for stronger conclusions to be drawn.

Pragmatic language encompasses a complex skill set; the execution of which needs to be constantly adjusted in dynamic social environments. As such, assessing pragmatic language is challenging for clinicians and researchers alike. In assessing pragmatic language outcomes, 10 studies included in this review utilised parent report rating scales or lab-based assessments administered to the child. The results of the meta-analysis indicate that a larger effect size is likely to be detected when pragmatic language is measured through these types of measures when compared to observational measures. The potential introduction of bias through the use of parent questionnaires has already been discussed in this paper due to the inability to blind caregivers to treatment conditions. Additionally, the structured nature of standardised lab-based assessments fails to capture the complex dynamics of the social context and is often not the ideal assessment medium for children with autism. Eleven included studies utilised observational ratings of pragmatic language skills. While these produced only a small effect size in comparison to other types of outcome measures, the ecological validity of these outcomes measures is recognised and perhaps provide a truer indication of the effect of the interventions studied. However, if researchers and clinicians are to use observational measures of pragmatic language, further investigation of the psychometric properties of available instruments is required. While the inter-rater reliability of observational measures is commonly reported in the included studies, other psychometric properties such as, internal consistency, validity and responsiveness, of the measures is mostly unknown.

A majority of the interventions reviewed (14 out of 20) targeted non-verbal communication, a hallmark impairment of autism (Chiang, Soong, Lin, & Rogers, 2008). Skills were usually targeted in isolation with just seven interventions targeting a combination of pragmatic language skills. With the expanding definition of pragmatic language comes a need for interventions to target a wider skill set, especially in the over 5-year age group. No one intervention included in this review targeted all of pragmatic language skills, and additionally, none of the studies targeted the skills of executive function or negotiation. Targeting skills in isolation neglects the dynamic and complex nature of

social interactions. It is possible that interventions that target one skill show a large effect, but are not as clinically beneficial as more holistic approaches that obtain smaller effects. More research is required into the effectiveness of interventions that target a more comprehensive skill set for pragmatic language.

Only one study differentiated groups by the presence or absence of an intellectual disability (Hopkins et al., 2011). The intervention group with participants who did not have an intellectual disability demonstrated a large treatment effect. This is contrasted against the moderate effect measured in the intervention group of children with autism with an intellectual disability who received the same intervention. This could mean that children without an intellectual disability gain more from pragmatic language interventions; however, due caution needs to be exercised here and more research is required comparing the cognitive profiles of children with autism and the impact this has on intervention effectiveness. These findings also emphasise the heterogeneity in autism profiles and the need to consider factors that might mediate an intervention's effect in order to make interventions as beneficial as possible.

The longitudinal benefits of the included interventions are mostly unknown. Follow-up data were reported in nine papers with times ranging from 5-weeks to 12-months post-intervention. Given that individuals with autism experience pragmatic language impairments into adulthood (Whitehouse et al., 2009), there is a need for researchers to track the benefits of interventions overextended time frames to evaluate their effectiveness in improving long-term social functioning.

Finally, results of the meta-analysis showed that treatment effects were greatest when comparison groups received no treatment (i.e., waitlisted controls), and the effect of tailored pragmatic language interventions was negligible in comparison to the treatment as usual control conditions. Again, these results are mirrored the findings of a review of spoken language interventions for children with autism; targeted interventions were no more effective in improving spoken language than comprehensive autism interventions (Hampton & Kaiser, 2016). Intervention approaches for improving pragmatic language, trialled with children with autism show some promise; however,

factors that might mediate greater change and the generalisation of skills need further investigation. In summary, we need a greater understanding of: 1) how cognitive and language profiles influence treatment effects; 2) the most effective intervention setting and intervention agents to achieve large effects; and 3) the inclusion of more strategies to enhance skill generalisation.

2.5.1 Limitations

Great care was taken during the process of this review in order to minimise the introduction of bias. A comprehensive search was conducted including relevant databases alongside a number of professional and academic information sources. Abstract screening for study selection and ratings of methodological quality were conducted by two independent researchers with acceptable levels of interrater reliability. Despite its methodological rigour, this review is subject to a number of limitations. Quasi-experimental design studies and single case experimental designs were excluded from the review. The choice to include randomised study designs only when evaluating interventions for children with autism could confound results given the potential for high levels of heterogeneity in participant samples. The included studies are also at risk of bias due to limitations in methodological design or reporting. The potential for within-group heterogeneity in samples of children with autism, coupled with incomplete control for confounding variables and inadequate blinding, somewhat limits the conclusions that can be generalised to the broader population of children with autism. With the exception of participant age, this study was also unable to address whether other participant characteristics (e.g., expressive or receptive language ability, autism symptom severity, cognitive ability) impacted on the effect of the included interventions. This was due to inadequate reporting of participant demographic and diagnostic variables.

2.5.2 Conclusions

The consequences of the social communication impairments in children with autism are far reaching and life-long, and tailored pragmatic language interventions have the potential to reduce these impacts for children with autism. This review of pragmatic language interventions for children with autism found a number of promising approaches. Findings of this meta-analysis suggest that the person(s) of

focus is a significant mediator of intervention effect, but the age of participants is not, suggesting that regardless of age, the child with autism and their parent must be actively included in an intervention in order to maximise benefits. Further, group interventions appear to be more effective than those delivered one-on-one, and the inclusion of typically developing peers may have the potential to increase the effectiveness of group interventions. At this point, the generalisation of pragmatic language skills outside of the clinical context and longitudinal effects of pragmatic language interventions for children with autism are largely unknown. There is a need for more studies that investigate: the most effective dosage of these intervention approaches; intervention effectiveness when confounding variables such as language competence or intellectual ability are controlled for; and the development of interventions targeting pragmatic language skills in adolescents with autism. The bias introduced into a number of studies via the use of parent rated measures of pragmatic language highlights the need for further development in the area of pragmatic language measurement. Instruments that capture the complex nature of the social interactions are required so that researchers and clinicians can obtain unbiased measurements of pragmatic language competence to assess change following intervention as well as skill generalisation.

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Chapter 3   Feasibility and Appropriateness

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Introduction

Chapter 2
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A systematic review of pragmatic language interventions for children with autism spectrum disorder

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Chapter 7
Discussion and Conclusion

This chapter describes Phase 2 of the research; feasibility and piloting. Following the initial pilot study by Henning et al. (2016), further piloting was required to optimise the peer-peer, play-based intervention for children with autism. This study evaluated the feasibility and appropriateness of the peer-to-peer, play-based intervention for children with autism and their families. This was the first study to investigate pragmatic language as an outcome following the intervention, so three assessments of pragmatics were trialled to determine which were most feasible and responsive, and therefore suitable for use in larger trials. Parents of children with autism were also interviewed two months following the intervention period to evaluate whether the intervention design was appropriate for children with autism and their families, and to understand whether further adaptations to the intervention are required to enhance the suitability

of the intervention for children with autism. The materials used to recruit participants (i.e.,

information letters and eligibility screening interview) and obtain consent (i.e., parent consent

forms and child assent forms) are presented in Appendices D and E. Intervention materials (e.g.,

playroom set- up, video self-modelling and parent manual) are presented in Appendix G and the

interview schedule is presented in Appendix H.

Journal Manuscript 2

The feasibility and appropriateness of a peer-to-peer, play-based intervention for improving pragmatic language in children with autism spectrum disorder

Lauren Parsons*[1], Reinie Cordier[1], Natalie Munro[2,1], Annette Joosten[3,1]

* Corresponding author

[1] Curtin University, School of Occupational Therapy, Social Work and Speech Pathology

[2] The University of Sydney, Faculty of Health Sciences

[3] Australian Catholic University, School of Allied Health

Mailing Address

GPO Box U1987

PERTH, Western Australia, 6845

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3.1 Abstract

Purpose: This study trialled a play-based, peer-to-peer intervention with children with autism spectrum disorder to identify suitable instruments for measuring changes in pragmatic language following the intervention and evaluate preliminary effectiveness. It also aimed to investigate the appropriateness of the intervention for participants.

Methods: Ten children with autism, their typically-developing peers, and parents participated. The Pragmatics Observational Measure (POM), Social Emotional Evaluation (SEE) and Profiling Elements of Prosody in Speech-Communication (PEPS-C) measured the participant's social communication skills before, after, and 2-months following the intervention. Parent interviews were conducted two months after the intervention and responses were analysed using a thematic approach.

Results: Children demonstrated gains in pragmatic language on the POM ($X^2(3) = 11.160$, $p = 0.011$) and related higher-level language on the SEE ($X^2(2) = 6.686$, $p = 0.035$). The PEPS-C did not produce any significant results. Parent interview responses indicated the intervention was appropriate for the children and families involved.

Conclusions: The intervention warrants further investigation of effectiveness with a more robust research design. Consideration should be given to using observational measures of pragmatic language away from the clinic environment to evaluate generalisation, and future development of the intervention might consider variations in playmates and group size.

3.2   Introduction

Pragmatic language and cooperative play skills are impaired in children with autism with concomitant difficulties in social interaction and communication (Wolfberg & Schuler, 1999). Early conceptualisations of pragmatic language relate to the use of language in context, focusing on the expression and reception of communicative functions via verbal, non-verbal and paralinguistic aspects of language (Prutting & Kirchner, 1987). Understanding of the construct has since evolved to also include behaviours encompassing the social, emotional and communicative aspects of language (Adams, Baxendale, Lloyd, & Aldred, 2005); acknowledging the interconnection between social skills, emotional understanding and pragmatic language. Deficits in pragmatic language are considered to be present in the language profile of all children with autism (Volden, Coolican, Garon, White, & Bryson, 2009). The psychosocial impact of pragmatic language impairments affects the ability to foster and maintain relationships, which, in turn, can lead to social exclusion and reduced resilience (Gerenberg, 2006).

The global prevalence of autism is increasing, necessitating the development and evaluation of feasible, appropriate and effective interventions that therapists can implement to address the pragmatic language difficulties experienced by individuals with autism. A recent systematic review and meta-analysis of pragmatic language interventions for children with autism found that the child with autism and their parent must be actively involved in the intervention to maximise benefits (Parsons, Cordier, Munro, Joosten, & Speyer, 2017). The systematic review highlighted that bias was introduced into the evaluation of many of the interventions via the use of proxy parent rated measures of pragmatic language. Furthermore, the generalisation of skills from the clinical setting to other environments was rarely evaluated; a known weakness of many autism targeted psycho-social interventions.

A recently trialled peer-to-peer, play-based intervention showed promising results in improving social play in children with ADHD and includes components that address the identified limitations of current pragmatic language interventions for children with autism (Wilkes-Gillan, Bundy, Cordier, Lincoln, & Chen, 2016). The therapist-facilitated intervention was delivered in

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the context of free-play with a typically developing peer, and included active involvement of the children with ADHD and their parent(s).

The intervention is based on a model of play comprising four elements: intrinsic motivation, internal control, freedom to suspend reality, and framing (Bundy, 2004; Cordier, Bundy, Hocking, & Einfeld, 2009). Thus play is a transaction between the individual and the environment (physical and social) in which the activity itself provides the impetus for involvement (intrinsic motivation), the individual feels free to decide on their own actions and impact on the interaction (internal control), the usual constraints of reality can be lifted (freedom to suspend reality), and playmates must give and read cues about how to interact with each other (framing). Play during childhood has been linked to cognitive, language, social and emotional development, and children with autism show delays and differences in social play development (Jordan, 2003).

This intervention focuses on promoting positive dyadic interactions between playmates during cooperative social play; the initial interactive process that children engage in with each other in order to develop and maintain friendships (Gifford-Smith & Brownell, 2003). A common finding in research is that children with autism have fewer friendships than their typically-developing peers despite having a desire to engage in social relationships with peers (Bauminger & Kasari, 2000). Friendships with peers serve to promote a child's sense of self-worth, act as a protective factor against the impacts of victimisation or loneliness, and enhance resilience (Gifford-Smith & Brownell, 2003). Child-led play is therefore a fitting context for a pragmatic language intervention for children with autism. The accurate giving and receiving of social cues between peers is a key element of play, and increasing the incidence and quality of positive social play interactions may reduce barriers to engagement in peer interactions and the development of friendships.

The play-based nature of the intervention also contextualises therapeutic goals and motivates children and parents to engage in the intervention (Wilkes-Gillan, Bundy, Cordier, Lincoln, & Hancock, 2015). If children are given the opportunity to observe and practise new pragmatic

language skills in a naturalistic, meaningful context, then skill generalisation beyond the clinic environment might occur more successfully. The inclusion of a familiar typically-developing peer in therapy sessions, who is known to the child with autism, may also further aid skill generalisation and maintenance. The existing relationship between two children provides the opportunity for sustained interaction with each other between clinic sessions and after intervention sessions have ceased. Parents participate in the intervention through observations of play in the clinic, being trained by the therapist in intervention principles, and the delivery of home-practice between clinic sessions. This upskilling of parents allows for parents to continue to facilitate the development of pragmatic language through play in new environments, and beyond the delivery of the intervention by a therapist.

An adaptation of this intervention was trialled with five children with autism aged 4 to 11 years and their typically developing peers (Henning, Cordier, Wilkes-Gillan, & Falkmer, 2016). Participants completed a seven-week program, and while pragmatic language abilities were not purposefully addressed or evaluated during the study, overall social play scores improved in some dyads but not others. Clinical observations of the children suggested that younger participants struggled with the cognitive demands of the program, and less cooperative play was observed when the playmate was younger than the child with autism.

Large scale studies with robust research designs are required to evaluate the effectiveness of complex interventions; however, researchers must first understand if such a large study is feasible (Craig et al., 2008). Feasibility studies allow researchers to examine uncertainties to ensure that evaluations of effectiveness are not undermined by problems such as participant recruitment or retention, inappropriate outcome measures that are not responsive to change, compliance with or the delivery of the intervention, or acceptability of the intervention. During their pilot study, Henning et al. (2016) found high levels of compliance (>90%) to the three key components of the intervention (clinic attendance, play dates between appointments, and use of home-based resources), and that the relative age of the peer to the child with autism, and a pre-existing relationship within the dyad are important considerations for the successful delivery of the intervention. What is still unknown are the best outcome measures for evaluating the

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intervention's impact on pragmatic language in children with autism, and whether the intervention is acceptable and appropriate for children with autism and their families.

Previous pilot studies of the play-based intervention, including participants diagnosed with ADHD, have evaluated pragmatic language using several instruments. No changes in pragmatic language were detected on The Children's Communication Checklist (Bishop, 2006) or conversational aspects in a child-adult interaction, with the authors suggesting this may be partly explained by the parent rated aspects of social contexts or assessment of the child-adult dyad beyond the peer-to-peer play interaction (Docking, Munro, Cordier, & Ellis, 2013). Instead, proximal observational measures of peer-to-peer interactions have been recommended as potential outcome measures for evaluating pragmatic language following a play-based intervention (Cordier, Munro, Wilkes-Gillan, & Docking, 2013; Docking et al., 2013). Indeed, two observational measures, the Pragmatic Protocol (Prutting & Kirchner, 1987) and Structured Multidimensional Assessment Profiles (Wiig, Larson, & Olson, 2004) detected significant changes in pragmatic language in the same children, thereby reinforcing this notion. Most recently, the Pragmatics Observational Measure (Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014) was used as an observational measure that operationalises contemporary definitions of pragmatic language in a single instrument. Children's pragmatic language scores increased following intervention but not to statistical significance, though this may be a result of a small sample size (n=5) (Wilkes-Gillan, Munro, Cordier, Cantrill, & Pearce, 2017).

To date the pragmatic language skills of children with autism have not been evaluated using the POM; however, it warrants consideration given that it evaluates skills in an authentic social interaction. Furthermore, assessors can be blinded to study purpose, timing of samples, and participant diagnosis, addressing a limitation of previous evaluations of pragmatic language interventions for children with autism. Despite these advantages, given the heterogeneity of pragmatic language deficits in children with autism, it is also possible that other measures of pragmatic language could be used as distal intervention outcome measures. This study assessed the feasibility of a peer-to-peer, play-based intervention by trialling a new suite of pragmatic language measures to determine whether the pragmatic language competency of children with

autism can be increased following this intervention, and evaluated which outcome measures are likely to respond to change. The preliminary effectiveness of the intervention was also evaluated during this process.

It is also important that researchers understand whether interventions are acceptable and appropriate to the participants receiving them (Evans, 2003). The literature identifies five key aspects to an intervention's appropriateness: 1) the intervention addresses a health issue important to the participant; 2) involvement is a positive experience for participants; 3) the outcomes are perceived by participants as beneficial; 4) the components are ecologically valid; and 5) techniques are continued once therapist input has ceased (Bowen et al., 2009; Evans, 2003; Nastasi et al., 2000). Participants are more likely to engage in interventions that they perceive as appropriate, which is critical to the effectiveness of the intervention (Nastasi et al., 2000). The appropriateness of the intervention for the children with autism and their families was evaluated via semi-structured interviews with parents after completion of the intervention.

3.3 Methods

This mixed-methods exploratory study included a small sample of children with autism. A single group, pre- and post-test research design was utilised to evaluate the preliminary effectiveness of the intervention and to understand whether the selected outcome measures have the potential to respond to change over the period of the intervention, while semi-structured interviews were conducted with parents of children with autism to understand the intervention's appropriateness. Prior to conducting the study, ethics approval was gained from the Curtin University Human Ethics Research Committee (approval number HR04/2015).

3.3.1 Participants

Ten children with autism with a mean age of 8.7 years (SD = 1.72) were recruited via an autism specific service provider in Western Australia. Families of children on the waitlist for the service were provided with information about the study and contacted the researchers if they identified social communication development as an area of need for their child. To be included in the study, children with autism needed to be between 6 and 12 years of age and have a current

diagnosis of autism without an intellectual disability. The autism diagnostic process in the jurisdiction in which this study occurred requires the consensus of a paediatrician, psychologist and speech pathologist in accordance with DSM IV or 5 criteria (as appropriate at the time of diagnosis). Participant autism diagnoses were confirmed by sighting multidisciplinary diagnostic reports. A standard score of >70 on the Expressive Vocabulary Test (Williams, 2007), and scaled score of >5 on the Elaborated Phrases and Sentences subscale of the Test for Auditory Comprehension of Language – 4 (TACL-4; Carrow-Woolfolk, 2014) were additional inclusion requirements to ensure children did not have severe structural language impairments.

Each child with autism invited a typically developing playmate to attend the intervention by providing their playmate's family with written information on the study. Playmates were also required to be aged between 6 and 12 years, with no neurodevelopmental disorders. The mean age of the playmates was 9.3 years (SD = 1.98). Informed by the findings of Henning et al. (2016), it was also a requirement that they were known to the children with autism, and were of a similar age. Playmates were invited to attend the program by the family of the child with autism, with eight of the peers being siblings of the child with autism, one being a cousin and one being a friend. While it was desirable that playmates were older than the child with autism, seven playmates were older than the child with autism, with the mean age difference being ±2.3 years. The same structural language requirements for children with autism were set for peers. Parent consent and child assent was obtained for all children with autism and playmates prior to participation in the study. The parents of each child with autism also participated in the intervention and the semi-structured interviews. Further details on participant demographics can be found in Table 3.1.

Table 3.1. Participant demographics

	Participants	Playmates
Parent Demographic Variables		
Age		
Mean (SD)	38.6 (4.83)	39.0 (4.45)
Range	31-46	33-46
English as first language	8 of 10	8 of 10
Education after high school	8 of 10	7 of 10

	Participants	Playmates
Child Demographic Variables		
Age		
Mean (SD)	8.7 (1.72)	9.3 (1.98)
Range	6.3-11.1	6.8-12.3
Male	9 of 10	5 of 10
Child Screening Assessments		
EVT		
Mean (SD)	96.2 (13.9)	102.8 (7.2)
Range	77-130	93-114
TACL-4 Elaborated Phrases and Sentences		
Mean (SD)	8.2 (2.3)	9.1 (2.3)
Range	5-12	5-13
CCC-2 General Communication Composite[a]		
Mean (SD)	27.8 (11.9)	61.9 (18.5)
Range	9-45	21-82
CCC-2 Social Interaction Difference Index[a]		
Mean (SD)	-3.9 (10.0)	-5.5 (9.5)
Range	-26 - 8	-22 - 12
CCBRS-3 Autistic Disorder [b]		
Mean (SD)	90 (0.0)	64.6 (16.9)
Range	-	34-90
CCBRS-3 Asperger's Disorder [b]		
Mean (SD)	86.3 (6.4)	60.5 (12.7)
Range	70-90	38-81
CCBRS-3 ADHD Predominantly Inattentive Type [b]		
Mean (SD)	83.9 (6.5)	64.1 (8.1)
Range	73-90	49-77
CCBRS-3 ADHD Predominantly Hyperactive-Impulsive Type [b]		
Mean (SD)	73.3 (13.8)	57.4 (9.0)
Range	54-90	46-79
CCBRS-3 Oppositional Defiant Disorder [b]		
Mean (SD)	78.2 (13.9)	62.9 (12.6)
Range	48-90	47-82
CCBRS-3 Academic Difficulties [b]		
Mean (SD)	76.8 (13.0)	60.0 (17.0)
Range	54-90	43-90
Dyad variables		
Sibling as playmate	8 of 10	-
Playmate older than child with autism	7 of 10	-
Mean age difference in dyads	± 2.3 (0.50)	-

Note. EVT = Expressive Vocabulary Test, TACL-4 = Test for Auditory Comprehension of Language – 4, CCC2 = Children's Communication Checklist, CCBRS-3 = Conners Comprehensive Behaviour Rating Scales; [a]A General Communication Composite <55 and a Social Interaction Difference Index <0 suggests a communication profile indicative of autism; [b]Clinical cut off = T-score >70, borderline clinical cut off = T-score >65.

3.3.2   Instruments

3.3.2.1   Screening measures

The *Expressive Vocabulary Test* (EVT-2; Williams, 2007), a measure of expressive vocabulary

and word retrieval, and the Elaborated Phrases and Sentences subtest of the *Test for Auditory*

Comprehension of Language - 4 (TACL-4; Carrow-Woolfolk, 2014), a comprehension measure of increasingly complex syntactic structures, were administered to all children prior to the intervention. Parents of all children also completed the *Children's Communication Checklist-2nd edition* (Bishop, 2006) and the *Conners Comprehensive Behavior Rating Scales* (CCBRS; Conners, 2008). The CCC-2 is a parent report screening measure for general language and pragmatic language impairment, and the CCBRS evaluates behaviours, emotions, and social and academic problems. All screening measures used have demonstrated strong psychometric properties.

3.3.2.2   Pragmatic language outcome measures

The *Pragmatics Observational Measure* (Cordier et al., 2014) was selected as the primary and proximal outcome measure for this study. It is a 27 item, observer-rated measure that operationalises the contemporary definition of pragmatic language used for this study. Suitable for use with children aged 5 to 11 years, it evaluates skill level and consistency on a four-point scale. Skills are assessed across five pragmatic language domains: 1) *Introduction and responsiveness* (initiation of conversations and responsiveness to the communication of others); 2) *Non-verbal communication* (use and comprehension of gestures, facial expressions, body postures and proximity to others); 3) *Social-emotional attunement* (understanding and responding to the emotions of others); 4) *Executive function* (attention to interactions and flexibly planning communicative content); and 5) *Negotiation* (cooperating and negotiating with communicative partners to promote interaction). The POM has demonstrated good internal consistency (Cronbach's α = .987), inter-rater reliability (r = .887), and criterion validity (Cordier et al., 2014).

For this study, four 15-minute videos of each dyad (i.e., child with autism and invited peer) engaging in free-play were captured: 1) in the clinic one week prior to intervention commencement; 2) in the clinic one week following the last intervention session; 3) in the clinic 2-months following the last intervention session, and 4) at the homes of children with autism 2-months following the last intervention session. The purpose of the fourth video was to evaluate the potential for new pragmatic language skills to generalise to new environments. A single

independent assessor viewed all videos collected and rated the children's pragmatic language using the POM. The collection order of the videos was randomised for the assessor who was then blinded to treatment timing, familial relationship and child diagnosis.

The *Social Emotional Evaluation (SEE)* (Wiig, 2008) was administered as a secondary and distal outcome measure at pre-, post- and 2-month follow-up to assess social skills and higher-level language. The assessment items evaluate a child's ability to understand and explain the social cues of others; a task requiring the use of pragmatic language alongside structural language. Test items assess comprehension of emotions via facial expression, catalysts that elicit a given emotion, inappropriate social behaviours, and conflicting messages in communication (e.g., jokes, sarcasm, lies). It also asks children to explain the appropriate behaviour for situations depicted, and the underlying message in a joke, lie or sarcastic comment. It has demonstrated acceptable internal consistency (*α* range .76 - .88) and strong interrater reliability (*r* range .96 - 1.00).

Reception and expression of prosody was assessed using four scales of the *Profiling Elements of Prosody in Speech Communication (PEPS-C)* (Peppé & McCann, 2003). Individuals with autism have difficulties in the use and perception of prosody which may lead to a decreased capacity for reading and responding to conversational cues (Paul, Augustyn, Klin, & Volkmar, 2005; Peppé et al., 2006). The Affect Input and Output scales assess encoding of emotions into utterances using tone, and the Focus Input and Output scales assess the use and understanding of syllabic stress in sentences to enhance meaning. These scales were selected as they assess areas of prosody that are often impaired in autism (Paul et al., 2005). The PEPS-C has demonstrated good inter-rater reliability (Peppé et al., 2006).

3.3.3   Intervention procedure

Each pair attended 10 appointments delivered by a speech-language pathologist or occupational therapist. The first appointment involved administration of screening and outcome assessments with children and parents, and filming of the baseline video for POM rating. Intervention sessions during weeks 2-9 comprised 10-15 minutes of video-feedback and –feedforward with

the therapist, 30 minutes of child-led free-play with the therapist, and 15-20 minutes of therapist discussion with the parent of the child with autism while the children continued to play. The final appointment involved administration of post-intervention assessments with children and parents, and filming of the post- video for POM rating.

Therapists were trained in the intervention procedures by the second author, who had previously implemented the program in studies involving children with ADHD. All intervention sessions were filmed, with the footage used by therapists to create tailored videos that facilitated video-feedback and -feedforward discussions with the children each week. Play in the video-feedback was coded as 'green-play' or 'red-play'. Green-play provided children with examples of self-modelled, social play interactions that were positive for all involved, and red-play videos were examples of situations when the social play interaction was not positive for one or both of the children. Both children would discuss the observed play with the therapist, identifying what happened within the interaction that made the play 'green' or 'red'. Through these feedback discussions, children learnt the principles of pragmatic language that could promote positive social play interactions with peers (i.e., green-play). During video-feedforward the children discussed with the therapist the pragmatic language principles to apply in order to promote sustained positive social play interactions when they entered the playroom that day. Immediately prior to entering the playroom, therapists summarised the target principles for the children in 2-3 short, simple phrases and these acted as 'things to remember' when they played that day.

The principles of advanced pragmatic language skills as described and operationalised in the POM informed the therapy goals for participants. Individualised goals were created based on baseline POM scores, and these formed the basis of the red and green play identified during video-feedback and –feedforward. For example, a child with low performance in the pragmatic language domain of *Introduction and responsiveness* would learn principles of conversation initiation in a child-friendly way (e.g., "share your ideas"). A child who performed poorly in the domain of *Negotiation* due to over assertion of control in the play-interaction would learn principles of cooperation (e.g., "say 'yes' to your friend's ideas"). POM items that had the

largest negative impact on pro-social interactions were selected at initial targets prior to progressing to more complex target behaviours. The interactions of the dyads were also taken into account so as to leverage the existing skills of the playmate as both a model and a facilitator.

Free-play in the playroom gave children the opportunity to use targeted pragmatic language principles in a functional context. Each week a small sandbox, small figurines (e.g., army, animals, pirates), dress-ups, toy guns and foam bullets, foam swords, a selection of board games and card games, wooden blocks, a train set, a large whiteboard and markers, playdough and accessories, some sporting equipment (e.g., balls, hoops, cone markers), and two small tables and chairs were available in the playroom. The therapist was in the playroom for a large portion of the play time; however, play activities were chosen by the children and therapists joined those games as a playmate. The role of the therapist was to move the play in a direction that facilitated therapy goals while ensuring the activities remained as play and child-directed. While playing, the therapist also modelled target pragmatic language skills for the child with autism (e.g., sharing of ideas, or saying "yes" to another's ideas), as well as ways to support those pragmatic language skills (e.g., asking a peer if they have any ideas) so that the playmate could learn to provide the same supports in play-based interactions away from the clinic. As the established dynamic between the children also directed intervention goals, playmates' existing pragmatic language strengths could be leveraged as a model of targeted pragmatic language principles.

Parents observed the play via computer monitors in an adjacent room. Upon leaving the playroom, the therapist and parents continued to watch the pair play via computer monitors while discussing adherence to the home practice from the preceding week and practise for the week ahead. The home-based component of the intervention involved three elements: 1) the parent read one chapter of the *Ultimate Guide to Making Friends* manual (Cordier & Wilkes-Gillan, 2012); 2) children and their parent(s) watched an episode of the *Ultimate Guide to Making Friends* DVD, with parents facilitating a discussion about play and pragmatic language skills observed; and 3) a play-date for the pair. The manual and DVD were adapted from those

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used with children with ADHD (Wilkes-Gillan et al., 2016). Two additional chapters were included to focus on dealing with restricted and repetitive conversation topics or ways of playing, and technology and play. In total, the manual and DVD included eleven chapters, each with a focus on a different social play and communication skill.

3.3.4 Semi-structured interviews

All parents (*n*=10) were invited to participate in a semi-structured interview developed for the study and conducted by a researcher who was not involved in the implementation of the intervention. The interview schedule contained open-ended questions to evaluate the appropriateness of the intervention for children with autism and their parents. Interviews with nine parents (one parent was not available) were conducted in person two months after the conclusion of the intervention. Eight mothers and one father completed the interviews. All interviews were audio recorded and transcribed verbatim for analysis. Parents were asked to relay their experiences related to the following topics: 1) their child's and their own experiences with the intervention (both positive and negative); 2) benefits to them and their child; 3) logistical arrangements related to the experience that were barriers to or facilitators of participation; 4) improvements or changes to the intervention that would enhance enjoyment or logistics; 5) changes in parent-child relationships; and 6) next steps to enhance benefits.

3.3.5 Data Analysis

3.3.5.1 Child outcome measures

Categorical ratings of POM items were entered into Winsteps (version 3.91.0; Linacre, 2016) to obtain interval level overall measure scores via Rasch analysis. The rater was an occupational therapist who had been trained and calibrated on the POM. To be calibrated, raters independently score a set of existing videos, which are compared other raters who have scored the same videos. Using Rasch analysis, it was determined the rater's scores were reliable as the goodness-of-fit statistics were within the required parameters (MnSq < 1.4 and <0.07; standardised value $\leq$ 2). *Z*-scores for the four PEPS-C subscales were calculated for analysis using IBM SPSS (version 20; IBM Corporation, 2015). Data were normally distributed; however, non-parametric tests were used due to the small sample size. All outcome measures

were entered into IBM SPSS version 20 to compare scores over time using Friedman's tests, with post-hoc Wilcoxon signed ranked tests. Significance was set at $p < .05$.

3.3.5.2   Parent interviews

A thematic analysis (Braun & Clarke, 2006) of parent interviews was undertaken by two of the authors. The first and fourth author read the interview transcripts multiple times, coding the data using annotations and text highlighting. Annotations provided connections between the data and some early interpretations. The two authors met to discuss annotations and themes emerging from the data, then the first author expanded, collapsed, and redefined the themes to ensure the range of participant experiences were captured adequately. The research team discussed the set of themes and refined them into the final set of reported themes. Parents who completed the interviews were provided with descriptors of the final theme set and were asked to clarify the accuracy of the themes as a way of member checking. The process of theme development is depicted in Figure 3.1.
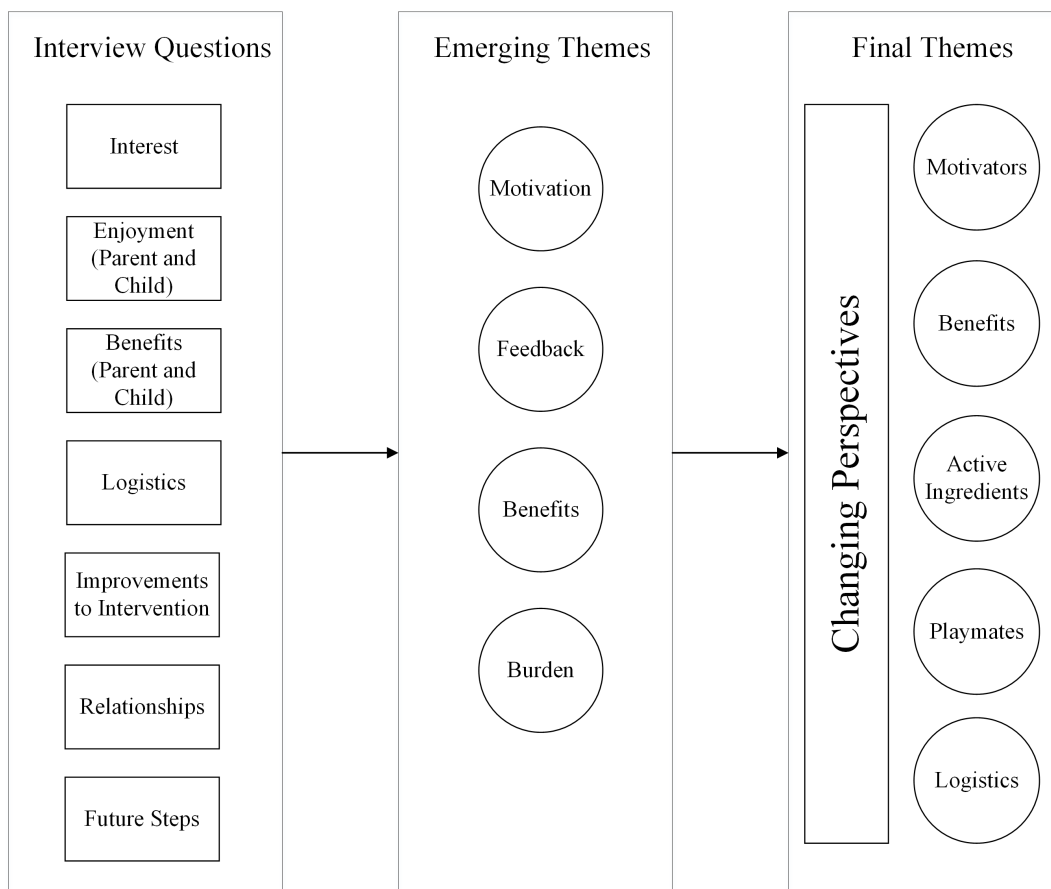
Figure 3.1. Interview theme map.

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3.4   Results

3.4.1   Child outcome measures

Video recordings of play sessions were collected for all ten dyads, pre- and post-intervention, and at 2-month follow-up both in the clinic and at the home of the child with autism. One dyad did not complete the SEE or PEPS-C post-intervention, so their scores were excluded from the analysis of these scales.

Analysis of pragmatic language data showed a significant effect of time on the POM overall measure scores ($X^2(3) = 11.160$, $p = 0.011$), with post hoc analysis indicating a significant improvement occurred between pre- and 2-month follow-up at home ($Z(1) = 2.803$, $p = 0.005$). The exploratory analysis also found improvements in POM overall measure scores that were nearing significance between pre- and post-assessments ($Z(1) = 1.784$, $p = 0.074$). The small sample size precluded further item-level analysis of POM ratings.

There was also a significant effect of time on receptive ($X^2(2) = 8.581$, $p = 0.014$), expressive ($X^2(2) = 11.806$, $p = 0.003$), and overall SEE scores ($X^2(2) = 6.686$, $p = 0.035$). Post hoc analysis indicated significant changes pre- to post-intervention in, receptive ($Z(1) = 2.100$, $p = 0.036$), expressive ($Z(1) = 2.100$, $p = 0.036$), and overall SEE scores ($Z(1) = 2.073$, $p = 0.038$). A significant increase pre-intervention to 2-month follow-up was also measured in expressive ($Z(1) = 2.192$, $p = 0.028$) and total scores ($Z(1) = 1.988$, $p = 0.047$). No significant effect of time was found on any of the four PEPS-C subscales administered. Full results are included in Table 3.2.

Table 3.2. Changes in outcome measures for participants with autism over time

| | Descriptive Statistics | | | | | | | | Friedman's | | Wilcoxon Signed Ranks Test | | | | | | | | | |
| | T1 | | T2 | | T3C | | T3H | | T1-T2-T3C-T3H | | T1-T2 | | T2-T3C | | T1-T3C | | T2-T3H | | T1-T3H | |
	Med	IQR	Med	IQR	Med	IQR	Med	IQR	X²	p	Z	p	Z	p	Z	p	Z	p	Z	p
POM Measure score	-10.87	43.68	35.11	61.63	13.37	64.36	57.61	36.24	11.16	0.011*	1.78	0.074	0.36	0.721	1.07	0.285	1.78	0.074	2.80	0.005*
SEE Receptive	-1.98	2.33	-0.84	2.05	-0.55	2.28	NA	NA	8.58	0.014*	2.10	0.036*	1.35	0.176	1.12	0.260	NA	NA	NA	NA
SEE Expressive	-1.90	2.21	-0.32	2.23	0.04	1.87	NA	NA	11.81	0.003*	2.10	0.036*	1.69	0.091	2.19	0.028*	NA	NA	NA	NA
SEE Total	-1.98	1.87	-0.66	2.33	-0.03	1.72	NA	NA	6.69	0.035*	2.07	0.038*	1.40	0.161	1.99	0.047*	NA	NA	NA	NA
PEPS-C Affect Input	-0.23	1.28	0.11	1.92	-0.04	1.76	NA	NA	0.22	0.895	-	-	-	-	-	-	-	-	-	-
PEPS-C Focus Input	-0.32	1.93	-0.32	2.07	0.14	2.27	NA	NA	0.22	0.895	-	-	-	-	-	-	-	-	-	-
PEPS-C Affect Output	0.16	2.09	1.5	2.60	0.35	1.45	NA	NA	2.89	0.236	-	-	-	-	-	-	-	-	-	-
PEPS-C Focus Output	-0.05	1.03	0.34	1.97	-0.16	1.91	NA	NA	0.22	0.895	-	-	-	-	-	-	-	-	-	-

Note. T1 = Pre, T2 = Post, T3C= Follow-up clinic, T3H= Follow-up home, Med = Median, IQR = Inter-quartile range, *p = <0.05, NA = Not Applicable as the SEE and PEPS-C were not administered at the home follow-up; - Post hoc analysis not completed for PEPS-C as Friedman's test was not significant.

3.4.2 Parent interviews

Interviews were conducted with the parents of nine study participants. The tenth parent could not be contacted. Parent responses to interview questions revealed how they, their child, and their child's playmate developed new understandings of each other and their role in play-based interactions. Parents developed a new perspective of their child's abilities and how to support their play and communication, children benefitted from a new understanding of how to play and communicate with peers, and increased pro-social interactions were reported in the home environment as children were better able to share ideas, negotiate and cooperate with each other. Five themes related to the appropriateness of the intervention were embedded within the overarching theme of *changed perspectives*: 1) motivators; 2) benefits; 3) active ingredients; 4) playmates, and; 5) logistics.

3.4.2.1 Motivators

Parents described the importance of play to their child's development and the difficulties their children experienced in play, particularly in reading others' social cues. When talking about her child's difficulties and her initial interest in the intervention one parent explained: "…it's also finding the right way to play, and understanding how to join into games, and get people's attention in a positive way. So I really wanted to get him some help in those areas". The value that parents placed on play as a context for developing social communication also motivated them to engage in learning to assist their child. One parent stated: "…because play is important to me, and an intervention close to my heart there would be good this year, and I would make an effort to do that".

Equally, children were motivated to participate in clinic sessions and home-based practice because the context was motivating for them. One parent described his child's history of resisting attending therapy was not apparent during this program:

> … having him know that he's going, and to be happy that he knew he was going…and
> not really have that 'I'm not going!' sort of thing with [sic], which he has a tendency to
> do. It was really good, and he was looking forward to it.

Children found enjoyment in the social play interactions with each other during the clinic sessions, and that motivated them to participate fully and remember and practise the pragmatic language principles discussed with therapists.

3.4.2.2 Benefits

Parents identified benefits following the intervention for their child, themselves, and the peers. All those involved in the program learned new roles in promoting the social communication of the children with autism.

Parents themselves reported a greater understanding of their child's capabilities, their use of language, and communication behaviours during play-based interactions. The intervention helped some parents to realise their child needed support to play, particularly in how to use language to initiate and maintain play, avoid, or resolve conflicts and negotiate effectively. Parents had a realisation that they needed to learn to play as well; evidenced by one parents' thoughts: "Yeah, it was good watching them interact, and for me to learn how to help them. Because as a parent, you assume that you should know how to play!"

The most widely reported benefit to parents was a change in their role in solving problems during their child's play at home; shifting from an 'umpire' to a 'facilitator'. This change occurred because children could share their thoughts and ideas more effectively, and they learnt to listen to and attempt the ideas of others as a way of creating a mutually beneficial social interaction. If conflicts arose between children then parents could prompt the children to resolve conflicts themselves using social communication principles learned during the intervention rather than simply stepping in and adjudicating an outcome. One parent described the benefits to their children as follows:

> Before they would have just blocked each other off, and gone their separate ways. Whereas now they will actually talk to each other and, as I said, with a game like Minecraft, or something else that requires interaction, they are actually talking and so even now. iPad and he would have just shut himself away, whereas now he's playing a game that he can share with someone else.

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Together the dyads also learnt that they could be independent in starting, progressing and maintaining a play-based interaction with each other. Parents attributed the benefit to an increase in capacity to initiate interactions with each other, and then maintain the interaction by continuing to verbalise ideas and thoughts as they played. One parent explained: "…they get that confidence to rely on themselves, to make the decisions. Not just relying on me". A second parent echoed this sentiment saying, "Watching them play without them having me to back them up, or to be 'mediator' and things like that; that was really good, because they had to kind of sort things out".

Children with autism were described as participating in more pro-social play following the intervention, especially when interacting with the playmate who also participated. Parents attributed this to a new understanding that by cooperating and considering another's perspective, play interactions became more 'fun' and therefore more motivating. The essence of this was captured by one parent's description of her child's initial narrow understanding of play: "I think he benefited from it, because I think that idea of maximising play hadn't occurred to him, and he genuinely did not know how to read people's social cues and behaviours". Parents provided evidence of these benefits through descriptions of fewer negative behaviours (e.g., 'meltdowns', less aggression) more frequent communication of ideas, maintenance of conversation topics, acceptance of others' suggestions, and more skilled negotiations.

Parents also described peers as having a new understanding of their role in playing with the child with autism. One parent explained: "I think she learnt new skills, but then she learnt that he doesn't understand things as well, which was really good". Parents described playmates as realising that the child with autism needed support in their play. Peers learnt that it was their role to provide that support and developed new skills in how to do so.

3.4.2.3   Active Ingredients

Parents provided insights about their perceptions of the intervention components that were responsible for the observed changes. Video-feedback and –feedforward was unanimously reported as the greatest facilitator of change for children with autism and the peers. Importantly,

children were given feedback, provided with practical strategies to apply, and were then given the opportunity to apply them immediately in a real context.

By observing the play and therapist modelling during clinic sessions, parents learned to understand their child's capabilities and how to support their child's play and communication skills at home. One parent explained: "So yeah, the fact that I have been able to be more observant about what is going on. Not that I'm saying I wasn't observing before, but I know what I'm looking for". Through discussions with the therapists, parents learnt how to model and support the play and communication of their child and developed a new perspective of play and their child's capabilities. On learning from the therapists' perspectives one parent explained: "…the fact that they were able to see things in their play – that I didn't pick up, because I see it all the time. So it was really interesting to see an outsider's perspective – point of view".

3.4.2.4   Playmates

The sibling relationship was identified as an important relationship within the family dynamic, which motivated some parents to opt for siblings as peers. Others expressed a reluctance to ask a child outside of the family to attend for the duration of the intervention. On asking a peer from outside of the family one parent stated:

> I know it's a playdate, but it's very, almost a selfish playdate… Yeah. I think it would feel a bit weird doing it. Because you're, you're asking, you're stepping out of your comfort zone and asking someone to 'lend' your child to us.

Further to this, being able to select a sibling as a playmate enabled the children with autism to access the intervention if their child did not have any friends of a similar age. Parents also recognised that while convenient, selecting a sibling as a playmate had its limitations. Some explained the sibling dynamic affected the play-based interactions at times:

> It's not the same as doing it with his group of friends, and you know, there is more complex play going on with his friends. But as an older brother, he has some dominance that he doesn't have with his peers.

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Others noted that siblings could assist in skill development to a point and adjusting the peer(s) in the interaction would increase the challenge and therefore benefits. Suggested adjustments included introducing a non-sibling peer for a limited number of weeks either during or after the 8 weeks of intervention, introducing a second peer to the interaction, and a school-based adaptation so that their child's classmates would also be familiar with the strategies their child has learnt and how to support their child's play.

3.4.2.5 Logistics

The 'costs' associated with attending the intervention were deemed minimal by parents. Each family found ways to include the home-based components of the intervention (DVD viewing, play-date and manual reading), and the strategies used continue to fit into every-day life for some. Parents attributed this to the common language learnt by children and parents during the program. The greatest burden placed on families participating in the study was travel time; however, several families used that time to talk about the strategies learnt the previous week and then discuss what they might play in their upcoming session.

3.5 Discussion

3.5.1 Instrument feasibility

This study aimed to further test the feasibility of a play-based, peer-to-peer intervention by trialling a suite of measures for evaluating the pragmatic language skills of children with autism. Immediately following the intervention period there was an increase in POM measure scores for the children with autism that was nearing statistical significance. This study is at risk of Type II error due to the small sample size; however, determining effectiveness was not the primary aim of this study. The POM appears to have the sensitivity required for detecting changes over the ten-weeks of this intervention; however, a larger sample and control comparison are required to draw stronger conclusions around effectiveness. The small sample size of this study also prevented an item-level analysis of POM ratings; however, an increase in conversation turns between children, topics of conversation being maintained for longer durations, increased awareness of distance in relation to playmates, more open body postures, and an increased

willingness to accept and attempt a peer's ideas were observed clinically. A larger sample in future studies would also allow for an analysis of trends in the individual POM items to provide clarity around the specific pragmatic language skills that were most improved.

There was a drop in POM scores from post-intervention to the 2-month follow-up in the clinic, which was contrary to the trend in results of the same intervention with children with ADHD (Wilkes-Gillan et al., 2016). While the decrease was not significant it is important to note that the children took part in a concurrent eye tracking study (independent of this current study) immediately prior to the post-intervention and follow-up play sessions which may have adversely affected performance. In the eye-tracking study, children watched a video-feedback video while eye-tracking hardware detected eye gaze. Problems with instrument calibration for some children resulted in extended periods of focused attention prior to entering the playroom. It is possible that those children became over stimulated or fatigued, which may have negatively impacted on their performance on the POM.

However, the children's POM ratings during the 2-month follow-up at home were captured during the same week as the clinic follow-up, and these results indicated that pragmatic language gains were maintained; a trend more closely aligned with previous studies involving children with ADHD. Another explanation for this trend could be that children with autism demonstrated increased pragmatic language competence in the home environment, but as recordings were not collected at home prior to the intervention this could not be evaluated. Future studies of effectiveness might consider collecting pre-intervention recordings in the home and clinic to draw stronger conclusions about skill generalisation.

Changes in SEE scores indicated that children with autism became more adept at understanding and explaining emotional reactions and the problems that arose in social situations. This outcome likely demonstrates the effect of the video-feedback -feedforward. In viewing self-modelled play that inhibited continued interactions (red play) or desired social interactions (green play) and then problem-solving desired social behaviours for the situation, children could improve their knowledge of appropriate social behaviours and higher-level language. This study

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is also at risk of Type I errors due to the small sample size, so it is possible that these changes were a result of maturation and not treatment; however, the trend in the SEE data indicates this could be a suitable outcome measure in larger trials of the intervention.

No change was detected in any PEPS-C scale scores during this study. Expression or reception of prosody did not eventuate as a clinical goal for any child in this pilot intervention, so perhaps this trend is not surprising. During the course of this study, therapy goals largely centred around the pragmatic language domains of *Introduction and responsiveness* (e.g., initiating and maintaining conversations)*, Non-verbal communication* (e.g., detecting and responding to a playmate's body posture) and *Social-emotional attunement* (e.g., creating a mutually enjoyable social interaction where both children contribute equally). Reception and expression of prosody may be a higher-level conversation skill than these children were developmentally ready for. Furthermore, we were unable to find any published intervention studies utilising the PEPS-C as a pre- post- measure, so currently the responsiveness of the instrument is unknown. It is possible that the PEPS-C is suitable for identifying prosody, but not to detect change following intervention so may not be an appropriate outcome measure for this intervention.

3.5.2 Intervention appropriateness

Similar to the findings of other studies, parents in this study expressed the importance of engaging in an intervention that would support their child's social development (Wilkes-Gillan et al., 2015). The domain of pragmatic language was especially important to parents in this study, indicating appropriateness of the intervention (Evans, 2003). Parents were able to understand their child's challenges and abilities in new ways following the intervention. Prior to the program, parents compensated for their child's difficulties by stepping in to resolve conflicts or negotiate on behalf of their child and following the intervention parents felt equipped to facilitate rather than adjudicate their child's social communication needs. This new way of thinking was beneficial for parents and children alike, enhancing the intervention's appropriateness (Evans, 2003).

Children were motivated to attend and engage in the sessions, and parents reported noticeable improvements in social-play interactions in the home environment. Video-feedback and feedforward- was noted as the major active ingredient for this change, accompanied with the opportunity for children to immediately practice pragmatic language skills discussed with the therapist. Lockton, Adams, and Collins (2016) found some children with social communication disorder can demonstrate and verbalise an awareness of pragmatic rules but then violate those rules in practice. They suggest that these children are more likely to benefit from interventions that focus on self-monitoring rather than teaching pragmatic rules. The video-feedback feed-forward in this intervention allowed children the opportunity to learn new pragmatic rules, but importantly gave children ways to monitor their interactions in context and learn to consider the thoughts, emotions, and intentions of others. Literature suggests that one aspect of intervention appropriateness is that participants perceive the process as beneficial, as this empowers participants to take ownership of an intervention (Evans, 2003; Nastasi et al., 2000). The video-feedback techniques contributed to the benefits perceived by parents, and thus the intervention's appropriateness (Evans, 2003).

Parents reported continued use of strategies two-months after regular therapy sessions had finished. The phrases used by therapists during the intervention (e.g., "red play", "green play", "share ideas", "say yes to ideas") became a common language between parents, children with autism and playmates, which they continued to use after therapists withdrew. The common language allowed participants to take ownership of the intervention; an important contributor to intervention acceptability (Nastasi et al., 2000). Also, the 2-3 points to remember at the end of the video-feedforward were easily recalled by children when phrasing was short, syntax was simple, and vocabulary concrete (e.g., "think of new ideas" rather than "come up with new ideas"). No participant had moderate to severe receptive language difficulties; however, children with autism can have impairments in semantics that impact interpretation of abstract vocabulary (Botting & Adams, 2005). The language used during video-feedback and -feedforward should be carefully considered in future implementations of this intervention.

Several aspects contributed to the ecological validity of the intervention (Nastasi et al., 2000). It was important to parents that siblings improved their social communication with each other, though some parents recognised that the involvement of non-sibling peers may contribute to greater gains for their child in the future. The inclusion of siblings as peers may be the ideal starting point for families but future adaptations of the intervention may need to consider alternative peers. This might include switching the playmate to a non-sibling peer when the benefits of attending with a sibling peer have reached a ceiling, increasing the number of children in the interactions by introducing a non-sibling peer to the dynamic, or a school-based intervention where classmates are the peers and children can generalise newly acquired pragmatic language skills in a new context.

3.6   Conclusion

The findings from this study suggest that a play-based, peer-to-peer intervention is an appropriate approach for improving pragmatic language in children with autism. The intervention targeted skills deemed relevant to participants and involvement was perceived as enjoyable and beneficial. The intervention components were ecologically valid and techniques were continued after therapy sessions ended. Future development of the intervention may consider variations to the playmates or the number of children in the play-based interactions to progress the social challenge of the environment.

A systematic review of pragmatic language interventions for children with autism highlighted a need to evaluate generalisation of pragmatic language gains following therapy and reduce measurement bias using observational measures. Trends in POM and SEE scores for children with autism in this study indicated that they are likely suitable outcome measures for this intervention. An advantage of observational assessments such as the POM is that they lessen participant burden, thus increasing the feasibility of a study.

Preliminary results suggest that the intervention is also effective, however solid conclusions around its effectiveness cannot be drawn from this study due to its small sample size and the

absence of a control group. Future studies of effectiveness are recommended, with a larger sample size, comparison controls and random allocation to groups.

3.7   References

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Chapter 4   Effectiveness for Children with Autism
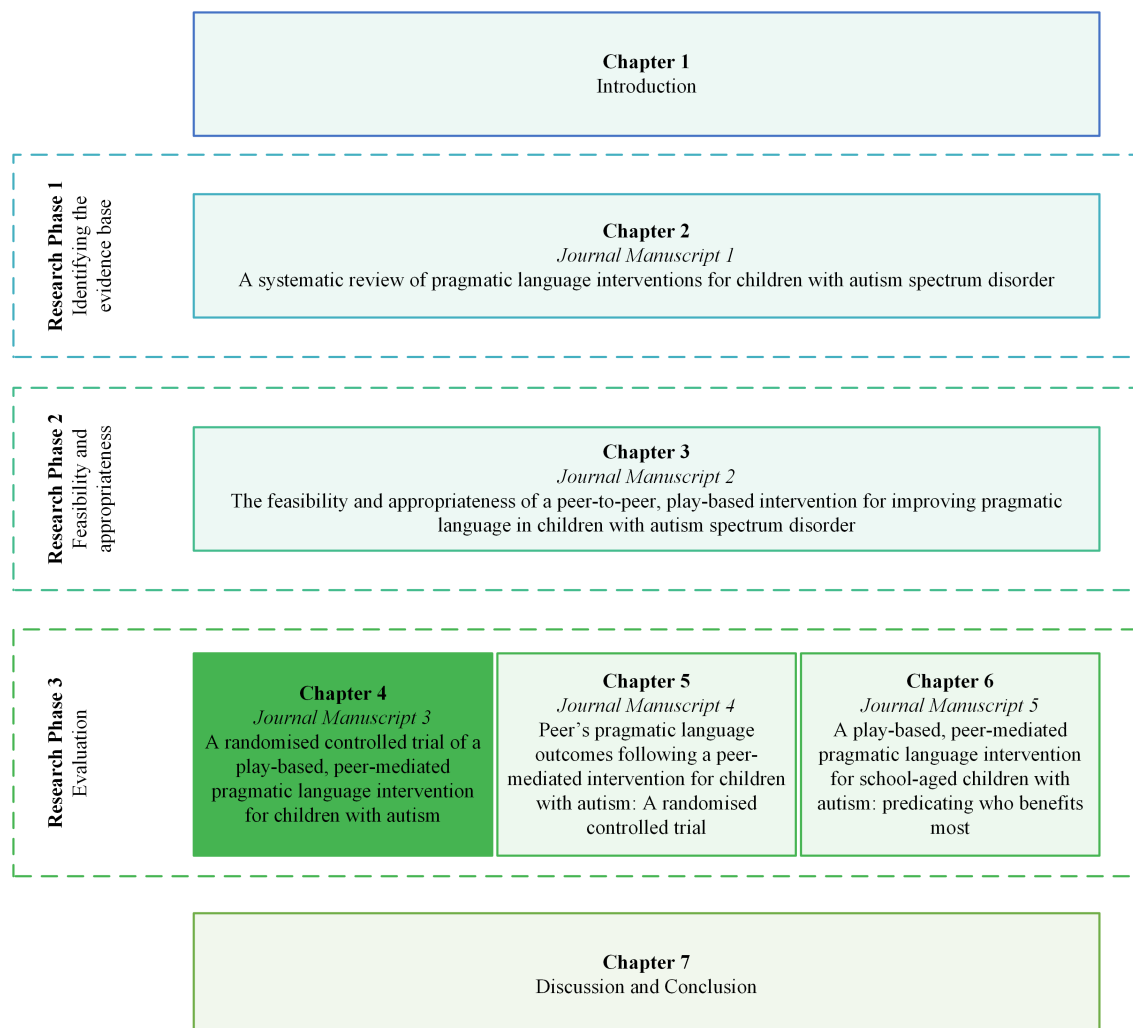
This chapter is the first of three chapters that constitute Phase 3 of the research. The UKMRC recommends the use of experimental research designs to evaluate the effectiveness of complex interventions. Guided by UKMRC recommendations, this study utilised a pair-wise randomised controlled trial (RCT) design to evaluate the effectiveness of the intervention for improving the pragmatic language capacity and performance of children with autism. Within the context of this study the term *capacity* refers to children's knowledge of pragmatic rules, and the term *performance* refers to children's execution of pragmatic language skills while participating in naturalistic social interactions.

Between the implementation of the pilot study and the RCT the authors of the primary outcome measure (Pragmatics Observation Measure; POM) conducted further psychometric evaluation of the instrument and devised an updated measure (POM-2) by removing four misfitting items. Appendix I details the items of the POM and indicates the items that were removed to create the POM-2 used within this Phase of the research.

Journal Manuscript 3

A randomised controlled trial of a play-based, peer-mediated pragmatic language intervention for children with autism

Lauren Parsons[1], Reinie Cordier[1], Natalie Munro[2,1], Annette Joosten[3,1]

[1]Curtin University, School of Occupational Therapy, Social Work and Speech Pathology, Bentley, Western Australia 6102

[2]The University of Sydney, Faculty of Health Sciences, Lidcombe, New South Wales, 2006

[3]Australian Catholic University, School of Allied Health, Fitzroy, Victoria, 3065

Running head: RCT of a pragmatic language intervention for children with autism

Corresponding author

Lauren Parsons

Email: lauren.parsons@curtin.edu.au

Phone: +61 89266 9266

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4.1 Abstract

Purpose: This randomised controlled trial evaluated the effectiveness of a play-based pragmatic language intervention for children with autism.

Methods: A sample of 71 children with autism were randomised to an intervention-first group ($n = 28$ analysed) or waitlist-first ($n = 34$ analysed) group. Children attended ten, weekly clinic play-sessions with a typically-developing peer, and parents mediated practice components at home. The Pragmatics Observational Measure (POM-2) and the Social Emotional Evaluation (SEE) evaluated pragmatics before, after and 3-months following the intervention.

Results: A moderate, significant effect in favour of the intervention-first group was measured for POM-2 ($p=0.031$, $d=0.57$). Between groups differences were not significant for the SEE ($p=0.304$, $d=0.27$). Treatment effects measured by the POM-2 were maintained at 3-month follow-up ($p<0.001$-0.05, $d=0.49$-0.64). POM-2 scores were not significantly different in the clinic and home settings at follow-up.

Conclusions: Findings support the combination of play, peer-mediation, video-feedback and parent training to enhance pragmatic language in children with autism.

Keywords: social communication, video-modelling, intervention development, school-age

4.2   Introduction

The construct of pragmatic language is complex, and a consensus definition has not been established in the literature. Early theoretical work describes pragmatics as the use of language appropriate to the social context (Prutting & Kirchner, 1987); however, more recent conceptual work recognises an interconnection between pragmatics, social cognition and emotional understanding (Adams, Baxendale, Lloyd, & Aldred, 2005; Fujiki, Brinton, & Clarke, 2002; Rodas, Eisenhower, & Blacher, 2017). For example, social cognition has been associated with conversation skills, but the nature of the relationship between the two constructs is unknown (Matthews, Biney, & Abbot-Smith, 2018). Difficulties in the language domain of pragmatics have also been significantly associated with emotional difficulties and problems with peer relations; an association that is not apparent in other domains of language (St Clair, Pickles, Durkin, & Conti-Ramsden, 2011).

This study utilised a contemporary description of pragmatic language, defining it as behaviour encompassing the social, emotional, and communicative aspects of social language (Adams et al., 2005). This definition has been operationalised in the Pragmatics Observational Measure (POM); an observational assessment of pragmatic language behaviours recognisable in children aged 5-11 years during peer-peer play (Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014). Verbal and nonverbal communicative behaviours encompassed in traditional descriptions of pragmatics are operationalised within the POM (e.g., conversation initiation, topic maintenance and change, contingency, conversation repair, facial expressions, gestures, body postures, and adapting language appropriate to the context). In addition, the interconnection between communication and social and emotional understanding is recognised through the inclusion of communication behaviours related to perspective taking, recognising and responding to the emotions of another, regulating and expressing one's own emotions appropriately, engagement in an interaction, and cooperation to create a mutually beneficial social exchange (Cordier et al., 2018; Cordier et al., 2014).

Impaired pragmatic language is a core feature of autism (American Psychiatric Association, 2013) and just as the construct of pragmatic language is multifaceted, so are the presenting pragmatic

language impairments in the communication profile of autism. Compared with typically-developing children, children with autism initiate communication and use nonverbal cues with less frequency (Adams et al., 2012; Mundy, Sigman, Ungerer, & Sherman, 1986). Conversational problems are also reported, such as reduced reciprocity, less varied communicative acts, diminished contingency in responses to what was previously spoken, and difficulties judging the appropriate amount of language to use in conversational responses (Paul, Orlovski, Marcinko, & Volkmar, 2009). Difficulty expressing emotions, taking another's perspective during conversation, and recognising and responding to the emotional state of others are also recounted (Begeer, Koot, Rieffe, Terwogt, & Stegge, 2008; Paul et al., 2009).

Pragmatic language behaviours, per the definition adopted by this study, are associated with crucial friendship qualities in childhood. Cooperation, intimacy and trust distinguish friends from non-friends during childhood (Gifford-Smith & Brownell, 2003) and social conversation, verbal and nonverbal expressions of emotions, and cooperative skills are described as behavioural markers related to these characteristics of friendships (Bauminger et al., 2008). Children with autism have reported feelings of loneliness and poorer quality friendships than their typically-developing peers (Bauminger & Kasari, 2000), thus facilitating quality social interactions between children with autism and peers through a focus on pragmatics might encourage the development of quality friendships that serve to promote a sense of self-worth and resilience in childhood (Gifford-Smith & Brownell, 2003). The impact of pragmatic language difficulties on social participation continues through the lifespan for individuals with autism (Tobin, Drager, & Richardson, 2014). It is therefore imperative that interventions are available to target pragmatic language at all stages of development. The complexity of an individual's social environment increases with age, placing greater demands on an individual's social interaction skills at each developmental stage. The focus of this study is a new pragmatic language intervention for school-aged children with autism (ages 6-11 years) as there is a paucity of intervention research targeting pragmatics in older children.

A recent systematic review and meta-analysis of pragmatic language interventions for children with autism identified 10 interventions targeting this age group (Parsons, Cordier, Munro, Joosten, &

Speyer, 2017). The review found that most current interventions for older children target a narrow range of the pragmatic language skills included in contemporary definitions of the construct. Eight of the 10 interventions for older children targeted verbal and non-verbal communication behaviours (e.g., conversation initiation, facial expressions). Just two interventions included commination behaviours related to social-emotional skills, an important element of the evolving understanding of pragmatics.

Intervention techniques included in existing interventions for school-aged children with autism are varied. Computer-based training exercises are becoming a popular approach for targeting emotion recognition skills through nonverbal cues, with mixed findings of effectiveness (Beaumont & Sofronoff, 2008; Hopkins et al., 2011; Thomeer et al., 2015). Other approaches combine didactic instruction with structured activities for reinforcement, such as role play or workbook activities (Lopata, Thomeer, Rodgers, Donnelly, & McDonald, 2016; Lopata et al., 2010; Ryan & Charragain, 2010; Soorya et al., 2015). In a novel approach, (Corbett et al., 2015) trained typically-developing peer actors to mediate a 10-week theatre-based intervention targeting directed verbal communication, nonverbal communication, and empathic responding. DeRosier, Swick, Davis, McMillen, and Matthews (2011) evaluated a group-based social skills training program that included some parent attendance, with modules targeting conversation skills in combination with perspective taking. Social communication improvements were significant for both studies, as measured by a parent-report outcome measure (Corbett et al., 2015; DeRosier et al., 2011).

Distinctly absent from current approaches to pragmatic language interventions for school-aged children with autism is a focus on using pragmatic language during ecologically valid social interactions. Likewise, longer-term maintenance and generalisation of treatment effects are under evaluated in current research (Parsons et al., 2017). The instructional techniques and practice components of current interventions have a strong focus on improving discrete aspects of pragmatic knowledge (*capacity*). Pragmatics as a language domain is context dependent, therefore it is important that interventions at all stages of development also focus on contextualising those skills for children within important social interactions in their daily lives (*performance*).

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The distinction between capacity and performance is important for this study. The International Classification for Functioning, Disability and Health (ICF; World Health Organization, 2001) provides a framework for language assessment and intervention that goes beyond considering isolated skills (capacity), to include functional outcomes for daily participation (performance) in life situations (Westby & Washington, 2017). When applied to the language domain of pragmatics, the ICF indicates that assessment and intervention should focus on both pragmatic knowledge *and* how pragmatic skills are performed in functional social contexts. The importance of assessing and targeting pragmatic performance during intervention is further emphasised by recent findings that report a discord between meta-pragmatic knowledge and pragmatic performance in some children with pragmatic language impairments (Lockton, Adams, & Collins, 2016).

One approach to facilitating children's learning and practice of pragmatic language is via child-led, free-play interactions with a typically-developing peer. A recently developed play-based, peer-mediated intervention facilitates children's learning and practise of pragmatics in child-led, free-play interactions with a typically-developing peer. The intervention is based on a theoretical framework that models how behaviours, symptomatic in children with neurodevelopmental disorders, reduce specific elements of a child's playfulness, and that reductions in elements of playfulness can be offset by intervention techniques that enable those elements (Cordier, Bundy, Hocking, & Einfeld, 2009). In this approach, play is defined as an interaction between an individual and the environment (physical and social) that includes four elements: internal control, intrinsic motivation; freedom from the constraints of reality, and framing (the giving and receiving of social cues; Bundy, 2004). Informed by this model, the pragmatic language difficulties associated with autism will therefore reduce children's playfulness by impacting the play element of framing. The techniques included in the intervention therefore are designed to address pragmatic language difficulties by enabling the play element of framing.

Techniques utilised in the intervention to enable pragmatics are self- modelling through video-feedback and -feedforward, and peer- and therapist-modelling, during child-led play activities. These intervention elements have been associated with improvements in multiple social skills domains. For

example, the use of video-feedback and peer-mediation have both been associated with improvements in social communication, and skill maintenance and generalisation (Bellini & Akullian, 2007; Chang & Locke, 2016; Watkins et al., 2015). The combined techniques used in the current study was first evaluated by Wilkes-Gillan, Bundy, Cordier, Lincoln, and Chen (2016) in an RCT evaluating the intervention for children with ADHD. Children with ADHD made significant gains in playfulness, particularly in behaviours related to empathy. Benefits were also maintained and generalised to the children's home environment (Wilkes-Gillan et al., 2016). These improvements in emotional understanding suggest that the intervention may also be effective for targeting pragmatic language.

A systematic approach should be taken to designing and evaluating complex interventions; combining theory development, trials of feasibility, and exploratory studies that culminate in evaluations of effectiveness (Craig et al., 2008). The aforementioned intervention was found to significantly improve play skills in children with ADHD, with gains maintained at 2-month follow-up (Wilkes-Gillan et al., 2016). Recently, pilot studies have established the feasibility and appropriateness of an adapted version of this play-based intervention tailored to the needs of children with autism (Kent, Cordier, Joosten, Wilkes-Gillan, & Bundy, 2018; Parsons, Cordier, Munro, & Joosten, 2018). Preliminary effectiveness in the areas of pragmatic language performance and capacity were evaluated using the POM and the Social Emotional Evaluation (SEE; Wiig, 2008) respectively (Parsons et al., 2018).

This randomised controlled trial (RCT) aimed to evaluate the effectiveness of the intervention for improving pragmatic language performance and capacity in children with autism during social play with peers. Specific research questions were:

1. Do children with autism who receive a play-based, peer-mediated intervention make greater gains in pragmatic language performance (POM-2) and capacity (SEE) than children with autism who have not received a pragmatic language intervention?
2. Are changes in pragmatic language performance (POM-2) and capacity (SEE) maintained 3-months after the intervention period?

3. Is pragmatic language performance (POM-2) in play-based interactions equivalent in the clinic and home environments following the intervention?

4. Which variables moderate pragmatic language performance (POM-2) and capacity (SEE) over the duration of the study?

4.3   Methods

4.3.1   Trial design and registration

This RCT used two parallel groups, comprising part of a larger project also evaluating the intervention's impact on children's play skills. The reporting of this study was guided by the Consolidated Standards of Reporting Trials (CONSORT) guidelines (Schulz, Altman, & Moher, 2010) to ensure transparent reporting of methodology. The Template for Intervention Description and Replication (TIDieR) guidelines (Hoffmann et al., 2014) were also considered to allow for easier intervention replication and utilisation.

The trial was registered with the Australia New Zealand Clinical Trials Registry a priori (ACTRN12615000008527) and the protocol was approved by Curtin University's Human Research Ethics Committee (HR04/2015). Researchers explained the study requirements to all children and parents prior to obtaining consent. Parents provided written consent on behalf of their children, and children provided verbal assent (ages <7 years) and written consent (ages >7 years). Recruitment took place between February 2016 and April 2017, and 3-month follow-ups were completed by October 2017.

4.3.2   Participants

Recruitment occurred using convenience sampling. Fliers were distributed to schools and speech pathology and occupational therapy clinics and posted on online forums for speech pathologists and parents of children with autism. Study information was also disseminated to families waitlisted for a large, local autism service provider. Parents of 102 children with autism contacted researchers and were screened for eligibility via telephone; 80 children met the inclusion criteria and were able to commit to the study schedule. To attend the study, children with autism were required to invite a

typically-developing playmate to attend the study. Of the 80 children screened as meeting inclusion criteria, nine were unable to identify a suitable playmate, leaving a total of 71 children who entered the study. One family enrolled three children with autism and a second family enrolled two children with autism. One intervention-first dyad (child with autism and playmate) dropped out after eight sessions and two waitlisted dyads did not return for baseline 2 due to family illness, reducing the total sample to 68 children with autism. One waitlist-first dyad did not commence the intervention due to scheduling conflicts and another dropped out after seven sessions. A total of 66 children completed the intervention. See Figure 4.1 for the participant flow diagram. Three typically-developing playmates attended the intervention twice; each time with a different child with autism. Three playmates who dropped out were replaced with three new playmates. See Table 4.1 for demographic information for all children and parents.
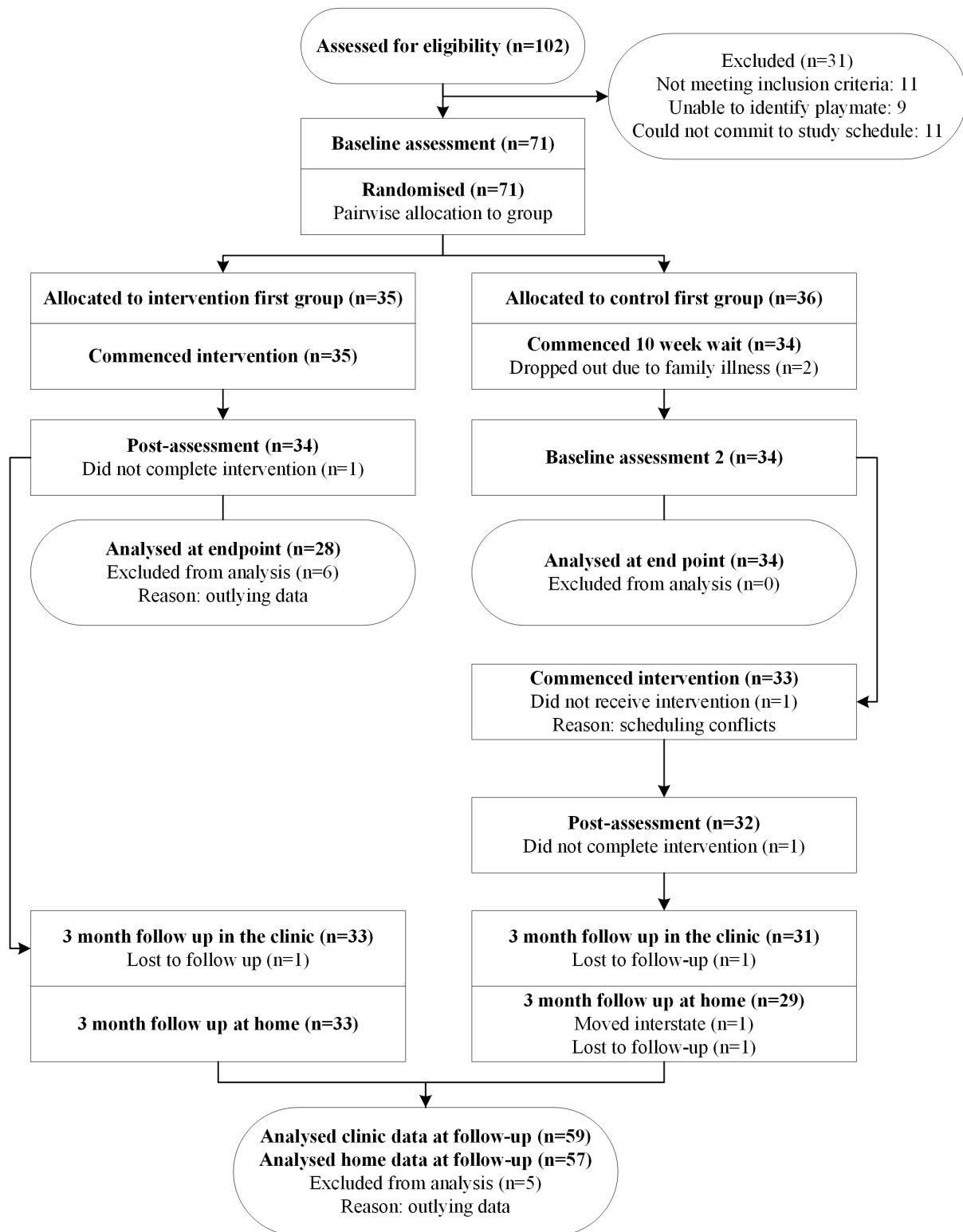
Figure 4.1. CONSORT flowchart

Table 4.1. Participant demographic variables

	Children with Autism			Playmates		
	Intervention-First	Waitlist-First	p	Intervention-First[a]	Waitlist-First[b]	p
Parent Demographics[c]						
Age (years)	42.4 (5.92)	40.6 (3.94)	0.170	42.5 (5.68)	39.8 (6.67)	0.108
Education after high school	20 of 26	26 of 33	0.906	20 of 26	29 of 35	0.877
Child Demographics						
Age (years)	8.6 (1.38)	8.4 (1.36)	0.558	8.6 (1.83)	8.0 (1.48)	0.185
Gender (male)	26 of 28	28 of 34	0.220	12 of 27	20 of 35	0.321
Screening Assessments						
CCBRS[d]						
Autistic disorder	86.0 (7.88)	85.5 (7.37)	0.819	50.5 (10.12)	55.7 (15.92)	0.179
Asperger's disorder	81.1 (11.00)	79.0 (11.06)	0.492	50.2 (9.39)	53.1 (12.16)	0.350
ADHD (inattentive)	75.5 (11.42)	81.5 (8.97)	0.037*	57.2 (16.43)	59.0 (13.91)	0.668
ADHD (hyperactive-impulsive)	74.8 (13.70)	69.9 (15.25)	0.217	54.6 (13.17)	57.5 (15.43)	0.460
CCC-2[e]						
General Communication Composite	40.3 (11.62)	35.4 (17.15)	0.248	74.1 (20.02)	73.0 (21.69)	0.932
Social Interaction Difference Index	-11.4 (9.18)	-4.4 (8.02)	0.006**	0.3 (7.70)	0.5 (7.41)	0.363
EVT-2	104.8 (13.16)	104.4 (12.50)	0.908	107.8 (11.87)	110.3 (11.56)	0.432
TACL-4	8.6 (2.42)	8.4 (2.09)	0.844	8.7 (1.47)	9.2 (1.95)	0.306
Dyad Variables						
Age difference (months)	1.68 (23.4)	-5.8 (19.44)	0.177			
Playmate sibling (%)	19 of 28 (67.9)	28 of 34 (82.4)	0.233			

Note. CCBRS = Conners Comprehensive Behaviour Rating Scale, CCC-2 = Children's Communication Checklist 2nd Edition, EVT-2 = Expressive Vocabulary Test 2nd Edition, TACL-4 = Test for Auditory Comprehension of Language 4th Edition; aNumber of playmates not equal to number of children with autism as two playmates attended twice with different children with autism, and one dropped out and was replaced by a new playmate; bNumber of playmates not equal to number of children with autism as one playmate attended with two different children with autism, and two dropped out and were replaced by two new playmates; cSome parents enrolled multiple children with autism, and one parent had two children enrolled as playmates; dClinical cut off = T-score > 70, borderline clinical cut off = T-score > 65; eGeneral Communication Composite < 55 and a Social Interaction Difference Index < 0 suggests a communication profile indicative of autism; *p < 0.05; **p < 0.01.

4.3.2.1　　　　　　　**Children with autism**

Children with autism needed to be aged 6-11 years to participate and have a diagnosis of autism or Asperger syndrome in accordance with the DSM-IV or 5 (American Psychiatric Association, 2000, 2013) without an intellectual disability. To receive an autism diagnosis in Western Australia, children are assessed by a psychiatrist or paediatrician, psychologist and speech pathologist who then collaborate to make a joint diagnostic decision that the child meets the DSM diagnostic criteria (Glasson et al., 2008). Researchers sighted these multidisciplinary diagnostic reports to confirm children's autism diagnoses and absence of an intellectual disability. As severe structural language difficulties may reduce children's comprehension of intervention concepts, a standard score ≥70 on the Expressive Vocabulary Test (EVT-2; Williams, 2007) and scaled score ≥4 on the Elaborated Sentences and Phrases subtest of the Test for Auditory Comprehension of Language (TACL-4; Carrow-Woolfolk, 2014) were additional eligibility requirements. Parents of children with autism identified improving social communication and play skills as goals for their children.

4.3.2.2　　　　　　　**Playmates**

Children with autism invited a typically-developing peer to attend the trial as a playmate. Informed by pilot studies (Henning, Cordier, Wilkes-Gillan, & Falkmer, 2016; Kent et al., 2018; Parsons et al., 2018), peers needed to be known to the child with autism (i.e., sibling or friend), and of a similar age; ideally within two years. A majority (75.8%) of playmates in the study were siblings of the children with autism. The remainder were friends with the exception of three cousins. Playmates were required to be aged 6-11 years, with no parental concern for neurodevelopmental disorders. An EVT-2 standard score ≥70, and a TACL-4 Elaborated Sentences and Phrases scaled score ≥4 were also required to ensure playmates did not have severe structural language difficulties that might reduce comprehension of intervention concepts.

4.3.3   Instruments

4.3.3.1   Screening measures

The *Expressive Vocabulary Test, 2nd Edition* (EVT-2; Williams, 2007) and the *Elaborated Phrases and Sentences* subtest of the *Test for Auditory Comprehension of Language 4th Edition* (TACL-4; Carrow-Woolfolk, 2014) were used to screen children's structural language. The EVT-2 is a measure of word recall and expressive vocabulary with strong internal consistency (α = 0.96), and test-retest reliability (r = 0.95). EVT-2 standard scores show moderate to strong correlations with Clinical Evaluation of Language Fundamentals, 4th edition (Semel, Wiig, & Secord, 2003) standard scores (r = 0.68 – 0.80; Williams, 2007).

Elaborated Phrases and Sentences evaluates receptive syntax. The TACL-4 has sensitivity and specificity indices of 0.22 and 1.00 respectively, for detecting children with language impairment at the selected cut-off.

Two parent report measures were used to characterise the communication and behaviour profiles of the children with autism and to confirm there were no developmental concerns for the playmates. The *Children's Communication Checklist 2nd Edition* (CCC-2; Bishop, 2006) evaluated language form, pragmatics, and semantics, and the *Conners Comprehensive Behaviour Rating Scales* (CCBRS; Conners, 2008) assessed behavioural, emotional, academic and social problems in children and adolescents. The CCC-2 has sensitivity and specificity values of 0.89 and 0.97 respectively, for identifying children with autism symptomology and pragmatic language impairment (Bishop, 2006). The CCBRS has good evidence for internal consistency (α = 0.67-0.97), test-retest reliability (r = 0.56-0.96), and inter-rater reliability (r = 0.50-0.89), and overall correct classification rates of 0.70-0.89 for its clinical indexes (Conners, 2008).

4.3.3.2   Performance outcome measure

The *Pragmatics Observational Measure 2* (POM-2; Cordier et al., 2018; Cordier et al., 2014), was the primary outcome measure. It is an observational instrument that evaluates pragmatic language performance during social play and can be used by blinded assessors to reduce measurement bias.

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Items within the POM-2 operationalise the definition of pragmatic language adopted for this study. Items are rated on a 4-point scale; higher scores indicate more advanced pragmatic language competence. In this updated version of the POM, an Overall Measure score and two subscale scores (Nonverbal Communication and Verbal Communication) are produced. The POM and POM-2 have strong evidence for internal consistency ($\alpha = 0.99$), and construct validity (99% of items and 97% of people fit Rasch expectations) (Cordier et al., 2018; Cordier et al., 2014). Criterion validity was assessed against the Pragmatic Protocol (Prutting & Kirchner, 1987), and was found to be strong (Cordier et al., 2014). The Pragmatic Protocol was the only psychometrically validated observational measure of pragmatic language at the time the POM was validated.

To evaluate the pragmatic language performance of children with autism and their playmate, 15-minute videos of each dyad playing in the clinic playroom were recorded pre and post intervention, and at 3-month follow up. Waitlist-first dyads were also filmed playing in the clinic 10-weeks prior to starting the intervention. Additional play footage was recorded at the homes of children with autism at 3-month follow-up to compare performance across environments. De-identified videos were sent to an independent assessor for rating. The assessor was blinded to study purpose, group allocation, participant diagnosis, and timing of the videos. Rasch analysis determined the assessor's scores were reliable for the 310 videos sampled, as goodness-of-fit statistics were within the required parameters (*MnSq* < 1.4 and > 0.7; standardised value < 2.0).

4.3.3.3   Capacity outcome measure

The *Social Emotional Evaluation* (SEE; Wiig, 2008) measured the pragmatic language capacity of the children with autism and their playmates. Subtests within the SEE evaluate children's understanding of verbal and nonverbal communication behaviours, specifically related to perspective taking, nonverbal expression of emotion and the communicative intent of utterances. It is criterion-referenced, providing *z*-scores for ages 6;0-7;11, 8;0-9;11, and 10;0-12;11. The four core subtests were administered; each containing receptive and expressive tasks: *Identifying Common Emotions*, *Recognising Emotional Reactions*, *Understanding Social Gaffes*, and *Understanding Conflicting*

Messages. Subtest raw scores are summed and converted to *z*-scores producing receptive, expressive and total composite scores. The SEE has demonstrated good internal consistency (α = 0.76 - 0.88), test-retest reliability (*r* = 0.88-0.93), and inter-rater reliability (r = 0.96-1.00; Wiig, 2008). At a *z*-score cut-off of -1.00 the SEE has overall sensitivity and specificity values of 0.95-1.00, for identifying children with autism.

4.3.4 Procedures

The necessary sample size for this study was calculated using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). A sample size of 34 participants per group was needed to detect a moderate-to-large effect size (Cohen's *d* $\geq$ 0.7) with 80% power using a *t*-test with an alpha of 0.05 (two tailed significance). A moderate-to-large effect size was selected after consideration of the effect sizes available through the previous pilot study (*r* = 0.6), other RCTs of pragmatic language intervention for children with autism (Hedge's *g* = -0.5 – 1.4), and an earlier RCT of a similar intervention for children with ADHD (*d* = 1.5).

4.3.4.1 Randomisation

Participants were randomised in pairs, as recruitment was sporadic. An independent researcher used a random number generator (random.org; Haahr, 2010) to allocate participants to group 1 (intervention-first) or group 2 (waitlist-first). Group allocation was concealed in envelopes until baseline assessments were completed to ensure researchers, participants and assessors were blinded to group allocation at baseline. Intervention-first participants attended the intervention immediately (*n* = 35). Waitlist-first participants waited for 10-weeks before starting the intervention (*n* = 34). All participants agreed not to undertake any pragmatics and play interventions while participating in this study. To avoid contamination between groups, families received the same group allocation if they enrolled multiple children with autism at the same time (*n* = 4). This was also done to avoid burdening families with an extended intervention period if children were allocated to different groups.

4.3.4.2 Baseline assessment

Week one of participation included the following baseline assessment procedures. Dyads entered the clinic playroom to play for 15-minutes. The play session was filmed to allow for a blinded assessor to rate both children's pragmatic language performance using the POM-2. The playroom contained a variety of toys and equipment to encourage social-play activities such as role playing, board games, construction, or gross-motor play. A list of available toys is reported in Parsons et al. (2018). Therapists and parents observed dyads playing via a computer screen in an adjacent room, and the therapist consulted with parents about their child's social communication difficulties. Following the play, children with autism and their playmates completed the EVT-2, TACL-4 and SEE, and parents were provided with parent-report questionnaires (i.e., CCC-2 and CCBRS).

4.3.4.3 Intervention: Clinic components

Dyads attended weekly intervention sessions with a therapist at Curtin University. Additional appointments were scheduled for children who missed sessions to optimise participation. A speech pathologist and an occupational therapist conducted the eight intervention sessions between pre- and post- assessment (sessions one and ten respectively). Both therapists received training in the intervention during the pilot study with 10 participants and were supported by the second author. Children were allocated to a therapist based on mutual availability. Of the children who completed post- assessments ($n = 66$), 97% attended eight intervention sessions. Two participants had post-assessments after six intervention sessions, and one after seven sessions, as the families were unable to commit to additional weekly appointments. On average, participants completed eight intervention sessions in 8.3 weeks.

All weekly clinic sessions followed the same format: 1) 15-20 minutes of therapist-lead video-feedback; 2) 20 minutes of child-lead play with therapist modelling; and 3) 15 minutes of therapist-parent discussion while children continued playing. Toys in the playroom were selected to suit a range of ages, play skill levels, and interests. There were two wall-mounted video cameras fitted in the playroom to film all intervention play sessions for use in video-feedback.

During video-feedback, dyads viewed 3-4 clips of video footage (30-60 seconds each) from their previous week's play session, coded as 'red play' or 'green play', and discussed observed pragmatic language skills with the therapist. Parents were present during these video-feedback discussions. 'Green play' exemplified pragmatic language that promoted social interaction (e.g., responding to questions, making suggestions to evolve the play, using body posture to demonstrate engagement in the interaction). The pragmatic language viewed in 'red play' did not promote social interaction (e.g., rejecting playmate's suggestions, tangential discourse, failure to consider playmate's perspective or emotions). Therapists and children discussed the pragmatic language skills exemplified in green play, and the skills that could promote the social interaction in red play. Video-feedback ended with video-feedforward in the form of 2-3 pragmatic language skills to put into practice in the playroom that day. Therapists created the video-feedback sequences between children's intervention sessions by editing the digital video files recorded by cameras in situ in the playroom using video editing software (Adobe Premier Pro CC; Adobe Systems Incorporated, 2014).

The therapists entered the playroom with the dyads following video-feedback and played with the dyad as a playmate, rather than an instructor, to ensure activities were child-led. Parents viewed the play in an adjacent room on a computer screen. While playing, the therapist ensured that activities remained as play (based on the adopted model; Bundy, 2004), but moved in a direction that promoted the intervention goals. Therapists promoted intervention goals by modelling targeted pragmatic language skills to children with autism (e.g., sharing a new play idea if conversation initiation or maintenance was a target) and strategies for supporting another's pragmatic language to playmates (e.g., asking questions if the child with autism did not provide enough information about their play idea). After 20-minutes, therapists joined the parents in an adjacent room to discuss their child's intervention goals and strategies to promote targeted pragmatic language principles at home.

Pragmatic language targets were informed by the pragmatic language behaviours operationalised by the POM-2, and individualised targets were selected by the therapists and tailored to each dyad based on POM-2 performance. A list of all possible targets is provided in Table 4.2. Challenges in the pragmatic language performance profile of the child with autism (based on POM-2 baseline scores)

were considered in relation to their playmate's pragmatic language performance (also based on POM-2 baseline scores). In doing so, a playmate's pragmatic language performance could be leveraged both as a model and facilitator of performance for the child with autism. Pilot-studies indicated that children recalled principles more easily when presented as short, syntactically simple 'catch phrases' (Parsons et al., 2018). Prior to commencing this RCT, researchers developed a matrix of catch phrases representing all possible target skills (e.g., 'share ideas' if conversation initiations were targeted). Therapists used these phrase labels when discussing the pragmatic language principles during video-feedback.

Table 4.2. Pragmatic language skills targeted by the intervention studied.

Pragmatic language skill

Introducing communication and being responsive to a playmate's communication:
- Selecting a range of conversation topics
- Conversation topic maintenance and change
- Contingency with previously communicated content
- Initiating verbal communication
- Responding to playmate's communication
- Repairing or revising communication to resolve breakdowns

Using non-verbal communication and interpreting a playmate's non-verbal communication:
- Using and responding to facial expressions
- Using and responding to gestures (i.e., body movements or actions)
- Using and responding to body positioning
- Using physical space between playmates appropriately

Understanding and responding to the emotional reactions and intentions of a playmate:
- Being aware of and responsive to playmate's emotional needs
- Integrating playmate's perspective or emotions
- Using verbal and non-verbal language appropriate to the social context
- Adapting behaviour and language to environmental demands

Using cognitive processes to promote an interaction with a playmate:
- Attending to playmate's communicative content, planning and initiating appropriate responses
- Planning and delivering organised communication content

Using negotiation techniques to promote an interaction with a playmate:
- Resolving conflicts
- Cooperating to promote a mutually beneficial exchange
- Engagement in play-based interaction with playmate
- Effectively expressing viewpoint, emotions or opinions
- Making suggestions and effectively offering opinions
- Disagreeing effectively so that the interaction is continued

To maintain fidelity during the intervention, therapists worked closely with each other to set intervention goals, debrief between intervention sessions, review the language used to talk to children about pragmatic language skills. Therapists also viewed each other delivering the intervention to provide feedback and discuss consistent use of techniques.

4.3.4.4 Intervention: Home components

Therapists trained parents in the home-based intervention components during session 1. Parents were provided with a manual to review each week, containing ten modules on social communication and play skills that are challenging for children with social difficulties (e.g., perspective taking, negotiation and problem solving). Each module defined the focus skill, explained its importance at home and school, and described strategies for parents to use to support their child's social play. Therapists prescribed one module to parents each week based on observed challenges in the playroom and problems occurring at home or school.

Families were also given a series of short videos (6-8 minutes) aligned with the modules contained within the manual. Parents and children with autism viewed one video per week at home. The videos portrayed the play-based interactions of two fictional characters in contexts familiar to children (e.g., playground, park, at home). The videos included examples of red and green play and the characters received help from superheroes to resolve red play before modelling how to repair the social interaction. Parents guided a discussion with their child about the play and social communication skills and strategies observed. Information about the manual and videos will be made available by the authors upon request. Parents were instructed to arrange weekly playdates for dyads between clinic sessions.

Through discussions with the therapist and the parent manual, parents were coached to provide feedback before, during and after the playdate using the language and terminology that the therapist used during clinic sessions. Through weekly discussion with parents, it was clear that parents were highly compliant with reading the prescribed chapters, viewing the videos with their child and

following through on arranging playdates for their children, however compliance was not formally assessed.

4.3.4.5 Post-intervention and follow-up assessment

Participation week 10 included post-intervention assessments (i.e., POM-2 and SEE), conducted mirroring baseline procedures in the clinic. The same procedures were completed at the clinic 3-months later. Therapists also attended the homes of children with autism in the week proceeding their clinic follow-up, to film dyads playing for 15-minutes using hand-held cameras. This allowed for the blinded assessor to rate children's pragmatic language performance (POM-2) in a secondary environment at follow-up. Play at home included outdoor or indoor play with the children's own toys.

4.3.5 Statistical analysis

4.3.5.1 Data preparation

Ordinal POM-2 item ratings were converted to interval level measure scores using Rasch analysis in Winsteps (Version 3.92.0; Linacre, 2016). Measure scores for POM-2 Overall, and the Non-verbal and Verbal Communication subscales were derived for each participant for all assessment time-points. POM-2 and SEE scores of participants with TACL-4 scores of 4 (i.e., at inclusion cut-off; $n = 7$) and participants who attended <10 sessions prior to post- assessment ($n = 2$) were reviewed. Person-fit statistics did not fit Rasch expectations for all POM-2 measure scores at all time points for four participants and so they were excluded from analysis as their data was not considered reliable. SEE composite z-scores were below floor level for a further two participants, so they were excluded from analysis as a true baseline could not be established. The remaining analyses of participant demographic, screening and outcome measure data were performed using IBM SPSS Statistics (Version 22; IBM Corporation, 2013).

4.3.5.2 Baseline differences

Shaprio-Wilkes tests indicated data were normally distributed, so independent samples t-tests for interval level variables or Pearson's Chi Square tests for categorical variables were used to compare baseline demographic and screening data of children in each group. Parent and playmate data were

equivalent between groups. The demographic, language and behavioural profiles of children with autism did not differ, with the exception of their Inattentive ADHD and Social Interaction Deviance Composite (SIDC) scores. While the group means for these two scores differed, the scores of both groups fell within the same clinical categories defined by the cut-off scores of each measure. The Inattentive ADHD T-scores for both groups were above the clinical cut-off score of 70. The SIDC for both groups was < 0, which in combination with a General Communication Composite < 55 suggests a communication profile characteristic of autism (see Table 4.1). Baseline POM-2 and SEE scores for both groups were also compared and no difference was detected ($p = 0.13 – 0.75$).

4.3.5.3 Differences in change between groups

Change-scores was calculated for POM-2 Overall, POM-2 Nonverbal Communication, POM-2 Verbal Communication, SEE Receptive, SEE Expressive and SEE Total scores by deducting baseline from post scores (for intervention-first participants; $n = 28$) or baseline one from baseline two scores (for waitlist-first participants; $n = 34$). Independent samples t-tests compared the difference in the change-score means of both groups. Significance was set at $p < 0.05$. Cohen's d effect sizes were calculated, and interpreted as follows: 0.2 = small effect size, 0.5 = medium effect size, 0.8 = large effect size (Cohen, 1988).

4.3.5.4 Changes over time

To increase the statistical power of the remaining analyses, pre, post and 3-month follow up POM-2 and SEE scores for all participants ($n = 59$) were combined. Linear mixed models were created for each score (i.e., POM-2 Overall, POM-2 Nonverbal Communication, POM-2 Verbal Communication, SEE Receptive, SEE Expressive and SEE Total) to assess the fixed effect of time, allowing for subject level random intercepts. Pairwise comparisons of main effects between each time point were assessed if a significant overall main effect of time was detected. Significance was set at $p < 0.05$. Cohen's d effect sizes were calculated and interpreted using the previously described convention.

4.3.5.5 Pragmatic language performance across environments

A difference-score was calculated for all POM-2 scores (Overall, Verbal and Nonverbal) at 3-month follow-up by deducting home follow-up scores from clinic follow-up scores. Single sample t-tests were conducted on the difference-scores to determine whether they were significantly different from zero. Pragmatic language performance during play-based interactions with a peer was considered to be equivalent across environments at the end of the study if results were not significant ($p > 0.05$).

4.3.5.6 Moderator analysis

An exploratory moderator analysis was conducted using linear mixed models. Six potential moderating variables were examined: time (i.e., pre, post, follow-up), expressive vocabulary (EVT-2 score), receptive syntax (TACL-4 score), playmate relationship (sibling, non-sibling), age difference between children within the dyads, age group of children with autism (i.e., 6-7, 8-9, 10-11 years; age categories mirrored those used in the SEE z-scores), and therapist profession (speech pathologist, occupational therapist). These variables were selected as they represent child, dyad and therapist characteristics that might influence children's pragmatic capacity and performance during the intervention. Dependent variables examined were POM-2 Overall, POM-2 Nonverbal Communication, POM-2 Verbal Communication, SEE Receptive, SEE Expressive and SEE Total scores, allowing for subject level random intercepts. Time was the independent variable.

As there was no a priori hypothesis for entering variables into the model, univariate models first assessed the significance of each moderating variable as a means of screening for moderators to include in the final multivariate analysis. Then, significant univariate variables were entered into a multivariate model. As there was no a priori hypothesis for entering variables into the model, non-significant independent variables were removed from the model until only significant explanatory variables remained. Significance was set at $p < 0.05$ for the multivariate analysis. Correction for multiple comparisons was not made as conclusions were drawn from the multivariate analysis only.

4.4 Results

4.4.1 Differences in change between groups

The overall pragmatic performance change in children with autism in the intervention-first group over the 10-weeks of intervention was significantly greater than the change in the waitlist-first group during their 10-week waiting period, $t(60) = 2.213$, $p = 0.031$, $d = 0.57$. Changes in non-verbal communication were also significantly greater for the intervention-first group compared to the waitlist-first group over the same time period, $t(60) = 2.676$, $p = 0.010$, $d = 0.68$. A small to medium effect was detected in favour of the intervention-first group when comparing changes-scores for Verbal Communication, SEE Receptive, SEE Expressive and SEE Total composites; however, between-groups differences were not significant (Table 4.3).

Table 4.3. Comparison of intervention-first group change scores with waitlist-first group change scores

Measure	Intervention-First		Waitlist-first		Change score comparisons		Effect size
	Mean (SD)		*Mean (SD)*				
	Baseline 1	Post-Intervention	Baseline 1	Baseline 2	*t*	*p*	*d*
POM-2							
Overall	26.7 (30.42)	43.6 (26.04)	16.6 (29.62)	20.7 (28.84)	2.21	0.031*	0.57
Nonverbal	28.4 (33.47)	51.3 (28.74)	19.9 (31.67)	22.4 (30.60)	2.68	0.010*	0.68
Verbal	17.5 (35.62)	38.9 (33.35)	3.9 (34.41)	9.7 (35.90)	1.74	0.087	0.46
SEE							
Receptive	-0.59 (1.13)	-0.16 (0.92)	-0.28 (1.10)	-0.20 (0.13)	1.61	0.112	0.47
Expressive	-0.62 (1.05)	-0.25 (1.03)	-0.53 (1.03)	-0.50 (1.03)	1.61	0.114	0.40
Total	-0.63 (1.16)	-0.26 (0.99)	-0.49 (1.08)	-0.35 (1.10)	1.04	0.304	0.27

Note. POM-2 = Pragmatics Observational Measure 2nd Edition; SEE = Social-Emotional Evaluation; SD = standard deviation; *p < 0.05; Cohen's d interpretation: 0.2 = small, 0.5 = medium, 0.8 = large.

4.4.2 Change over time

A significant main effect of time was detected for children with autism on: a) POM-2 Overall, $F(2,119) = 22.381$, $p = <0.001$; b) Nonverbal Communication, $F(2,119) = 21.041$, $p = <0.001$, and c) Verbal Communication scores, $F(2,119) = 18.860$, $p = <0.001$. Pairwise comparisons showed overall pragmatic language, non-verbal communication, and verbal communication performance improved

significantly pre to post intervention and pre to 3-month follow-up in the clinic, with medium effect sizes. POM-2 scores increased between post and 3-month follow-up, however changes were not significant (Table 4.4). Results indicate that treatment effects for pragmatic language performance were maintained.

There was a significant main effect of time on the: a) SEE Total, $F(2, 117) = 3.783$, $p = 0.026$; b) SEE Receptive, $F(2,117) = 5.000$, $p = 0.008$, and c) SEE Expressive scores, $F(2,117) = 4.709$, $p = 0.011$. Pairwise comparisons of SEE scores showed that receptive and expressive composites improved significantly pre to post and pre to 3-month follow-up. The overall composite increased significantly pre to post intervention but not pre to 3-month follow-up. Treatment effects for pragmatic capacity were maintained at 3-month follow-up as changes from post to 3-month follow-up were not statistically significant.

Table 4.4. Comparison of outcome measures over time

Measure	Fixed Effect of Time		Estimated Marginal Means			Pairwise comparisons[a]					
			Pre-	Post-	3-mth follow-up	Pre-Post		Pre-Follow-up		Post-Follow-up	
	F	*p*	*Mean (SE)*	*Mean (SE)*	*Mean (SE)*	*p*	*d*	*p*	*d*	*p*	*d*
POM-2											
Overall	22.38	<0.001***	23.4 (3.73)	45.5 (3.78)	49.3 (3.80)	<0.001***	0.54	<0.001***	0.63	0.360	0.09
Nonverbal	21.04	<0.001***	25.1 (4.05)	49.3 (4.11)	53.7 (4.14)	<0.001***	0.54	<0.001***	0.64	0.354	0.10
Verbal	18.86	<0.001***	12.2 (4.63)	37.2 (4.70)	43.9 (4.74)	<0.001***	0.49	<0.001***	0.62	0.223	0.13
SEE											
Total	3.78	0.026*	-0.46 (0.14)	-0.11 (0.14)	-0.23 (0.14)	0.008**	0.23	0.080	0.15	0.349	-0.08
Receptive	5.00	0.008**	-0.35 (0.17)	0.03 (0.14)	-0.10 (0.14)	0.002**	0.22	0.040*	0.15	0.310	-0.09
Expressive	4.71	0.011*	-0.54 (0.14)	-0.15 (0.14)	-0.28 (0.14)	0.003**	0.26	0.050*	0.17	0.304	-0.09

Note. POM-2 = Pragmatics Observational Measure 2nd Edition; SEE = Social-Emotional Evaluation; SE = Standard error; aPOM-2 scores from 3-month follow-up assessment in the clinic; *p < 0.05; **p < 0.01; ***p <0.001; Cohen's d interpretation: 0.2 = small, 0.5 = medium, 0.8 = large.

4.4.3   Pragmatic language performance across environments

At 3-month follow-up children's POM-2 Overall measure scores were higher in the home (mean = 50.65, SD =32.36) than the clinic (mean = 49.51, SD = 29.99). Likewise, Non-verbal Communication scores were greater in the home (mean = 58.27, SD = 34.49) than the clinic (mean = 53.93, SD = 32.13); however, Verbal Communication scores were higher in the clinic (mean = 44.04, SD = 38.35) than at home (mean = 40.15, SD = 42.71). Single sample t-tests on the difference between home and clinic scores were not significant for: a) POM-2 Overall, $t(56) = 0.312$, $p = 0.757$; b) Nonverbal Communication, $t(56) = 0.1.029$, $p = 0.308$, and c) Verbal Communication, $t(56) = -0.761$, $p = 0.450$; supporting the hypothesis that the differences between clinic and home POM-2 scores were equivalent to zero.

4.4.4   Moderator analysis

Univariate main effects were explored for six variables that could potentially moderate the intervention effect as measured by the POM-2 and SEE. Variables examined were time (i.e., pre, post, follow-up), expressive vocabulary (EVT-2 score), receptive syntax (TACL-4 score), playmate relationship (sibling, non-sibling), age difference between children within the dyads, age of children with autism (i.e., 5-7; 8-9; 10-11 years), and therapist profession (speech pathologist, occupational therapist). Playmate relationship, age difference between children in each dyad, and the age group of the child with autism (6-7; 8-9;10-11 years) did not have a significant main effect on POM-2 or SEE scores. A significant, positive main effect of TACL-4 score was detected for all outcome scores. Higher TACL-4 score predicted greater changes in: a) POM-2 Overall, $F(1,57) = 15.00$, $p < 0.001$; b) POM-2 Nonverbal, $F(1,57) = 14.18$, $p < 0.001$; c) POM Verbal $F(1,57) = 13.34$, $p < 0.001$; d) SEE Total, $F(1,58) = 12.93$, $p = 0.001$, $= 0.004$; e) SEE Receptive, $F(1,58) = 13.66$, $p = <0.001$, and e) SEE Expressive, $F(1,57) = 9.08$, $p = 0.004$. A significant, positive main effect was present for EVT-2 score. Higher EVT-2 scores predicted greater changes in: a) POM-2 Overall, $F(1,56) = 4.02$, $p = 0.05$; b) POM-2 Verbal Communication, $F(1,56) = 5.16$, $p = 0.046$; c) SEE Total, $F(1,57) = 25.67$, $p < 0.001$; d) SEE Receptive, $F(1,57) = 45.47$ $p < 0.001$, and e) SEE Expressive, $F(1,56) = 19.57$, $p < 0.001$. The main effect of therapist profession was significant, favouring speech pathologist, for all

POM-2 scores: a) Overall, $F(1,58) = 12.98$, $p = 0.001$; b) Nonverbal, $F(1,58) = 13.59$, $p < 0.001$, and c) Verbal ($F(1,57) = 11.00$, $p = 0.002$), but not the SEE scores.

Significant predictor variables from the univariate analyses were simultaneously entered into the linear mixed models for POM-2 and SEE scores to produce a final model of variables that predicted children's pragmatic language scores across the study. Non-significant variables were removed from the multivariate analysis through backwards elimination. Final models for POM-2 and SEE scores are presented in Table 4.5 and Table 4.6 respectively. Significant main effects of time (i.e. pre, post, 3-month follow-up), therapist profession (i.e., speech pathologist, occupational therapist) and receptive syntax (TACL-4 score) were present for all POM-2 scores. Significant main effects of time, EVT-2 and TACL-4 were present for SEE Total and SEE Receptive scores, and time and EVT-2 were significant main effects for SEE Expressive scores.

To understand the effect of therapist profession baseline TACL-4 and POM-2 scores of children seen by the occupational therapist were compared with those of children seen by the speech pathologist. No significant differences were present in baseline POM-2 scores, but TACL-4 scores were significantly lower for children seen by the occupational therapist, $t(59) = -2.94$, $p = 0.05$. However, as TACL-4 is also a significant variable within the multiple regression models, this difference does not explain the moderating effect of therapist profession. Conditional R^2 was calculated to understand the variance in POM-2 scores explained by therapist profession using the method described by Nakagawa and Schielzeth (2013). Therapist profession accounted for 8.5%, 8.8% and 6.7% of the variance in POM-2 Overall, Nonverbal and Verbal scores respectively. This therapist comparison should be interpreted with caution, as only one therapist from each profession was involved.

Table 4.5. Results of multiple linear mixed model regression for POM-2 scores.

	POM-2 Overall			POM-2 Nonverbal			POM-2 Verbal		
	Parameter Estimates (95%CI)	F	p	Parameter Estimates (95%CI)	F	p	Parameter Estimates (95%CI)	F	p
Time		21.47	<0.001***		19.93	<0.001***		18.28	<0.001***
Pre	-25.8 (-34.2 – -17.4)			-28.3 (-37.8 – -18.8)			-31.7 (-42.7 – -20.2)		
Post	-4.1 (-12.5 – 4.3)			-4.7 (-14.2 – 4.9)			-7.0 (-18.0 – 3.9)		
3-month follow-up[a]	0			0			0		
Therapist Profession		6.50	0.014*		7.05	<0.001***		7.08	0.010*
OT	-13.8 (-24.7 – -3.0)			-15.1 (-26.5 – -3.7)			-17.2 (-30.2 – -4.2)		
SP	0			0			0		
TACL-4	3.6 (1.1 – 6.0)	8.69	0.005**	3.6 (1.1 – 6.2)	8.18	0.006**	4.3 (1.4 – 7.2)	8.85	0.004**

Note. POM-2 = Pragmatics Observational Measure 2nd Edition; TACL-4 = Test for Auditory Comprehension of Language 4th Edition; OT = Occupational Therapist; SP = Speech Pathologist; aPOM-2 scores from 3-month follow-up assessment in the clinic; *p < 0.05;*p < 0.05; **p < 0.01; ***p <0.001.

Table 4.6. Results of multiple linear mixed model regression for SEE scores

	SEE Total			SEE Receptive			SEE Expressive		
	Parameter Estimates (95%CI)	F	p	Parameter Estimates (95%CI)	F	p	Parameter Estimates (95%CI)	F	p
Time		3.89	0.023*		5.15	0.007**		4.75	0.010*
Pre	-0.22			-0.26			-0.24		
	(-6.5 - -3.1)			(-0.50 - -0.01)			(-0.50 - -0.01)		
Post	0.14			0.14			0.16		
	(-0.1 - 0.4)			(-0.11 - 0.38)			(-0.10 - 0.42)		
3-month follow-up	0			0			0		
TACL-4	0.12	4.89	0.031*	0.08	4.08	0.048*	-	-	-
	(0.01 - 0.21)			(0.00 - 0.17)					
EVT-2	0.03	16.64	<0.001***	0.04	32.31	<0.001***	0.03	15.82	<0.001***
	(0.02 - 0.05)			(0.03 - 0.06)			(0.01 - 0.05)		

Note. SEE = Social Emotional Evaluation; EM = estimated marginal; TACL-4 = Test for Auditory Comprehension of Language 4th Edition; EVT-2 = Expressive Vocabulary Test 2nd Edition; *p < 0.05; *p < 0.05; **p < 0.01; ***p <0.001.

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4.5   Discussion

The primary purpose of this randomised controlled trial was to evaluate the effectiveness of a play-based, peer-mediated intervention for improving pragmatic language in children with autism aged 6-11 years. Results indicated that the intervention is effective in improving non-verbal communication and overall pragmatic *performance* (POM-2) in children with autism during play-based interactions with a peer. The definition of pragmatic language adopted for this study includes verbal and non-verbal communication behaviours related to the emotional, social and communicative aspects of social language (Cordier et al., 2014). A previous systematic review of pragmatic language interventions for children with autism found that existing interventions targeted a limited range of these pragmatic language skills (Parsons et al., 2017), making this the first study to evaluate the effectiveness of an intervention for school-aged children with autism that targeted *all* aspects pragmatic language encompassed by contemporary definitions of the construct.

The use of a comprehensive observational measure of pragmatic language is also novel in the evaluation of pragmatic language interventions for school-aged children with autism. Prior to this study, a systematic review identified that children's pragmatic language *performance* during a naturalistic social interaction had been evaluated as an outcome in only one pragmatic language intervention RCT for older children with autism (Parsons et al., 2017). However, the measure was narrow in focus, limited to capturing social initiations (Hopkins et al., 2011), and therefore provided little insight into performance of other pragmatic language skills. Results from the current study indicate it is possible for psychosocial interventions to have a positive impact on how children with autism enact pragmatic language skills during peer-peer play, suggesting a functional, performance focused approach to intervention and assessment is valid in this area.

Results from this study also demonstrated that changes in pragmatic language performance (POM-2) were maintained three months after the intervention period. Maintenance of treatment effects three months following a pragmatic language intervention has been evaluated following two previous RCTs for children with autism aged 6-11 years with mixed findings (Ryan & Charragain, 2010; Soorya et

al., 2015). No RCT including children with autism aged 6-11 years has evaluated maintenance of treatment effects in pragmatics over a longer term (Parsons et al., 2017). There is a need for researchers to assess longer-term intervention effects to ensure benefits in targeted skills are maintained. Furthermore, investigations of longer-term benefits could also address friendship development, resilience, and self-worth.

Psychosocial interventions targeting pragmatic language do so with a broader aim of enhancing the daily social interactions of children, yet to date evaluations of intervention efficacy for school-aged children has not addressed whether targeted skills are enacted in ecologically valid social settings (Parsons et al., 2017). The current study was the first RCT to evaluate the range of pragmatic language skills applicable to school-aged children with autism during peer-to-peer social play interactions. Moreover, it was the first RCT to compare the pragmatic language performance of school-aged children with autism in multiple settings following an intervention. Results showed that children with autism demonstrated equivalent performance in the clinic and their homes at the end of the study, indicating maintenance and generalisation of treatment effects to the home environment. Findings support the combined use of video-feedback, -feedforward, peer-modelling, therapist-modelling, and parent mediation in conjunction with child-lead free-play to improve pragmatic language performance of children with autism, and that gains are maintained and generalised between clinic and home environments.

Interestingly, changes in children's verbal pragmatic performance (POM-2 Verbal Communication Element) did not differ between children who did and did not receive the intervention, though verbal pragmatic performance did improve for all children over the intervention period, with maintenance three months later. Rasch analysis produces a person-item map to represent the spread of item difficulty within a measure. More difficult items sit at the top of the vertical axis, while easier items sit towards the bottom. Examination of the person-item map of all POM-2 items for this sample found that almost all of Verbal Communication Scale items appeared towards the top of the person-item map, indicating they represent the items on which the fewest participants performed at an 'expert' level across the study (i.e., the most difficult items within the overall scale). As such, children may

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need more time to make greater gains in this area. Furthermore, therapists can place a consistent focus on verbal communication during the intervention period by 1) ensuring verbal communication skills are demonstrated and discussed in video-feedback on a weekly basis, and 2) facilitating the social play interactions where conversations are consistently maintained with both children making equal contributions.

Changes in pragmatic capacity (SEE) did not differ between children who did and did not receive the intervention. One reason for this may be the performance focus of the intervention components. For example, child-therapist discussions about pragmatic language during video-feedback concentrated on how skills can be enacted in contextualised practice, rather than explicit instruction to increase knowledge of unknown pragmatic rules. Practice effects might also explain the discord between results in pragmatic performance and capacity. Children in both groups could become more adept at responding to the items of the SEE as the time between tests was relatively short (i.e., 10-weeks). Conversely, even though the time interval was the same, children were unaware of the assessment criteria for the POM-2 and so practice effects are controlled for through the nature of the assessment. Another reason why pragmatic capacity changes were not different for the intervention-first and waitlist-first groups may be the way that SEE *z*-scores are calculated. The SEE's authors report age-referenced *z*-scores are used for assessment interpretation. However, its subtests progress in difficulty, hence researchers have suggested that evaluation of subtest level competence may be diluted when subtests are conflated to derive composite scores (Elleseff, 2015).

A key finding of the moderator analysis was that the relationship between the children within dyads did not significantly predict the pragmatic language performance (POM-2) of children with autism. Parents have previously expressed a preference for inviting siblings as playmates due to concerns around placing burden on friends if they were asked to fill the role of playmate (Parsons et al., 2018). As siblings are the most frequently available playmate for children, and children with autism report having fewer quality friendships (Bauminger & Kasari, 2000), this finding contributes to both the feasibility and appropriateness of the intervention by supporting the use of siblings as playmates.

Children's receptive syntax moderated pragmatic language performance and capacity scores in this study. Results reflect findings of previous meta-analyses showing that interventions for language content and form are most effective for children without concomitant receptive language difficulties (Law, Garrett, & Nye, 2004). This finding also reflects a body of evidence, which suggests a child's ability to integrate spoken language with the social context for comprehension is associated with their structural language abilities (Norbury, 2005; Pijnacker, Hagoort, Buitelaar, Teunisse, & Geurts, 2009). Care was taken within this study to present children with short, syntactically simple 'catch phrases' to aid recall of targeted pragmatic language principles. Future development of the intervention might consider incorporating cues that are less linguistically laden (e.g., images, or gestures) to associate with the 'catch phrases' and support comprehension for children with receptive language difficulties. Therapists must also ensure simple, concrete language is used during video-feedback discussions and within the playroom.

In this study, children's pragmatic language performance scores (POM-2) were higher when the intervention was delivered by the speech pathologist than the occupational therapist, even when accounting for differences in receptive syntax scores. However, this result should be interpreted with caution and cannot be generalised as only one therapist from each profession was involved, this is the first time a speech pathologist has delivered this intervention, and therapist profession accounted for less than 10% of the variance in POM-2 scores. Implementing a play-based intervention for children with autism presents a prime opportunity for inter-professional collaboration between speech pathologists and occupational therapists. The model of play adopted for this intervention incorporated pragmatic language through the element of framing (Bundy, 2004); however, speech pathologists must consider all elements of the play model to ensure that the activities children engage in to practice targeted pragmatic language principles are in fact play. Similarly, the intervention provides occupational therapists with the opportunity to enhance children's pragmatic language while targeting other elements of an important childhood occupation. Results suggest that future therapist training might consider providing occupational therapists with a more in-depth understanding of pragmatic

language principles to maximise the integration of the play element of framing into clinical goal setting by both professions.

This study takes an important step towards addressing gaps in the pragmatic intervention literature by demonstrating maintenance and generalisation of intervention effects. What is not yet known is whether effects generalise to social play interactions in other environments (i.e., school), with playmates who have not attended the intervention, or interactions with more than one peer. Future evaluation of children's pragmatic language performance would establish the longer-term intervention effects, and consideration should be given to evaluating future friendship development and quality.

4.5.1 Limitations

Although a majority of playmates were siblings who interacted on a regular basis, there is a possibility that children's pragmatic language improved as a result of spending more time interacting with a playmate. This possible explanation could not be evaluated in this study due to the waitlisted control design. Future studies might consider an active control condition where non-sibling peers are also encouraged to interact regularly, but without any directed pragmatic language feedback or modelling.

Potential moderators not evaluated in this study due to sample size restrictions were the behavioural, structural language and pragmatic language abilities of the playmates. The playmates are an active ingredient in this intervention and it is reasonable to expect that their demographic (e.g., age, gender), behavioural (e.g., CCBRS scores) and language (e.g., CCC-2, EVT-2, TACL-IV, POM, SEE) factors influenced the intervention effects for the children with autism. Future studies should explore the impact of playmate profiles on the outcomes for children with autism to better understand a crucial active ingredient within the intervention. Furthermore, pragmatic language as measured by the POM-2 is a transaction between two individuals and as a result the scores of the playmates are dependent on the scores of the children with autism, and vice versa. In the context of this study, it is likely that the baseline POM-2 score of the playmates are an underestimation of their pragmatic language

performance capabilities. Future studies might consider analysing the POM-2 scores of the playmates to better understand the transactional nature of pragmatic language.

4.6   Conclusions

We found that a peer-mediated, play-based intervention was effective in improving pragmatic language performance in children with autism aged 6-11 years. Gains were maintained in the short term and were observed in the home environment following the clinic-based intervention sessions. This intervention utilised a constellation of active treatment ingredients, including video-feedback, video-feedforward, peer- and therapist-modelling, and parent mediation within the context of child-lead free-play to improve pragmatic language performance of children with autism. As yet, we do not know which intervention ingredients are specifically driving these intervention effects – we leave this for future investigation. Further research is also required to understand generalisation of skills to other social contexts (e.g., school), how best to support change for children with concurrent structural language difficulties, and appropriate training methods for therapists.

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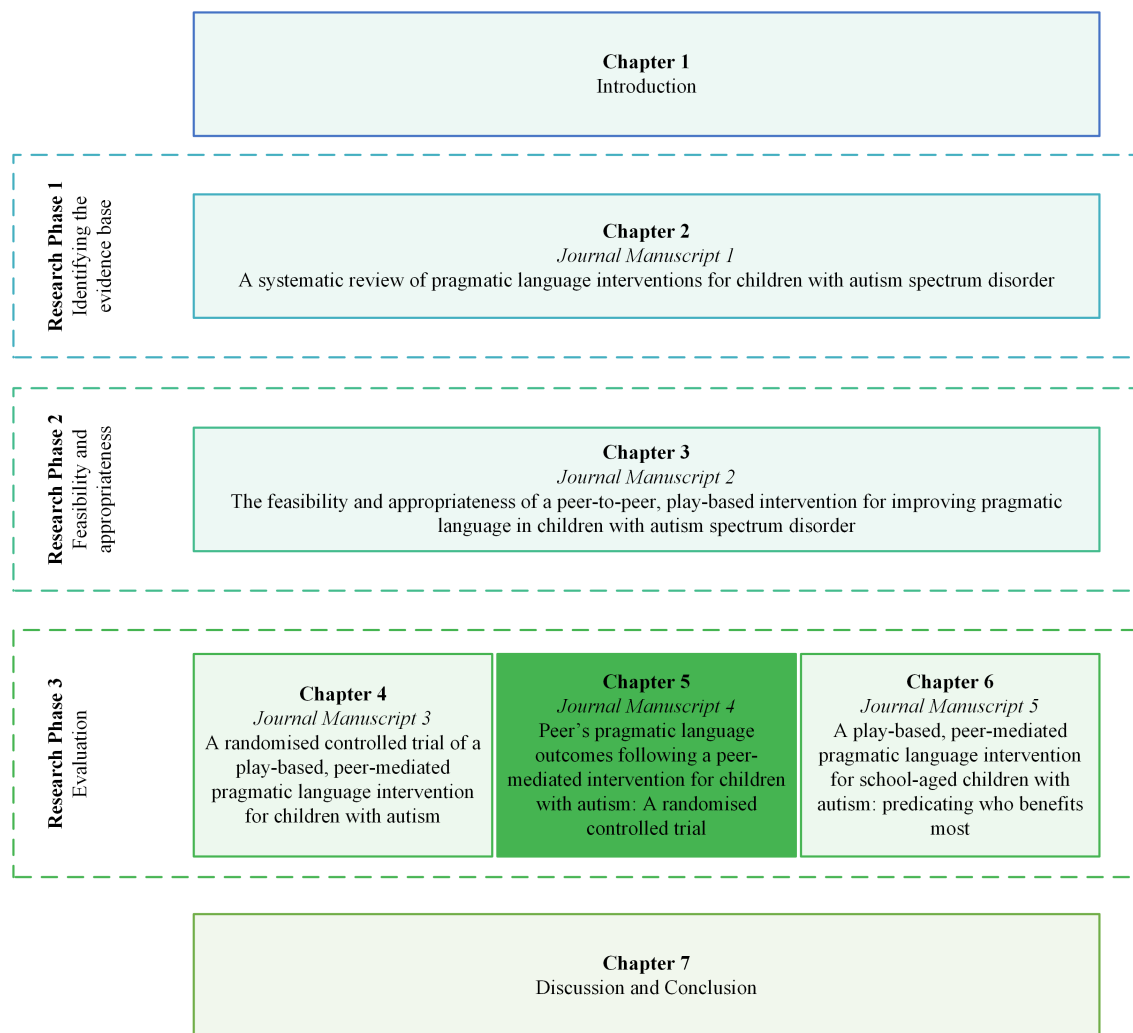
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Chapter 5 Effectiveness for Playmates

Chapter 1
Introduction

Research Phase 1
Identifying the evidence base

Chapter 2
Journal Manuscript 1
A systematic review of pragmatic language interventions for children with autism spectrum disorder

Research Phase 2
Feasibility and appropriateness

Chapter 3
Journal Manuscript 2
The feasibility and appropriateness of a peer-to-peer, play-based intervention for improving pragmatic language in children with autism spectrum disorder

Research Phase 3
Evaluation

Chapter 4	Chapter 5	Chapter 6
Journal Manuscript 3	*Journal Manuscript 4*	*Journal Manuscript 5*
A randomised controlled trial of a play-based, peer-mediated pragmatic language intervention for children with autism	Peer's pragmatic language outcomes following a peer-mediated intervention for children with autism: A randomised controlled trial	A play-based, peer-mediated pragmatic language intervention for school-aged children with autism: predicating who benefits most

Chapter 7
Discussion and Conclusion

This chapter constitutes the second component of Phase 3. Peer-mediation was not only an active ingredient within the intervention, but also aided in facilitating social play within the clinic and generalising intervention effects to the home environments of children with autism. Peers also constituted an essential aspect of intervention outcomes for children with autism; that is, the appropriate use of pragmatic language during social play with a peer. Thorough evaluation of intervention effectiveness should therefore also appraise outcomes for peers. This study investigated the pragmatic language outcomes of the typically-developing peers who attended the intervention during the randomised controlled trial (RCT). Coupled with Chapter 4, this study also provided insight into the transactional nature of pragmatic language.

Journal Manuscript 4

Peer's pragmatic language outcomes following a peer-mediated intervention for children with autism: A randomised controlled trial

Lauren Parsons[1], Reinie Cordier[1], Natalie Munro[2,1], Annette Joosten[3,1]

[1]Curtin University, School of Occupational Therapy, Social Work and Speech Pathology, Bentley, Western Australia 6102

[2]The University of Sydney, Faculty of Health Sciences, Camperdown, New South Wales, 2006

[3]Australian Catholic University, School of Allied Health, Fitzroy, Victoria, 3065

Running head: Peer outcomes after a peer-mediated intervention for children with autism

Corresponding author

Lauren Parsons

Email: lauren.parsons@curtin.edu.au

Phone: +61 89266 9266

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5.1   Abstract

Purpose: This study evaluated the pragmatic language outcomes for typically-developing peers who participated in a peer-mediated intervention for children with autism.

Methods: Dyads (child with autism and peer; $n=71$) were randomised to a treatment-first or waitlisted-first comparison group. Dyads attended 10 clinic play-sessions with a therapist and parents mediated home-practice. The Pragmatics Observational Measure 2nd edition, and Social Emotional Evaluation evaluated pragmatics before, after and 3-months following the intervention.

Results: Changes in pragmatics were equivalent for intervention-first and waitlisted peers, but all peers made significant gains in pragmatics following the intervention. Treatment effects maintained for 3-months ($p < 0.001$-0.014, $d = 0.22$-0.63), were equivalent in different environments (clinic and home).

Conclusions: This peer-mediated intervention has a positive impact on peer's pragmatic language capacity and performance.

Keywords: social communication, video-modelling, intervention development, school-age

5.2   Introduction

Reduced pragmatic language proficiency has been linked to behavioural and emotional problems and impaired social functioning in childhood (St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). Pragmatic language difficulties are a common feature of the communication profile of children with autism (Helland & Helland, 2017). This study adopts a definition of pragmatic language which includes behaviour that incorporates the social, emotional and communicative aspects of social language (Adams, Baxendale, Lloyd, & Aldred, 2005). This definition was selected as it recognises the emerging evidence of an interconnection between language and socioemotional skills (Fujiki, Brinton, & Clarke, 2002); domains which are implicated in autism spectrum disorder.

The pragmatic language difficulties associated with autism span across communicative and socioemotional aspects of social interaction. Conversational differences have been noted, including fewer initiations, less reciprocity and turn taking, reduced contingency in relation to previously communicated content, and trouble judging how much language to use in conversational responses (Adams et al., 2012; Paul, Orlovski, Marcinko, & Volkmar, 2009). The socioemotional problems associated with autism, such as difficulties with empathy, can be linked to other pragmatic language challenges such as difficulty expressing emotions, taking the perspective of another during conversation, and interpreting and responding to the emotions of others (Begeer, Koot, Rieffe, Terwogt, & Stegge, 2008; Paul et al., 2009). In combination, these pragmatic language difficulties can adversely affect social experiences of children with autism.

Children with autism report fewer friendships than their typically-developing peers and the quality of those friendships is often poorer. According to maternal reports, children with autism have significantly shorter friendships and less frequent meetings with friends than their typically developing peers (Bauminger & Shulman, 2003). Children with autism also report stronger feelings of loneliness than their typically-developing peers (Bauminger & Kasari, 2000); feelings that continue into adulthood (Tobin, Drager, & Richardson, 2014). Adults with autism have described discomfort participating in social dialogue and attribute this stress to pragmatic difficulties, such as understanding

implied meanings, interpreting and using nonverbal cues, making socioemotional inferences, and producing impromptu responses (Müller, Schuler, & Yates, 2008). To ensure more positive outcomes into adulthood, psychosocial interventions for children with autism should address these communication-related social challenges.

Poor social outcomes reported by individuals with autism cannot be solely attributed to individual differences in social interaction skills. The perceptions of others, the quality and the quantity of social interactions are contextual factors that may also influence the social functioning of children with autism (Sasson et al., 2017). This notion is supported by The *International Classification of Functioning, Disability and Health* (ICF), which conceptualises a person's functioning and disability as an interaction between their health condition and their contextual factors (World Health Organization, 2001). If the ultimate aim of social skills interventions for children with autism is to enhance every-day social interactions (DiSalvo & Oswald, 2002), then pragmatic language interventions for children with autism should not just enhance the pragmatic skills children use in every-day social interactions; they should also include and target the skills of those people with whom the children are interacting.

Peer-mediated interventions are well suited as a means of increasing an individual child's pragmatic language skills, while simultaneously targeting the skills of the peers that facilitate participation in social interactions. Peers can be a conduit to improved pragmatic language as they model and reinforce positive social interactions (DiSalvo & Oswald, 2002). Then, as the recipients of these improved skills, a peer's motivation to initiate and continue social interactions with the child with autism can be increased, thus expanding the social interaction opportunities for the child with autism (DiSalvo & Oswald, 2002). With increased opportunities for social interaction, children with autism are likely to be in a stronger position to participate in types of positive social interaction that develop and maintain friendships.

A systematic review of pragmatic language interventions for children with autism identified only one randomised controlled trial (RCT) evaluating a peer-mediated intervention for school aged children

with autism (Parsons, Cordier, Munro, Joosten, & Speyer, 2017). Corbett et al. (2015) evaluated an intervention that included typically-developing peer actors who were trained in behavioural strategies, modelling techniques and intervention principles prior to a theatre-based program. Results showed a significant improvement in parent-reported social communication, with a medium effect size (Corbett et al., 2015). The authors suggested that the inclusion of peers in the intervention would enhance generalisation; however, pragmatic language was evaluated via proxy and unblinded measurement, so it is unclear if generalisation truly occurred. In addition, the peer actors were previously unknown to the children with autism, highlighting a need for pragmatic language interventions that also include the regular peers of children with autism, in order to target children's participation in daily social activities (e.g. play).

Since the review by Parsons et al. (2017), a randomised controlled trial (RCT) evaluated the effectiveness of a pragmatic language intervention for children with autism that combined peer-mediation with video self-modelling, therapist modelling and parent mediated practice embedded within peer-peer social play (Parsons, Cordier, Munro, & Joosten, 2018b). Pragmatic language was assessed directly in the study via two means: 1) pragmatic *capacity* (knowledge of pragmatic 'rules') was assessed using a standardised measure administered to the children (Social Emotional Evaluation [SEE];Wiig, 2008); and 2) pragmatic *performance* (enactment of pragmatic language skills within ecologically valid social contexts) was assessed via an observational measure by a blinded assessor (Pragmatics Observational Measure, 2nd edition; POM-2; Cordier et al., 2018). The use of an observational measure allowed for the direct evaluation of pragmatic language in different social contexts. Results of the RCT showed the intervention was effective in improving the pragmatic language performance of children with autism, with treatment effects for pragmatic performance and capacity maintained 3-months following the 10-week intervention. Children with autism also demonstrated equivalent pragmatic performance in the clinic and home environments at the end of the study, indicating skill generalisation. Purposefully included in the RCT were peers known to the children with autism, namely siblings (76%) and friends (24%), so that social environmental factors

could also be targeted, and generalisation promoted, as children continued to interact between clinic sessions and after the intervention period ended.

Beyond the preschool years, similar aged peers are an increasingly important source of social interaction (Cordier, Bundy, Hocking, & Einfeld, 2010; Gifford-Smith & Brownell, 2003; Stocker & Dunn, 1990), linking children to an extended social world outside of the family. In a systematic review of friendship in children with autism, Petrina, Carter, and Stephenson (2014) reported children with autism were more likely to have friends with a disability than typically developing children, and two of the studies in that review reported that children and adolescents with autism tended to form friendships with other children with autism (Bauminger et al., 2008; Locke, Ishijima, Kasari, & London, 2010). Though the sample sizes in these studies were relatively small ($n = 26$ and 7 respectively), the evidence suggests that the daily social interactions of children with autism may often include models that reinforce their pragmatic language difficulties.

The activities that children with autism engage in with peers and the perceptions of typically-developing children affect their participation in social interactions. Mothers of children with autism report that their children tend to engage in structured and predictable actives with their friends (e.g., board games, video games, watching TV), while mothers of typically developing children report engagement in less predictable, socially complex actives (e.g., 'hanging out', parties; Bauminger & Shulman, 2003). Typically-developing children tend to view children with autism less favourably than their typically-developing peers, and are therefore less likely to engage them in ongoing social interactions (Sasson et al., 2017). Including typically-developing peers of children with autism in peer-mediated interventions may increase a peer's inclination to interact with a child with autism and build on the complexity of their social environment, thus building a foundation for enhancing the quality of daily social interactions for children with autism, and a social relationship for both children.

Given that children with autism tend to have few friendships, siblings are often their most frequently available playmates. The high heritability of autistic traits has focused research on the developmental trajectories of siblings of children with autism. Developmental differences in language, cognition and

social engagement have been noted in early development; however, observed differences are much less consistent once children reach school age (Gamliel, Yirmiya, Jaffe, Manor, & Sigman, 2009). Given the potential for siblings of children with autism to present with similar, albeit sub-clinical social difficulties, some may argue they are not an ideal model to include in peer-mediated interventions. However, according to parents of children with autism, siblings are the most feasible peers to attend clinic-based peer-mediated interventions with their child (Parsons, Cordier, Munro, & Joosten, 2018a). Siblings may therefore provide children with autism a graded level of social challenge. Different to peers, they are familiar and motivated to interact, but similar to peers, they can be close in age and have comparable cognitive and social abilities. Typically-developing siblings are therefore ecologically valid, feasible and appropriate candidates to fill the role of peer in peer-mediated interventions, and for these reasons the decision was made to include siblings as peers within this intervention.

Concerns over the outcomes for typically-developing children who participate in peer-mediated interventions have been reported, specifically in relation to the appropriateness of the responsibility placed on the peers and their motivation to assist as an agent of change (Ogle & Alant, 2014). To investigate this potential impact, researchers have interviewed typically-developing peers, their parents or teachers following peer-mediated programs to better understand the peers' perspective. Typically-developing peers have reported finding the experience of participating in a peer tutoring program to be rewarding and enjoyable (Jones, 2007). Teachers and parents have reported positive changes in typically-developing peers' attitudes and perceptions of their peers with autism following an integrated playgroup program (Wolfberg & Schuler, 1999). Peer outcomes following participation in integrated classroom settings also have similar themes; positive effects on peer's acceptance of and attitudes towards peers with autism (Ferraioli & Harris, 2011). These studies testify to the positive impact of inclusive models of intervention on the attitudes of typically-developing peers. However, there is a dearth of evidence for the impact, be it positive, neutral or negative, of peer-mediated interventions on the typically-developing peers' abilities in the particular skill area that they are expected to mediate.

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Participation in this peer-mediated intervention is unlikely to have a negative effect on peers' pragmatic language abilities as they are exposed to the same active ingredients as children with autism. The social play interactions of children with autism and their peers are supported by trained therapists, and peers also receive video-feedback on targeted pragmatic language skills. In the very least we expect that participation should improve a peer's ability to actively engage in and maintain social interactions with the child with autism. Given that the usual peers of children with autism (i.e., siblings and friends) are likely to also have difficulties in pragmatic language, albeit at a sub-clinical level, it is plausible that participation in a peer-mediated pragmatic language intervention could also improve the pragmatic language of the peers. For such effects to be truly meaningful they must also be maintained beyond the period of intervention and generalise across environments.

This study focuses on the pragmatic language skills of the *typically-developing peers* who participated in a peer-mediated intervention studied by Parsons et al. (2018a) and Parsons et al. (2018b). As was the case for the children with autism, the pragmatic language capacity and performance of the *typically-developing peers* were assessed in the study using the SEE and the POM-2 respectively. This is also the first peer-mediated pragmatic language intervention for children with autism to include peers with a pre-existing relationship (i.e., friends and siblings), and can therefore provide novel insight into the influence that different types of relationships have on a peer's active engagement in social interactions with children with autism. Specific research questions addressed were:

1. Is a peer-mediated pragmatic language intervention for children with autism effective for improving the pragmatic language of typically-developing peers who participated in the intervention?

2. Do typically-developing peers who participated in a peer-mediated pragmatic language intervention for children with autism make significant improvements in pragmatic language immediately after the intervention that are maintained at 3-month follow-up?

3. Do typically-developing children demonstrate equivalent pragmatic language in play-based interactions with a peer with autism in the clinic and home environments at the end of the study?

4. What factors moderate the the pragmatic language of typically-developing children during play-based interactions with a peer with autism in this study?

5.3 Methods

5.3.1 Trial design and registration

This study used a randomised controlled trial (RCT) design with two parallel groups; one group received the 10-week intervention immediately (intervention-first) and the other waited for 10-weeks before commencing the intervention (waitlist-first). The study formed part of a larger project evaluating the effectiveness of a play-based intervention for improving pragmatic language and play in children with autism. The pragmatic language outcomes for children with autism are reported in Parsons et al. (2018b). This study focuses on the outcomes of the typically-developing peers.

The protocol was approved by Curtin University Human Research Ethics Committee (approval HR04/2015), and registered with the Australia New Zealand Clinical Trials Registry (ACTRN12615000008527). Researchers explained participation requirements to parents and children before parents provided written consent on behalf of their children. Children provided written consent (aged >7 years) or verbal assent (aged 6 years).

5.3.2 Participants

Children with autism were recruited into the study using convenience sampling. A local autism service provider distributed fliers to families on their waitlist and researchers distributed fliers to speech pathology and occupational therapy clinics, local schools, and online forums for speech pathologists and parents of children with autism. Interested parents contacted researchers who conducted a screening questionnaire via phone calls to assess their child's eligibility to participate. Eligible children with autism ($n = 71$) invited a typically-developing peer to accompany them in the study as a playmate. Those typically-developing peers will henceforward be referred to as playmates.

Dyads (child with autism and playmate) were randomised to a treatment-first group ($n = 35$) or waitlist-first group ($n = 36$). One treatment-first dyad dropped out after 7 sessions, and one treatment-

first playmate dropped out after 3 sessions and was replaced by another playmate for the remaining sessions. Two waitlist-first dyads did not return for their second baseline due to family illness, and one waitlist-first playmate did not attend baseline two; another playmate attended instead, from baseline two onwards. One waitlist-first dyad did not commence the intervention due to scheduling conflicts, another waitlist-first dyad dropped out after 7 sessions and one further waitlist-first playmate dropped out after 4 sessions and was replaced by another playmate for the remaining sessions. There were three playmates who each attended with two different children with autism. See Figure 5.1 for the participant flowchart. Participant demographic information is provided in Table 5.1.
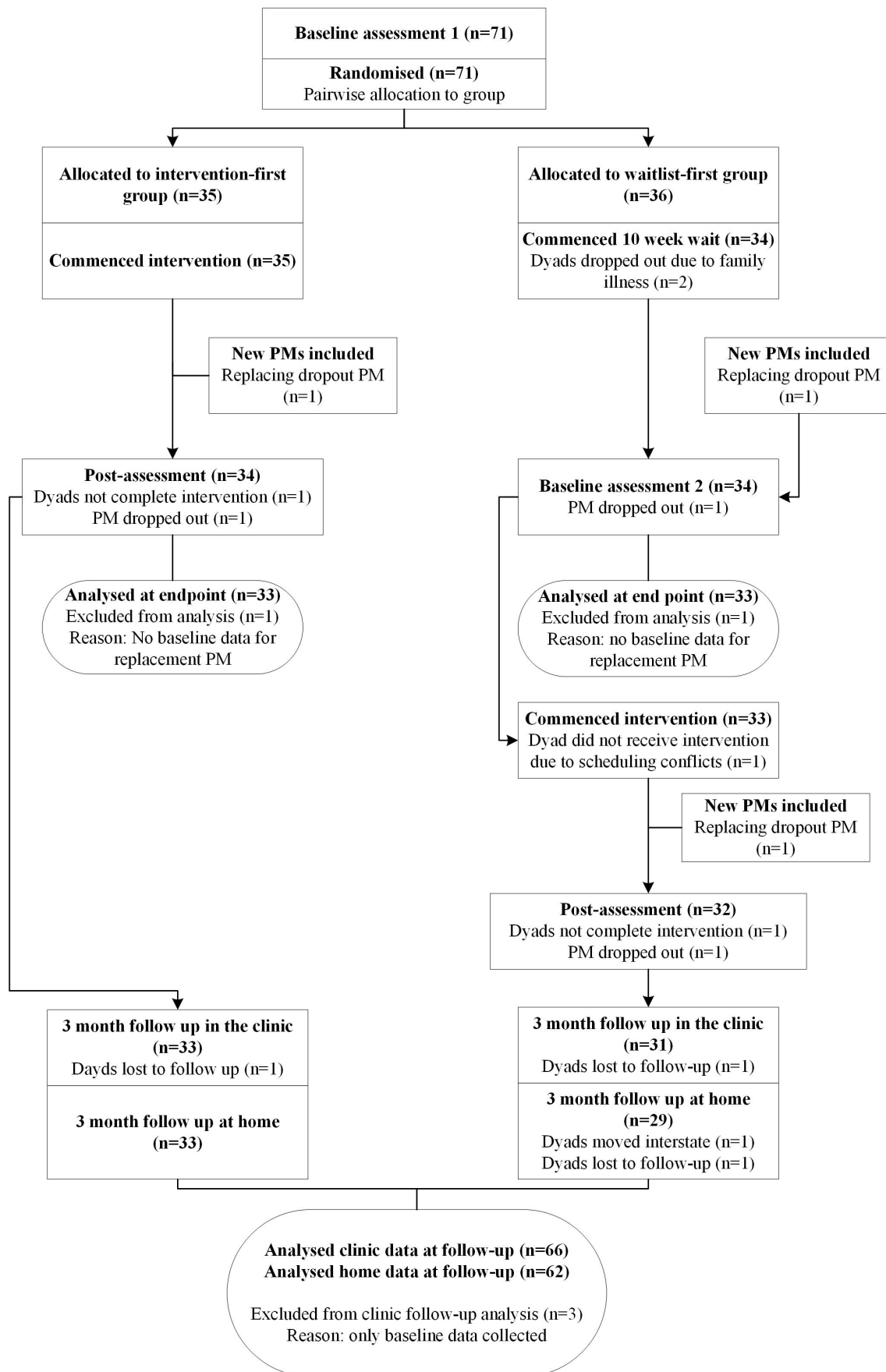
Figure 5.1. CONSORT flowchart.

Table 5.1. Participant demographic and screening variables.

	Playmates			Children with Autism		
	Intervention-First	Control-First	p	Intervention-First	Control-First	p
Parent Demographics[a]						
Age (years)	41.76 (5.58)	39.65 (6.75)	0.183	42.20 (5.95)	40.59 (3.94)	0.210
Education after high school	24 of 34	28 of 34	0.292	23 of 32	26 of 33	0.501
Child Demographics						
Age (years)	8.67 (1.73)	8.03 (1.49)	0.111	8.68 (1.38)	8.40 (1.36)	0.411
Gender (male)	15 of 34	20 of 34	0.225	31 of 34	28 of 34	0.283
Screening Assessments						
CCBRS[b]						
Autistic disorder	49.30 (9.60)	55.66 (15.92)	0.067	86.37 (7.29)	85.48 (7.37)	0.645
Asperger's disorder	49.03 (8.97)	53.07 (12.16)	0.151	81.80 (10.30)	79.03 (11.06)	0.345
ADHD (inattentive)	57.10 (14.86)	58.97 (13.91)	0.621	76.23 (10.82)	81.50 (8.97)	0.049*
ADHD (hyperactive-impulsive)	55.03 (12.76)	57.55 (15.43)	0.497	75.00 (13.08)	69.86 (15.25)	0.166
CCC-2[c]						
General Communication Composite	74.31 (19.18)	73.04 (22.14)	0.822	38.34 (13.03)	35.37 (17.15)	0.466
Social Interaction Difference Index	0.31 (7.99)	0.16 (7.40)	0.943	-10.93 (8.25)	-4.44 (8.02)	0.007*
EVT-2	106.48 (12.89)	110.72 (11.45)	0.167	102.76 (14.68)	104.39 (12.50)	0.627
TACL-4	8.70 (1.74)	9.27 (1.94)	0.209	8.12 (2.68)	8.44 (2.09)	0.581
Dyad Variables						
Age difference (months)	0.72 (22.92)	-5.76 (19.32)	0.214			
Playmate sibling	18 of 34	21 of 34	0.462			

Note. CCBRS = Conners Comprehensive Behaviour Rating Scale, CCC-2 = Children's Communication Checklist 2nd Edition, EVT-2 = Expressive Vocabulary Test 2nd Edition, TACL-4 = Test for Auditory Comprehension of Language 4th Edition;a Number of parent no equal to number of children with autism as two families enrolled multiple children with autism; bClinical cut off = T-score > 70, borderline clinical cut off = T-score > 65; cGeneral Communication Composite < 55 and a Social Interaction Difference Index < 0 suggests a communication profile indicative of autism; *p < 0.05.

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5.3.2.1   Playmates

Playmates were aged 6-11 years and did not have any neurodevelopmental disorders or concerns

reported by parents, teachers or health professionals. All playmates were known to their peer with

autism (i.e., siblings or friends) and were of a similar age. To be included, playmates were required to

score ≥70 on the Expressive Vocabulary Test (EVT; Williams, 2007) and scaled score ≥4 on the

Elaborated Sentences and Phrases subtest of the Test for Auditory Comprehension of Language

(TACL-4; Carrow-Woolfolk, 2014).

5.3.2.2   Children with autism

Children with autism were also aged 6-11 years at recruitment. They were required to have a

diagnosis of autism or Asperger syndrome in accordance with DSM-IV or 5 (American Psychiatric

Association, 2000, 2013), without an intellectual disability. Researchers sighted diagnostic reports

from multidisciplinary community teams (i.e., paediatrician, speech pathologist and psychologist) to

confirm children's autism diagnoses. Achieving an EVT standard score of ≥70 and TACL-4

Elaborated Sentences and Phrases scaled score ≥4 were also required for inclusion.

5.3.3   Instruments

Parent report measures of emotional, behavioural and communication skills were administered as

developmental screening tools, as it was important for this study to ensure that included playmates

were indeed typically developing. Two standardised language measures were also administered to

children to ensure no severe oral language impairments were present that might affect comprehension

of intervention concepts. To capture a holistic view of pragmatic language outcomes, two measures

were selected: 1) a measure of pragmatic language *capacity* to assess children's knowledge of

pragmatic skills, and 2) a measure of pragmatic language *performance* to assess how children enact

pragmatic skills in a naturalistic social interaction.

5.3.3.1   Screening measures

Children's structural language abilities were screened using the *Expressive Vocabulary Test 2nd*

Edition (EVT; Williams, 2007) and the Elaborated Sentences and Phrases subtest of the *Test for*

Auditory Comprehension of Language 4th Edition (TACL-4; Carrow-Woolfolk, 2014). The EVT

evaluates expressive vocabulary and word recall. Its standard scores have moderate-to-strong

correlations ($r = 0.68 – 0.80$) with the Clinical Evaluation of Language Fundamentals, 4th edition

(Semel, Wiig, & Secord, 2003) standard scores. Strong internal consistency ($\alpha = 0.96$) and test-retest

reliability ($r = 0.95$) are also reported (Williams, 2007). The *Elaborated Phrases and Sentences*

subscale of the TACL-4 assesses receptive syntax. At the selected cut-off (scaled score of 4), the

subscale has sensitivity and specificity values of 0.22 and 1.00 respectively, for identifying children

with language impairment (Carrow-Woolfolk, 2014).

Parent report measures were used to screen children's behaviour and communication profiles. The

Children's Communication Checklist 2nd Edition (CCC-2; Bishop, 2006) evaluated language content,

form and pragmatics. The *Conners Comprehensive Behaviour Rating Scale* (CCBRS; Conners, 2008)

evaluated social, academic, emotional and behaviour problems. The CCC-2 identified children with

autism symptomology and pragmatic language difficulties with a sensitivity value of 0.89 and

specificity value of 0.97 (Bishop, 2006). The clinical indexes of the CCBRS have correct

classification rates of 0.70-0.89 overall (Conners, 2008).

5.3.3.2 Performance outcome measure

The *Pragmatic Observational Measure, 2nd edition* (POM-2; Cordier et al., 2018) measured children's

pragmatic language performance in this study. It is an observational measure that operationalises the

adopted definition of pragmatics, with items evaluating both verbal and nonverbal communication

behaviours related to the communicative, social and emotional use of social language. The POM-2 is

suitable for evaluating children's pragmatic language during peer-peer social play interactions. It is a

23 item, criterion referenced assessment. Each item is rated on a four point scale related expertise and

consistency of use of each pragmatic language skill.

To evaluate children's pragmatic language all dyads were filmed playing in the clinic play room for

15 minutes at each assessment time-point. Additional dyad footage was taken at the homes of the

children with autism at 3-month follow-up. The de-identified footage was then viewed by an

independent assessor who rated children's pragmatic language using the POM-2. The assessor was naïve to study purpose, children's diagnoses and relationship, group allocation, and timing of the videos.

The measure produces a Nonverbal Communication Element measure score and a Verbal Communication Element measure score, as well as an Overall measure score. Evidence for the psychometric properties of the POM-2 indicate strong internal consistency ($\alpha = 0.99$), construct validity (97% of people and 99% of times fit Rasch expectations), and criterion validity ($r = 0.95$, $p = 0.005$) when compared to the Pragmatic Protocol (Cordier et al., 2018; Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014). Rasch analysis confirmed the reliability of the assessor's scores for the 310 videos in the sample, with goodness of fit statistics falling within the expected parameters (*MnSq* < 1.4 and > 0.7; standardised value < 2.0).

5.3.3.3 Capacity outcome measure

The *Social Emotional Evaluation* (SEE; Wiig, 2008) evaluated social-emotional understanding and high-level language skills. The age-normed test evaluates pragmatics via four subtests, each evaluating a different aspect of verbal and non-verbal communication related to perspective taking, emotion expression, and understanding the communicative intent of the utterances of another (e.g., sarcasm, inferencing). Subtests contain an expressive and a receptive language task; receptive and expressive task scores are summed separately to create a Receptive Composite score and an Expressive Composite score. Composite scores are combined to create a Total Composite score. The SEE has sensitivity and specifically values of 0.95-1.00 for identifying children with autism at a *z*-score cut-off of -1.00, good internal consistency ($\alpha = 0.76 - 0.88$) and inter-rater reliability ($r = 0.96$-1.00; Wiig, 2008).

5.3.4 Procedures

5.3.4.1 Randomisation

As recruitment was sporadic, dyads were randomised in pairs to the treatment-first or waitlist-first groups. An independent researcher used an online random number generator (random.org; Haahr,

2010) to allocate participants to either group 1 (treatment-first) or group 2 (waitlist-first) and concealed allocated group numbers into opaque envelops. Researchers handed enveloped to families to open after baseline assessments were complete to ensure children, parents, researchers and assessors were blinded to group allocation at baseline.

5.3.4.2   Assessment procedures

At baseline assessment, dyads entered the playroom at the clinic to play without an adult present for 15 minutes. The play was filmed to allow for blinded POM-2 ratings. Prior to commencing the play, a therapist-researcher orientated dyads to the playroom and explained the playroom rules. Toys and equipment within the playroom encouraged social-play activities such as role-play, gross-motor play, construction or board games. A list of available toys is reported in Parsons et al. (2018a). While children played, parents and therapist-researcher observed the play on a computer screen in an adjacent room and discussed the social communication difficulties of the child with autism. Children left the playroom after 15 minutes to complete standardised assessments (EVT-2, TACL-4 and SEE). Parents were given the parent-report questionnaires at this time (CCC-2 and CCBRS).

Post-intervention and follow-up assessment procedures were the same as the baseline assessment procedures for play filming and SEE administration. At 3-month follow-up, researchers also attended the homes of the children with autism to film dyads playing in an alternative environment for evaluation using the POM-2. Play recorded at home involved indoor or outdoor play, based on children's preferences, with the children's own toys. Researchers recorded the play session at home using handheld cameras.

5.3.4.3   Intervention procedures

The intervention consisted of clinic-based and home-based components. Dyads attended eight, weekly intervention sessions between their pre- and post- assessments. The intervention was conducted by a speech pathologist and an occupational therapist who were trained to deliver the intervention and supported by the second author. Mutual availability determined which therapist children were

allocated to. To maximise participation, 'catch-up' sessions were scheduled if children missed an appointment. Children completed their eight intervention sessions in an average of 8.3 weeks.

All intervention sessions consisted of: 1) 15-20 minutes of video-feedback; 2) 20 minutes of child-led free play with the therapist present; and 3) 15 mins of discussion between the therapist and parent while the children continued to play. Toys in the clinic playroom were selected to encourage a variety of social-play activities and cater to a range of ages and interests. The play component of all clinic sessions was filmed using two wall-mounted digital video cameras inside the playroom.

During video-feedback, the therapist showed dyads 30-40 second clips of play footage from the previous week's intervention session. Some video clips exemplified pragmatic language that promoted the social interaction, while others illustrated pragmatics that did not promote the social interaction. After viewing each clip, the therapist discussed the observed pragmatic language with the dyads. Discussions aimed to help children understand the socioemotional impact of their verbal and nonverbal language during play, with the view to help both children learn pragmatic language strategies to promote positive play-based social interactions with each other. For children with autism this meant using new pragmatic language skills or enacting existing skills more expertly or more consistently. For playmates, this meant using their more expert (relative to the child with autism) verbal and nonverbal communication skills to model, support and prompt the targeted pragmatic language skills for their peer with autism.

Following video-feedback, dyads entered the playroom with the therapist to play. This free-play component of the intervention session provided the dyad with opportunities to practise the pragmatic language strategies discussed during video-feedback in a supported social context. Play activities were child-led and the therapist engaged in the play as a playmate to model targeted pragmatic language skills for the child with autism (e.g., telling their peer about a new play idea if initiating or maintaining conversations was a target). The therapist also modelled supportive strategies for playmates (e.g., questioning if the child with autism provided too little information in their explanations). Therapist modelling was graded such that as dyads demonstrated improved pro-social

play during intervention sessions, they would spend more time playing without the therapist being present in the room.

Home-based intervention components were mediated by parents of children with autism. Each week parents read a module in a parent manual between clinic sessions. Modules focused on pragmatic language and play skills such as initiation, problem solving, negotiating, perspective taking and interpreting nonverbal cues. The manual defined the skills, described their importance at home and at school, and explained strategies for parents to implement to support their child's use of the skills during play. Ten short (6-8 minutes) videos aligned with the manual models were provided to families. Each video depicted two fictional characters engaged in social play and included examples of green and red play. Children viewed one video per week, and parents guided a discussion with their child about observed pragmatic language. Parents also arranged a weekly playdate for dyads at the home of the child with autism between intervention sessions. Playdates provided dyads with the opportunity to practise and reinforce pragmatic skills learned in the clinic sessions to facilitate the generalisation of skills between the clinic and home environments for the child with autism.

5.3.5 Analysis plan

5.3.5.1 Data preparation

Ordinal POM-2 item ratings were entered into Winsteps (Version 3.92.0; Linacre, 2016) and converted to interval level scores using Rasch analysis. A POM-2 Overall, Verbal Communication and Nonverbal Communication measure score was obtained for all playmates at all assessment time points. Playmates who dropped out were excluded from the analysis when only baseline data had been collected ($n = 2$). Participant demographic, screening and outcome measure data were entered in IBM SPSS (Version 22; IBM Corporation, 2013) where all further analyses were conducted. Two sensitivity analyses were conducted: 1) with scores removed for playmates who replaced drop-outs, and 2) with second round of attendance scores removed for playmates who attended twice. The significance of results in both analyses remained unchanged, so no further data were excluded.

5.3.5.2   Baseline comparisons

Parametric tests were used as Shapiro-Wilkes test of normality indicated that data were normally distributed. Independent samples *t*-tests for interval data and Pearson Chi Square tests for categorical data were used to compare baseline demographic and screening data for parents and children in each group. Results are reported in Table 5.1. No statistically significant differences were detected for any demographic variables at a significance level of $p < 0.05$. Playmate screening assessment scores did not differ between groups and scores for children with autism fell within the same clinical categories.

5.3.5.3   Change score comparisons

A change-score was calculated for each participant for all POM-2 measure scores and SEE composite scores by deducting baseline 1 scores from post-intervention scores (treatment-first group) or baseline 1 from baseline 2 scores (waitlist-first group). The mean change scores were compared using independent samples *t*-tests to determine whether changes made by the intervention-first playmates ($n = 33$) over their intervention period were larger than those made by waitlisted-first playmates ($n = 33$), while they waited 10-weeks to start the intervention. Though this method each group's change-score is subject to inflated measurement error, however, the detection of a significant difference between the groups' change-scores despite this inflated measurement error means we can be confident that the magnitude of change made by the two groups is in fact different (Twisk et al., 2018). Significance was set at $p < 0.05$, and Cohen's *d* effect sizes were calculated (Cohen, 1988). Cohen's *d* was interpreted as follows: small $\geq .20$, medium $\geq .50$, or large $\geq .80$.

5.3.5.4   Changes over time

Linear mixed models were created to assess the fixed effect of time (pre, post, 3-month follow-up) on all POM-2 scores and SEE composites, allowing for participant level random intercepts, to evaluate changes in playmate pragmatic language over time. Pairwise comparisons of main effects were made between each assessment time point. For 3-month follow-up POM-2 scores, those from the clinic play session were used so that the play environment remained consistent across time for this analysis.

Significance was set at $p < 0.05$, and Cohen's d effect sizes were calculated and interpreted using the convention previously described.

5.3.5.5 Differences between environments

To evaluate whether the playmates demonstrated equivalent pragmatic language performance in the clinic and home environments at the end of the study, a difference-score was calculated for all POM-2 scores for playmates who completed both follow-up assessments ($n =64$). POM-2 difference-scores were calculated by deducting 3-month follow-scores from the clinic play session from 3-month follow-up scores from the home play session. Single sample t-tests were conducted on the difference-scores for each POM-2 score to determine whether they were equivalent to zero. Pragmatic language performance was considered to be comparable across environments if results were not significant ($p > 0.05$).

5.3.5.6 Moderators of pragmatic language performance

The effect of child, dyad and intervention variables on the pragmatic language scores of playmates across the study was explored using linear mixed models. Allowing for participant level random intercepts, models were assessed for all POM-2 scores and SEE composites. First, univariate linear mixed model regression was performed as a means of screening for variables to include in subsequent multivariate analysis. Variables assessed were time (pre-, post-, 3-month follow-up), expressive vocabulary (EVT-2 standard score), receptive syntax (TACL-4 subtest scaled score), playmate relationship (sibling, non-sibling), playmate age (6-7yrs, 8-9yrs, 10-11yrs), and therapist profession (speech pathologist, occupational therapist). Significance was set at $p < 0.05$. Correction for multiple comparisons was not made as no conclusions were drawn from this stage of analysis. Then, multiple regression was performed by entering all significant univariate variables into the model and removing non-significant covariates via a process of backwards elimination until only significant moderating variables remained. Significance was set at $p < 0.05$. Corrections for multiple comparisons were not made as only the multivariate analysis informed conclusions drawn.

5.4 Results

5.4.1 Change score comparisons

Change-score means for all POM-2 scores were greater for the intervention-first playmates than the waitlist-first playmates. For intervention group playmates, all mean change scores were positive, with POM-2 Nonverbal change scores (13.65, ± 39.29) higher than mean POM-2 Verbal change scores (9.34, ± 33.59). For control first playmates, POM-2 Overall and Nonverbal change scores were negative, and mean Verbal change scores (2.51, ± 28.41) were slightly greater than Nonverbal change scores (-1.90, ± 27.15). SEE Receptive change-scores were also greater for the intervention-first playmates, but SEE Expressive and SEE Total change-scores were greater for the playmates in the waitlist-first group. Independent samples t-tests revealed no significant differences between pragmatic language changes made by the intervention-first playmates over the intervention period and the waitlist-first playmates during their 10-week wait (see Table 5.2).

Table 5.2 Comparison of intervention-first group change scores with control-first group change scores for playmates

Measure	Intervention-First Mean (SD)		Control-First Mean (SD)		Change score comparisons		Effect size
	Baseline 1	Post-Intervention	Baseline 1	Baseline 2	t	p	d
POM-2							
Overall	34.88 (29.67)	45.29 (32.10)	20.44 (27.48)	21.48 (30.01)	1.56	0.124	0.38
Nonverbal	36.54 (32.23)	50.16 (36.44)	23.07 (29.22)	23.02 (32.43)	1.87	0.066	0.46
Verbal	28.23 (35.50)	38.04 (37.73)	8.30 (33.59)	13.00 (32.98)	0.83	0.411	0.20
SEE							
Receptive	0.12 (0.61)	0.29 (0.83)	-0.12 (0.81)	-0.02 (1.19)	0.34	0.738	0.07
Expressive	0.09 (1.02)	0.43 (0.83)	-0.30 (0.95)	0.23 (1.12)	-0.66	0.512	0.16
Total	0.12 (0.84)	0.42 (0.82)	-0.21 (0.96)	0.16 (1.14)	-0.23	0.816	0.06

Note. POM-2 = Pragmatics Observational Measure 2nd Edition; SEE = Social-Emotional Evaluation; Cohen's d interpretation: 0.2 = small, 0.5 = medium, 0.8 = large.

5.4.2 Changes over time

Pre- and post-intervention POM-2 scores and SEE scores were combined for playmates from the intervention-first and waitlisted groups to increase the power of remaining analyses ($n = 66$). Table

5.3 details results of the linear mixed models used to analyse the effect of time on POM-2 and SEE scores. The main effect of time was significant for POM-2 Overall ($F(2,128) = 18.42$, $p <0.001$), POM-2 Nonverbal ($F(2,128) = 17.02$, $p <0.001$) and POM-2 Verbal scores ($F(2,128) = 15.94$, $p <0.001$). Pre to post score comparisons were significant with medium, positive effect sizes for POM-2 Overall ($p < 0.001$, $d = 0.45$), POM-2 Nonverbal ($p < 0.001$, $d = 0.51$), and POM-2 Verbal scores ($p < 0.001$, $d = 0.50$), as were pre to 3-month follow-up POM-2 score comparisons ($p < 0.001$, $d = 0.59$-0.63). While the means of all three POM-2 scores increased between post and 3-month follow-up, no significant differences were found and effect sizes were negligible. This suggests that changes in playmate's pragmatic language performance during play-based interactions with a peer with autism maintained following the intervention period.

The main effect of time was also significant for SEE Total ($F(2,127) = 6.84$, $p = 0.002$), SEE Receptive ($F(2,126) = 5.81$, $p = 0.004$) and SEE Expressive ($F(2,127) = 5.09$, $p = 0.007$) scores. Pre to post score comparisons were significant with small, positive effect sizes for SEE Total ($p < 0.002$, $d = 0.31$), Receptive ($p < 0.009$, $d = 0.22$) and Expressive scores ($p < 0.014$, $d = 0.23$), as were pre to 3-month follow-up SEE score comparisons ($p = 0.002$-0.003, $d = 0.27$-0.30). No significant differences were observed for SEE scores between post and 3-month follow-up and effect sizes were negligible suggesting that changes in playmate's pragmatic language capacity maintained following the intervention period.

Table 5.3. Comparison of playmate's outcome measures over time

Measure	Test of Fixed Effect of time		Estimated Marginal Means			Pairwise comparisons[a]					
			Pre-	Post-	3-mth follow-up	Pre Post		Pre Follow-up		Post Follow-up	
	F	p	Mean (SE)	Mean (SE)	Mean (SE)	p	d	p	d	p	d
POM-2											
Overall	18.42	<0.001***	28.22 (3.76)	47.32 (3.71)	53.23 (3.76)	<0.001***	0.45	<0.001***	0.59	0.169	0.14
Nonverbal	17.02	<0.001***	29.80 (4.17)	50.86 (4.12)	57.39 (4.17)	<0.001***	0.51	<0.001***	0.60	0.185	0.09
Verbal	15.94	<0.001***	21.16 (4.44)	40.45 (4.38)	49.68 (4.44)	<0.001***	0.50	<0.001***	0.63	0.073	0.13
SEE											
Total	6.84	0.002**	0.15 (0.12)	0.56 (0.12)	0.55 (0.12)	0.002**	0.31	0.002**	0.30	0.961	-0.01
Receptive	5.81	0.004**	0.09 (0.10)	0.35 (0.10)	0.41 (0.10)	0.009**	0.22	0.002**	0.27	0.570	0.05
Expressive	5.09	0.007**	0.17 (0.12)	0.48 (0.12)	0.55 (0.12)	0.014*	0.23	0.003**	0.27	0.603	0.05

Note. POM-2 = Pragmatics Observational Measure 2nd Edition; SEE = Social-Emotional Evaluation; Cohen's d interpretation: 0.2 = small, 0.5 = medium, 0.8 = large; aPOM-2 scores from 3-month follow-up assessment in the clinic; *p < 0.05; **p < 0.01; ***p < 0.001.

5.4.3 Differences between environments

Mean POM-2 Overall scores for playmates at 3-month follow-up were higher when playing at the home of their peer with autism (mean = 55.71, ± 30.74) than in the clinic (mean = 53.19, ± 29.24), as were POM-2 Nonverbal scores (home mean = 63.08, ± 34.01; clinic mean = 57.39, ±32.04). Mean 3-month follow-up POM-2 Verbal scores for playmates were higher in the play-based interaction at the clinic (mean = 49.60, ±36.18) than at the home of their peer with autism (mean = 24.21, ±37.91). Single sample t-tests comparing follow-up POM-2 difference scores (home score – clinic score) to zero were not significant for POM 2 Overall ($t(61) = 0.67$, $p = 0.506$), POM-2 Nonverbal ($t(61) = 1.34$, $p = 0.185$), and POM-2 Verbal ($t(61) = -0.32$, $p = 0.752$) scores. This suggests that playmate's pragmatic language performances during play-based interactions with a peer with autism at the end of the study were equivalent in the clinic and in the homes of their peers with autism.

5.4.4 Moderators of pragmatic language performance

Univariate effects of six covariates: 1) time (pre-, post-, 3-month follow-up); 2) expressive vocabulary (EVT-2 standard score); 3) receptive syntax (TACL-4 subtest scaled score); 4) playmate relationship (sibling, non-sibling); 5) playmate age (6-7yrs, 8-9yrs, 10-11yrs), and 6) therapist profession (speech pathologist, occupational therapist) on POM-2 scores and SEE composite scores were assessed. No significant main effects were present for any of the POM-2 scores for receptive syntax (TACL-4 score) or expressive vocabulary (EVT-2 scores). A significant main effect of playmate relationship (sibling vs. non-sibling) was detected for POM-2 Overall ($F(1, 65) = 6.50$,$p = 0.013$), POM-2 Nonverbal ($F(1, 65) = 6.04$, $p = 0.017$) and POM-2 Verbal ($F(1, 65) = 7.04$, $p = 0.010$) scores. The effect favoured dyads who were not siblings. Therapist profession (speech pathologist vs. occupational therapist) also produced a significant main effect, favouring speech pathologist as the interventionist, on POM-2 Overall ($F(1, 65) = 14.17$, $p < 0.001$), POM-2 Nonverbal ($F(1, 65) = 11.97$, $p < 0.001$) and POM-2 Verbal ($F(1, 65) = 18.62$, $p < 0.001$) scores. The main effect of playmate age group (6-7yrs, 8-9yrs, 10-11yrs) was significant for POM-2 Overall ($F(2, 66) = 3.46$, $p = 0.038$) and POM-2 Nonverbal ($F(2, 63) = 3.22$,$p = 0.047$) scores, but not for the POM-2 Verbal score. Main effects increased with age. Expressive vocabulary was the only significant covariate for SEE Total

($F(1, 61) = 10.80$, $p = 0.002$), SEE Receptive ($F(1, 61) = 9.75$, $p = 0.003$) and SEE Expressive ($F(1, 61) = 6.41$, $p = 0.014$) composite scores. Higher EVT-2 scores were related to greater changes in SEE scores.

Multivariate linear mixed regression models were examined for all POM-2 scores and SEE composite scores by entering significant simple interaction covariates into each model and then removing non-significant covariates though backwards elimination. Significant explanatory variables for the POM-2 Overall score were time (pre, post, 3-month clinic follow-up), playmate relationship (sibling, non-sibling), therapist profession (speech pathologist, occupational therapist) and playmate age group (6-7yrs, 8-9yrs, 10-11yrs). Covariates of time (pre, post, 3-month clinic follow-up), playmate relationship (sibling, non-sibling) and therapist profession (speech pathologist, occupational therapist) were significant for POM-2 Nonverbal and Verbal scores (Table 5.4). All SEE composites shared the same two significant explanatory covariates: expressive vocabulary (EVT-2) and time (pre, post, 3-month follow-up; Table 5.5).

Table 5.4. Final results of multiple linear mixed model regression for playmate POM-2 scores.

Fixed Factor	POM-2 Overall			POM-2 Nonverbal			POM-2 Verbal		
	EM Mean (SE)	F	p	EM Mean (SE)	F	p	EM Mean (SE)	F	p
Time		17.92	<0.001***		16.45	<0.001***		15.27	<0.001***
Pre	32.78 (3.68)			32.48 (4.04)			24.39 (4.18)		
Post	51.63 (3.63)			53.21 (3.97)			43.27 (4.11)		
Follow-up[a]	57.45 (3.67)			59.60 (4.02)			52.30 (4.17)		
Playmate Relationship		6.21	0.015*		5.00	0.029*		6.20	0.015*
Sibling	41.08 (3.22)			42.09 (3.48)			32.72 (3.58)		
Non-sibling	53.49 (4.07)			54.77 (4.47)			47.25 (4.60)		

Fixed Factor	POM-2 Overall			POM-2 Nonverbal			POM-2 Verbal		
	EM Mean (SE)	F	p	EM Mean (SE)	F	p	EM Mean (SE)	F	p
Therapist Profession		10.87	0.002**		10.32	0.002**		16.81	<0.001***
OT	39.25 (3.58)			39.57 (3.82)			28.352 (3.93)		
SP	55.32 (3.69)			57.29 (4.08)			51.619 (4.20)		
Age Group (yr;mth)		3.41	0.039*						
6;0-7;11	38.55 (3.89)								
8;0-9;11	46.96 (3.69)								
10;0-11;11	56.35 (5.88)								

Note. POM-2 = Pragmatics Observational Measure 2nd Edition; EM Mean = estimated marginal mean; SE = standard error; OT = Occupational Therapist; SP = Speech Pathologist; [a]POM-2 scores from 3-month follow-up assessment in the clinic; *$p < 0.05$; **p < 0.01; ***p < 0.001.

Table 5.5. Final results of multiple linear mixed model regression for playmate SEE scores.

Fixed Factor	SEE Receptive			SEE Expressive			SEE Total		
	EM Mean (SE)	F	p	EM Mean (SE)	F	p	EM Mean (SE)	F	p
EVT-2		9.73	0.003**		6.34	0.014*		10.73	0.002**
Time		5.02	0.008**		4.40	0.014*		6.35	0.002**
Pre	0.10 (0.10)			0.19 (0.12)			0.17 (0.11)		
Post	0.35 (0.10)			0.48 (0.12)			0.56 (0.11)		
Follow-up	0.40 (0.10)			0.56 (0.12)			0.57 (0.11)		

Note. POM-2 = Pragmatics Observational Measure 2nd Edition; SEE = Social Emotional Evaluation; TACL-4 = Test for Auditory Comprehension of Language 4th Edition; EVT-2 = Expressive Vocabulary Test 2nd Edition; Time 1 = pre-intervention; Time 2 = post-intervention, Time 3 = 3-month follow-up; OT = Occupational Therapist; SP = Speech Pathologist; [a]POM-2 scores from 3-month follow-up assessment in the clinic; *$p < 0.05$; **p < 0.01.

5.5   Discussion

This study aimed to investigate the pragmatic language outcomes for typically-developing peers involved in a peer-mediated, play-based pragmatic language intervention for children with autism. These results are novel, as studies to date have only investigated the experiences and attitudes of typically-developing peers towards children with autism following peer mediated interventions. This study evaluated the impact of the intervention on the skill area (i.e., pragmatic language) that the typically-developing peers were expected to mediate.

Results indicate that the pragmatic language *performance* (POM-2) of all typically-developing peers involved (*n* = 66) improved significantly over the ten weeks of intervention, though a lack of significant results between intervention-first and control groups means this effect cannot conclusively be attributed to the intervention. Post-intervention effects for playmates were maintained 3-months later, and were equivalent across the clinic and home environments; mirroring the results of their peers with autism (Parsons et al., 2018b). A dearth of literature on peer skills before and after peer-mediated interventions for children with autism means that the expected magnitude of change for peers in this study, if any, was unclear at the outset of this study. It was expected that typically-developing peers would refine and impart the pragmatic language skills required to maintain a positive social-play interaction as this is an active ingredient for target children in peer-mediated interventions. However, change score comparisons between the intervention-first and waitlisted peers suggest that playmate's pragmatic performance improvements cannot entirely be attributed to the intervention. It is therefore more likely their increasing pragmatic performance is reflective of the improved pragmatic performance of their peers with autism.

The POM-2 evaluates a child's pragmatic language performance during peer-peer play, and as such, the transactional nature of the interaction means that a child's pragmatic language scores are likely to be influenced by the skills of their play partner. That is, while the pragmatic language of children within each dyad was scored independently, it is plausible that the lower pragmatic language

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performance of one child could adversely affect the pragmatic language of the other child within the dyad. Behavioural and language measures taken at baseline (CCBRS, CCC-2, EVT-2 and TACL-4) indicate that this group of playmates were typically-developing in all areas screened, and yet their POM-2 scores across the study were only marginally greater than the scores reported for children with autism in the study by Parsons et al. (2018b). The intervention was effective for improving the pragmatic performance of the children with autism in the study, which in turn would lead to a play interaction of greater quality through which the peer was afforded increased opportunity to demonstrate their pragmatic abilities. Furthermore, typically-developing peers should not have the same difficulties with generalisation as children with autism, so it is likely that the playmate's scores were equivalent across both environments because children with autism in this study were also able to demonstrate equivalent pragmatic language in the clinic and home environments. Future research should also collect data on each playmate's pragmatic language performance during play with another typically developing peer. Such data would help to tease out the playmate's true abilities from the interdependence on the abilities of their peer with autism.

There are a number of interesting findings with respect to the moderators that influenced the peers' pragmatic language performance. The relationship of the peer to the child with autism was a significant moderator of the peers' pragmatic language performance during the study. Non-sibling playmates demonstrated stronger pragmatic language performance than sibling playmates. These results are in contrast to the findings for children with autism in the study; their relationship to their playmate did not moderate their pragmatic language performance (Parsons et al., 2018b). When considering the associations between conversational features, social cognitive development, language ability and relationship quality, Cutting and Dunn (2006) found many differences between the conversational features, shared pretence and conflict of typically-developing children (mean age 4.16 years) when comparing child-friend and child-sibling interactions. Both their findings and ours, highlight the importance of considering the role that relationships and conversations play in the development of emotional understanding.

Cutting and Dunn (2006) were unable to analyse the contribution of emotional understanding to relational differences in their study due to sample size restrictions ($n = 43$). The POM-2 used to evaluate interactions in this study operationalises the adopted definition of pragmatics (behaviour that incorporates the social, emotional and communicative aspects of social language) and therefore gauges the quality of a social interaction from a communicative and socioemotional perspective. Our results suggest that for typically-developing, school-aged children, child-friend conversations contribute to greater gains in language behaviours related to socioemotional understanding than child-sibling interactions. Children cannot choose their siblings, but they enter into friendships voluntarily. Thus, they are perhaps more likely to be motivated to persevere in promoting positive interactions with non-sibling peers than sibling peers.

Another possible explanation is that the quality of a relationship might also predict how children use or gain socioemotional understanding (Cutting & Dunn, 2006). While siblings of children with autism report less competition and conflict within their relationship than typically-developing siblings, they also report less intimacy and prosocial behaviour (Kaminsky & Dewey, 2001). Moreover, recent results from a large, population-based sample of children ($n = 14,177$, aged 11 years) show that compared to typically-developing children, children with autism are at an increased risk of being involved in sibling bullying, both as the victim and as the bully (Toseeb, McChesney, & Wolke, 2018). It is therefore possible that some sibling dyads within this study had more hostile relationships at the outset of the study, which, in turn, contributed to sibling playmates demonstrating weaker pragmatic language performance than non-sibling playmates. The decision to include siblings as peers in this study was driven by feasibility (i.e., siblings are preferred by parents and a child with autism may not have a typically-developing friend who can attend the intervention). However, the decision to include siblings in peer-mediated interventions for children with autism may instead need to strike a balance between feasibility and relationship quality. To test this hypothesis, future studies might consider a priori measures of children's relationship quality to investigate whether this has a stronger moderating effect on findings than relationship type (i.e., sibling vs. friend).

The professional background of the therapists conducting the intervention also moderated the POM-2 scores of typically developing playmates in this study. Playmates in dyads attending the intervention conducted by the speech pathologist made greater pragmatic language gains. This finding is mirrored in the POM-2 scores of the children with autism in this study (Parsons et al., 2018b), however, it should be interpreted with caution. This is the first time that the intervention has been conducted by a speech pathologist and only one therapist from each profession delivered the intervention. This intervention presents an ideal opportunity for collaboration between speech pathologists and occupational therapists. Speech pathologists must have an in-depth understanding of play to ensure that children are engaging in truly playful activities when practicing targeted pragmatic skills. However, these findings indicate that training for occupational therapists should equip them with a deeper understanding of pragmatic language to maximise the integration of pragmatic language goals into an intervention for an important childhood occupation.

Typically-developing peers also demonstrated significantly improved pragmatic language *capacity* (SEE) over the intervention period that was maintained at the 3-month follow-up. The comparisons of change scores for the intervention-first and waitlisted peer groups indicate that these gains cannot be solely attributed to the intervention. These results mirror those of the children with autism in this study; changes did not differ between the intervention-first group and the waitlisted group, but significant gains were measured from pre- to post-intervention and maintained at 3-month follow-up for the Receptive and Expressive composite scores (Parsons et al., 2018b). However, the direction of change in pragmatic capacity scores between post-intervention and 3-month follow-up differed for children with autism and their playmates. Playmates' 3-month follow-up scores were equivalent to or greater than post-intervention scores, but follow-up scores for children with autism were lower than post-intervention scores (Parsons et al., 2018b). Pragmatic language capacity (i.e., pragmatic knowledge) has been linked to theory of mind (ToM), and both are considered to be areas of difficulty in autism. The evidence for ToM interventions indicates that intervention effects are not maintained for children with autism (Fletcher-Watson, McConnell, Manola, & McConachie, 2014), so it is unsurprising that children with autism did not maintain gains in pragmatic understanding in this study

once the intervention was withdrawn. On the other hand, typically developing peers were not expected to have the same difficulties with pragmatic knowledge and ToM and would therefore be more likely to maintain the knowledge gained during the intervention.

Moderator analysis showed that the pragmatic language capacity of peers during the study was moderated by their expressive vocabulary capacity. Similar results were found for the children with autism in this study, with expressive vocabulary and receptive syntax being significant moderators of SEE composite scores (Parsons et al., 2018b). The assessment tasks contained within the SEE require children to use oral language skills to comprehend questions and provide responses, hence it is unsurprising that children with stronger structural language demonstrated stronger performance. The confounding effect of oral language skills on the measurement of pragmatic understanding suggests standardised assessments evaluating children's meta-pragmatics provide only a portion of the total picture. When considering an individual's health-related functioning and disability the ICF combines both discrete skill capacities with their performance in natural contexts (World Health Organization, 2001). Therefore, evaluations of social functioning related to pragmatic language should include standardised evaluations of capacity (such as the SEE) along with observational measures of how those skills are performed during meaningful social interactions.

Overall, results from the study indicate that the intervention had a positive effect on the pragmatic language skills of the playmates involved and thus the quality of social interaction that the children with autism have with that playmate, be they siblings or friends. These findings are limited, however, to interactions with a single social partner. Further research is required to understand the ideal peer, combination of peers, and modes of delivery (e.g., clinic, home and classroom) that maximise intervention effects for children with autism, both in terms of influencing their own pragmatic language abilities, but also the quality of their social environments. Furthermore, for a more holistic investigation the impact this intervention has on all environmental factors related to play-based interactions for children with autism (as defined by the ICF), the perceptions and attitudes of the typically-developing peers should also be evaluated. Studies that have evaluated these aspects of the social environment have found positive changes in attitudes and typically-developing children's

inclinations to engage socially with their peers with autism (Jones, 2007; Whitaker, Barratt, Joy, Potter, & Thomas, 1998; Wolfberg & Schuler, 1999). Future studies of peer-mediated interventions should include examination of skill performance and attitudinal change.

5.6   Conclusion

This study found that attending a peer-mediated pragmatic language intervention for children with autism significantly improved the pragmatic language of the typically-developing peers involved in the intervention. While this change cannot be exclusively attributed to the intervention, benefits were maintained at 3-month follow-up and were found to be similar across clinic and home environments. This study raises important questions about the influence of a child's interlocuter on their pragmatic performance, and the influence that the nature and quality of a child's sibling and friend relationships might also have on their conversational and socioemotional development. Inclusive interventions are well placed to improve the social environments of children with autism and we hope that by targeting pragmatic language in this way that peer-peer interactions during play can be sustained for friendships to develop and be maintained. This cascading effect still needs to be empirically tested, but equipping children with autism with more expert pragmatic language skills and the social context of a peer willing and able to play and interact, is an important first step.

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Chapter 6   Predicting Children with Largest Intervention Effects
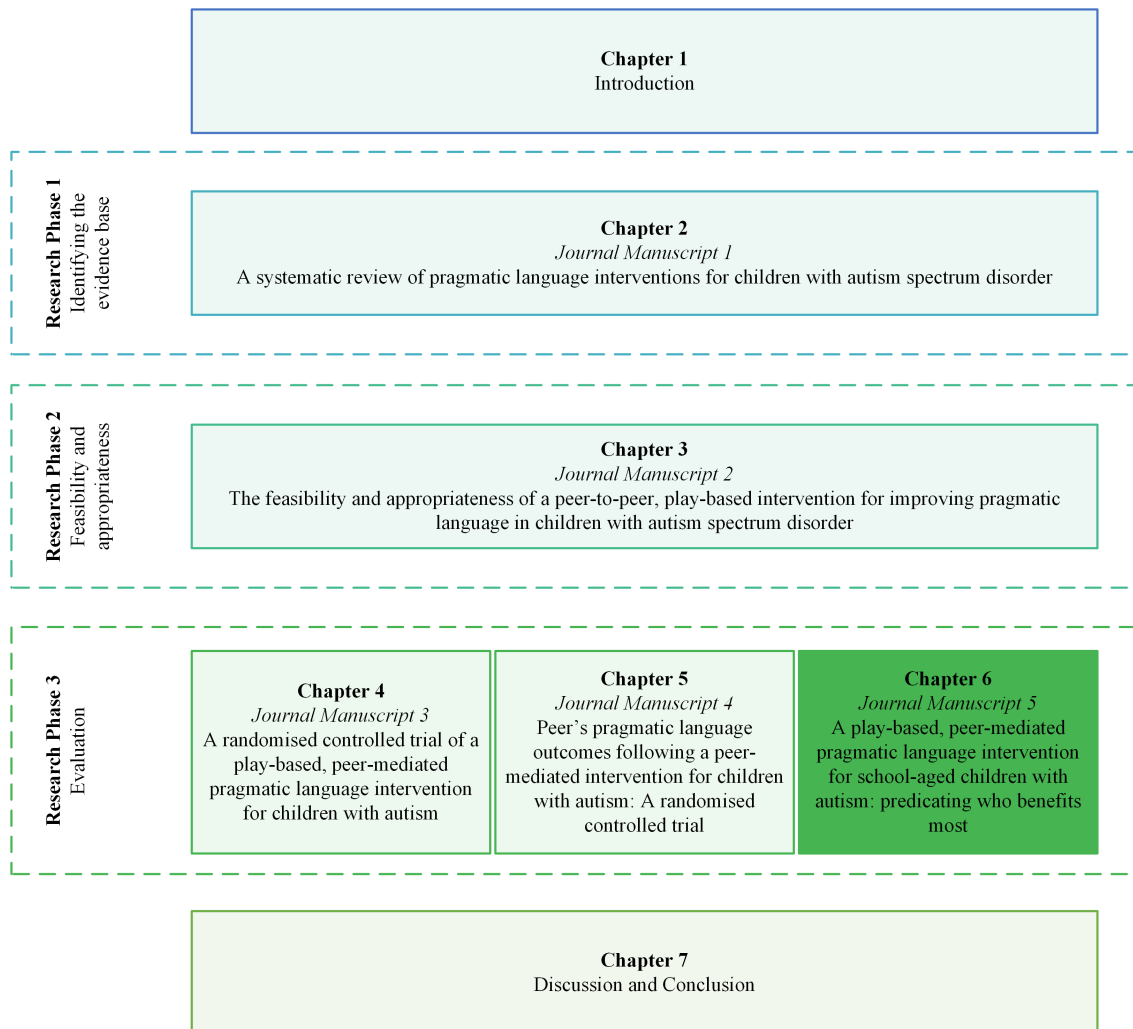
The UKMRC guidelines for complex intervention evaluation recommend an appraisal of factors to explain variability in results, such as the efficacy active ingredients or contextual factors related to change (Craig et al., 2008). Given that there is great variation amongst the language, emotional, and behavioural profiles of children with autism, child-factors are also likely to have an impact on children's responses to interventions. This study attempted to identify child-factors that predicted children who received the greatest intervention benefits. The analysis resulted in the development of a software application for used by therapists. The application will enable therapists to identify children within their clinics who are suitable candidates for the intervention. A link to download the application is provided in Appendix J.

Journal Manuscript 5

A play-based, peer-mediated pragmatic language intervention for school-aged children on the autism spectrum: Predicting who benefits most

Lauren Parsons[1], Reinie Cordier[1], Natalie Munro[2,1], Annette Joosten[3,1]

[1]Curtin University, School of Occupational Therapy, Social Work and Speech Pathology, Bentley, Western Australia 6102

[2]The University of Sydney, Faculty of Health Sciences, Camperdown, New South Wales, 2006

[3]Australian Catholic University, School of Allied Health, Fitzroy, Victoria, 3065

Running head: Predicting positive intervention effects

Author note:

Corresponding author: Lauren Parsons

Email: lauren.parsons@curtin.edu.au

Phone: +61 89266 9266

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6.1 Abstract

This study explored characteristics of children with autism with large intervention effects following a peer-mediated pragmatic language intervention, to devise algorithms for predicting children most likely to benefit. Children attended a 10-week intervention with a typically-developing peer. Data from a pilot study and RCT formed the dataset for this study. The POM-2 measured intervention outcomes. Children completed the EVT-2, TACL-4, and Social Emotional Evaluation at baseline, and parents completed the CCC-2 and CCBRS. High CCC-2 Use of Context and CCBRS Separation Anxiety scores and comparatively lower EVT-2, CCC-2 Nonverbal Communication and Cohesion scores predicted children with large intervention effects. Results can be used by clinicians to predict which children within their clinics might benefit most from participating in this intervention.

6.2   Introduction

Individuals on the autism spectrum have varying levels of structural language ability, but difficulties in the language domain of pragmatics are considered universal (Helland & Helland, 2017). Pragmatic language behaviours encompass the social, emotional and communicative aspects of social language (Adams, Baxendale, Lloyd, & Aldred, 2005). The social challenges experienced by individuals on the autism spectrum are apparent throughout the life-span, with adults describing pragmatic language difficulties as a stressor when participating in social dialogue (Müller, Schuler, & Yates, 2008). Such challenges in social participation are a likely contributing factor of findings that children on the autism spectrum have fewer friendships than their typically developing peers that are often poorer in quality, despite a desire to engage in social relationships (Bauminger & Shulman, 2003). As friendships are an important protective factor against social adversities (Gifford-Smith & Brownell, 2003), interventions that target the skills and contexts of friendship development are important for individuals on the autism spectrum. For children, arguably the most important context is socialising with peers during play (Cordier, Bundy, Hocking, & Einfeld, 2009).

A peer-mediated, play-based intervention was recently adapted and evaluated for children on the autism spectrum (Parsons, Cordier, Munro, & Joosten, 2018a). The intervention targets pragmatic language through the combination of self-modelling via video-feedback and feed-forward techniques, therapist- and peer-modelling during unstructured and child-led free play, and parent mediation of home-based components. This combination of techniques originated in the ADHD intervention literature, with studies focusing on social play-based outcomes (Cordier et al., 2009; Wilkes-Gillan, Bundy, Cordier, Lincoln, & Chen, 2016). Parsons et al. (2018a) evaluated the feasibility of assessing pragmatic language as an intervention outcome, and the appropriateness of the intervention for children on the autism spectrum and their families. Those results informed a randomised controlled trial (RCT), which evaluated the effectiveness of the intervention for improving the pragmatic language of children on the autism spectrum and their typically-developing peers (Parsons, Cordier, Munro, & Joosten, 2018b, 2018c). The pilot study by Parsons et al. (2018a) provided preliminary evidence of intervention effectiveness with a

small sample of children (n = 10). Findings from the RCT identified that the intervention improved the pragmatic language performance of children on the autism spectrum during play with a typically-developing peer. However, results from both studies were based on group data, and not all children within the two samples who completed the intervention (n = 76) demonstrated the same patterns of performance.

The heterogeneity of autism is widely recognised, both etiologically and phenotypically (Jeste & Geschwind, 2014). It is therefore unsurprising that the same intervention might be highly effective for some children on the autism spectrum and not others. Resources (e.g., time, money) are misdirected if children are enrolled in interventions that are of little benefit, so it is imperative that researchers identify which interventions are best suited for which children, rather than identifying one single gold-standard intervention for all (Howlin & Charman, 2011; Vivanti, Prior, Williams, & Dissanayake, 2014). Across branches of medicine, practitioners are equipped with tests and indicators to inform treatment decision making, but this is not the case for psychosocial interventions. Instead, factors such as location, hearsay or sales pitches might guide the decisions of parents and clinicians (Vivanti et al., 2014). This study builds on the initial efficacy findings of Parsons et al. (2018c) to investigate children's pre-intervention characteristics that predict individual intervention effects. The findings will allow clinicians to recommend a peer-mediated play-based pragmatic language intervention to the most suitable candidates and reduce the risk of wasted resources.

In a review of intervention outcome predictors following early interventions for children autism spectrum, Vivanti et al. (2014) noted mixed findings with regards to the influence of cognition, language, age, symptom severity and family factors on individual intervention effects. Other studies in the review have attributed positive intervention effects to play skills, joint attention and low levels of social avoidance (Ingersoll, Schreibman, & Stahmer, 2001; Kasari, Gulsrud, Freeman, Paparella, & Hellemann, 2012; Sherer & Schreibman, 2005). A recent systematic review of pragmatic language interventions for children on the autism spectrum identified 10 studies evaluating interventions for school aged children (6-12 years) with autism (Parsons, Cordier, Munro, Joosten, & Speyer, 2017). All were RCTs reporting intervention effects at a

group level. We have been unable to locate any studies that link individual children's characteristics to intervention response.

The intervention studied by Parsons and colleagues (2018a, 2018c) is comprised of multiple active ingredients and individual children will likely respond differently to these ingredients based on their combined language, emotional and behavioural abilities. For instance, through video-feedback and feed-forward, children are expected to integrate the video footage viewed, with therapist discussion, to form a new understanding of how to enact their pragmatic knowledge to promote a positive interaction during play. This would likely require strong structural language skills to comprehend the discourse with the therapist and a minimum level of pragmatic and socioemotional understanding. The free-play that occurred in the playroom relied on active engagement in a play-based social interaction to learn from social models within the environment (i.e., their peer and the therapist) and to practice new pragmatic language skills during play. Children with concurrent emotional or behavioural problems (e.g., anxiety, hyperactivity, impulsivity, oppositional tendencies) may struggle to engage in the play-based social interactions, or conversely, the nature of play might assist children to regulate their emotions and behaviours more readily, making social interaction more achievable.

This study aims to identify factors characteristic of the children on the autism spectrum who obtained the largest intervention effects following a peer-mediated, play-based pragmatic language intervention (Parsons et al., 2018a, 2018c). Using these findings, we aim to develop two algorithms for use by therapists to identify the best candidates for the intervention; the first algorithm contains parent reported communication, behavioural, and social and emotional variables, as well as standardised language variables, while the second algorithm only contains standardised child language variables only.

6.3 Method

Children's baseline pre-intervention variables, and pre- and post-intervention data from the pilot study and subsequent RCT by Parsons and colleagues (Parsons et al., 2018a, 2018c) were pooled to form the dataset for this study. Curtin University Human Research Ethics Committee

approved the protocol for both studies (HR04/2015) and the RCT was registered with the Australia New Zealand Clinical Trials Registry a priori (ACTRN12615000008527). Researchers informed dyads (child with autism and their peer) and their parents of the study requirements prior to parents providing written consent for their child's participation. Children also gave written consent (aged $\geq$ 7 years) or verbal assent (aged < 7 years) to participate. Dyads attended ten weekly sessions at the clinic. Pre- and post-intervention assessments occurred during weeks 1 and 10 respectively and children received the intervention during weeks 2–9.

6.3.1   Participants

Children were recruited into both studies through a large autism service provider, paediatric speech pathology and occupational therapy practices, and online social media groups for parents of children on the autism spectrum and speech pathologists in Perth, Western Australia. Parents of children on the autism spectrum contacted researchers who used a screening questionnaire to evaluate their child's eligibility for the studies. Children on the autism spectrum who met inclusion criteria invited a typically-developing peer of a similar age to attend the intervention as a playmate.

6.3.1.1   Children on the autism spectrum

Children on the autism spectrum were required to be aged 6-11 years, have a diagnosis of autism or Asperger syndrome in accordance with DSM-IV or DSM 5 criteria (American Psychiatric Association, 2000, 2013), without an intellectual disability, and without a severe language impairment. Children's diagnoses were confirmed by researchers sighting interdisciplinary (i.e., paediatrician, psychologist, and speech pathologist) diagnostic reports. Receptive and expressive language skills were screened using the *Elaborated Sentences and Phrases* subtest of the *Test for Auditory Comprehension of Language* (TACL-4; Carrow-Woolfolk, 2014) and the *Expressive Vocabulary Test* (EVT-2; Williams, 2007) respectively. All participants received a scaled score $\geq$4 on the Elaborated Sentences and Phrases subtest of the TACL-4, and a standard score $\geq$70 on the EVT-2.

6.3.1.2   Typically-developing peers

Playmates were also 6-11 years of age and had no neurodevelopmental disorders or concerns for neurodevelopmental disorders identified by parents, teachers or health professionals. Per the requirements of children on the autism spectrum, all playmates achieved a scaled score ≥4 on the Elaborated Sentences and Phrases subtest of the TACL-4, and a standard score ≥70 on the EVT-2. This reduced the likelihood that severe structural language difficulties would hinder children's ability to comprehend intervention concepts. Across both studies, a majority of playmates enrolled were siblings of children on the autism spectrum (61%), while the remainder were friends or cousins.

6.3.2   Instruments

Two parent-report assessments (Children's Communication Checklist Second Edition, Conners Comprehensive Behaviour Rating Scales) evaluated language, behavioural problems, and social and emotional abilities. Three standardised language measures (EVT-2, TACL-4, Social Emotional Evaluation) were administered to children prior to the intervention. Summary or subscale scores from these five measures were the baseline pre-intervention variables used for predicting positive intervention effects. Intervention effects were assessed using an observational measure of pragmatic language.

6.3.2.1   Baseline pre-intervention variables

Children's Communication Checklist, Second Edition (CCC-2; Bishop, 2006)

The CCC-2 is a parent-or teacher- report measure used to identify children likely to have a developmental language disorder or require referral for autism assessment. It contains ten scales; four scales assess language structure (A: speech, B: syntax, C; semantics, D: coherence); four assess pragmatics (E: inappropriate initiation, F: stereotyped language, G: use of context, H: nonverbal communication); and two scales assess behaviours typically challenging for children on the autism spectrum (I: social relations, J: interests). Items are rated on a four-point scale to indicate the frequency of occurrence of various communication behaviours (e.g., 0 = never; 3 = several times per day). Subscales A-H are combined to produce a General

Communication Composite. The sum of scales A-D are deduced from the sum of scales E, H, I and J to derive a Social Interaction Deviance Composite. Validation data suggests that the CCC-2 predicts children on the autism spectrum or pragmatic language impairments with high levels of sensitivity and specificity (89% and 97% respectively; Bishop, 2006).

Expressive Vocabulary Test, Second Edition (EVT-2; Williams, 2007)

Children's vocabulary acquisition was assessed using the EVT-2. Children are presented with drawings depicting a range of content areas (e.g., vegetables, actions) and parts of speech (i.e., nouns, verbs, adjectives) and are asked to label the picture or provide a synonym for a label provided by the assessor. The EVT-2 standard scores are co-normed and strongly correlated with ($r = 0.82$) the Peabody Picture Vocabulary Test, Fourth Edition (Dunn & Dunn, 2007). EVT-2 standard scores show moderate-to-strong correlations ($r = 0.68$-0.80) with Clinical Evaluation of Language Fundamentals, 4th edition (Semel, Wiig, & Secord, 2003; Williams, 2007). Standard scores within this study were derived using age-based norms.

Test for Auditory Comprehension of Language, Fourth Edition (TACL-4; Carrow-Woolfolk, 2014)

Children's receptive language was assessed using the Elaborated Phrases and Sentences subtest of the TACL-4. This subtest evaluates comprehension of syntactically-based word relations, phrases and sentence constructions, including active and passive voice, direct and indirect object, interrogative sentences, negative sentences, embedded sentences, and partially and completely conjoined sentences. The TACL-4 has sensitivity and specificity indices of 0.22 and 1.00 respectively, for detecting children with language impairment at a scaled score cut-off of 4 (Carrow-Woolfolk, 2014).

Social Emotional Evaluation (SEE; Wiig, 2008)

The SEE is a measure of social emotional understanding and higher-level language. Children are presented with pictures of facial expressions or social situations and are asked questions about each picture. Some items require children to respond by pointing, while others require a

verbal response. The measure contains four subscales comprising expressive and receptive tasks, with the exception of one subscale which is a receptive only task. Receptive task scores are summed, as are expressive task scores, to create a Receptive Composite and an Expressive Composite (expressed as a z-score). The composites are combined to create a Total Composite also expressed as a z-score. Z-scores are age-referenced based on the age groups 6;0-7;11, 8;0-9;11, and 10;0-12;11. The SEE has good internal consistency ($\alpha = 0.76$-0.88), test-retest reliability ($r = 0.88$-0.93), and inter-rater reliability ($r = 0.96$-1.00), and overall sensitivity and specifically values of 0.95-1.00 for identifying children on the autism spectrum at a z-score cut-off of -1.00 (Wiig, 2008).

Conners Comprehensive Behaviour Rating Scales (CCBRS; Conners, 2008)

Behavioural, social, emotional and academic abilities were assessed using the CCBRS Parent Form. The CCBRS contains 201 items rated on a four-point scale indicating the frequency of a given behaviour (e.g., 0 = never, seldom; 3 = very often, very frequently). Ratings are used to produce standardised T-score for 8 Content Scale composite scores (Emotional Distress, Defiant Aggressive Behaviour, Academic Difficulties, Hyperactivity/Impulsivity, Separation Fears, Perfectionist/Compulsive, Violence Potential Indicator, Physical Symptoms) and 12 Symptom Scales (ADHD predominantly Inattentive Type, ADHD predominantly Hyperactive Type, Conduct Disorder, Oppositional Defiant Disorder Major Depressive Episode, Manic Episode, General Anxiety Disorder, Separation Anxiety Disorder, Social Phobia, Obsessive Compulsive Disorder, Autism, Asperger's Syndrome) that are aligned with the DSM-IV (American Psychiatric Association, 2000). T-scores are calculated scale based on a child's age and gender, with higher scores indicating increased levels of concern in the area assessed. The CCBRS has overall correct classification rates of 0.70-0.89 for its clinical indexes, along with good evidence for internal consistency ($\alpha = 0.67$-0.97), test-retest reliability ($r = 0.56$-0.96), and inter-rater reliability ($r = 0.50$-0.89) (Conners, 2008).

6.3.2.2 Outcome measure

Pragmatic language during peer-peer social play interactions was the primary outcome used in the intervention studies. The *Pragmatics Observational Measure* (POM; Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014) was administered during the pilot study, and the updated *Pragmatics Observational Measure, Second Edition* (POM-2; Cordier et al., 2018) was administered for the RCT. The POM-2 is an observational measure of pragmatic language that operationalises the adopted definition of pragmatic language. It is suitable for use with children aged 5-11 years and can be used by blinded assessors to minimise measurement bias. Items are rated on a four-point scale to indicate a child's level of expertise in performing a particular pragmatic skill (e.g., 1 = beginner, 4 = expert), and an Overall measure score can be derived. In the updated POM-2, five items were removed and the remaining items grouped by two dimensions (Verbal Communication and Non-Verbal Communication) to produce two further measure subscale scores (Cordier et al., 2018). Both the POM and POM-2 have excellent evidence for criterion validity against the Pragmatic Protocol ($r = 0.95$, $p = 0.005$), with strong internal consistency ($\alpha = 0.99$), and construct validity (Cordier et al., 2018; Cordier et al., 2014).

6.3.3 Procedure

6.3.3.1 Assessments

To assess children's pragmatic language before and after the intervention (attendance weeks 1 and 10), dyads played in the clinic playroom for 15 minutes. The play sessions were filmed using two digital video cameras fixed within the playroom. Independent assessors used the POM (pilot study) or POM-2 (RCT) to rate children's pragmatic language performance during their play. POM ratings for pilot study participants ($n = 10$) were adjusted to conform with the updated item structure of the new edition of the POM-2; scores for the five removed items were excluded and videos were reviewed to rescore items for compliance with updated item descriptors of three items. Assessors were blinded to the timing of the videos and children's predictor variables. The toys available to children in the playroom were selected to encourage co-operative social-play and cater for a range of ages and interests. A description of the

available toys is provided in Parsons et al. (2018a, 2018c). The EVT-2, TACL-4 and SEE were administered to children at the pre-intervention session, and parents were also provided with the CCC-2 and CCBRS at this time.

6.3.3.2   Intervention

Weekly intervention sessions lasted approximately 50 minutes and were conducted by either a speech pathologist or an occupational therapist. Pragmatic language targets were individualised and selected based on children's pre-intervention POM-2 profile. Each session followed the same sequence: 1) 15-20 minutes of video-feedback and -feedforward; 2) 20-30 minutes of child-led free-play including peer and therapist modelling; 3) 10-20 minutes of therapist-parent discussion while dyads continued to play. All play within the clinic was filmed and footage formed the content of the video-feedback the following week.

A brief description of intervention procedures is provided here; for a detailed description see Parsons et al. (2018c). During video-feedback and -feedforward the therapist showed dyads clips from their previous week's play session. Clips provided feedback on pragmatic language that did or did not promote the social interaction during their previous play session and the therapist discussed the pragmatic language observed with the dyads. The discussion finished with video-feedforward where the therapist reminded children of three pragmatic language skills to use to promote the interaction when they played in the playroom that day. Dyads and the therapist then entered the playroom and engaged in child-led free-play. Therapists and peers modelled targeted pragmatic language skills during this time and children on the autism spectrum had the opportunity to practice new pragmatic language skills in a naturalistic environment.

Between intervention sessions, parents mediated the home-based components of the intervention. Dyads practiced pragmatic language targets during a playdate at the homes of the children with autism. Parents read a module in a parent manual that provided information and strategies for supporting the social communication and play skills that are challenging for children with social difficulties. Children and parents also viewed a pre-recorded video of

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fictional characters playing while parents guided a discussion with their child about the play and social communication observed.

6.3.4 Statistical analysis

6.3.4.1 Data preparation

All POM-2 ratings for all children in both studies (n = 79) were entered into Winsteps (Version 4.2.0; Linacre, 2016), where Rasch analysis was performed to convert ordinal-level item ratings into interval-level measure scores. Goodness of fit statistics were reviewed and were determined to fall within the required parameters ($MnSq$ < 1.4 and > 0.7; standardised value < 2.0), indicating suitable reliability and validity of the ratings for this combined sample, at both an item and person level. Each child received measure scores for the Overall scale, Verbal Communication subscale, and Non-Verbal Communication subscale, for each time point. Summary and scale scores from the baseline pre-intervention measures, and POM-2 pre- and post- measure scores from participants in both studies were entered into IBM SPSS Statistics (IBM Corporation, 2013) for further analysis. Participants who did not complete the intervention (n =3) and those with missing CCC-2, EVT-2, TACL-4, SEE or CCBRS scores (n = 16) were excluded from the analysis. See Figure 6.1 for participant flow from pre-intervention assessment to data analysis. See Table 6.1 for demographic information and pre-intervention scores for children on the autism spectrum included in the analysis.
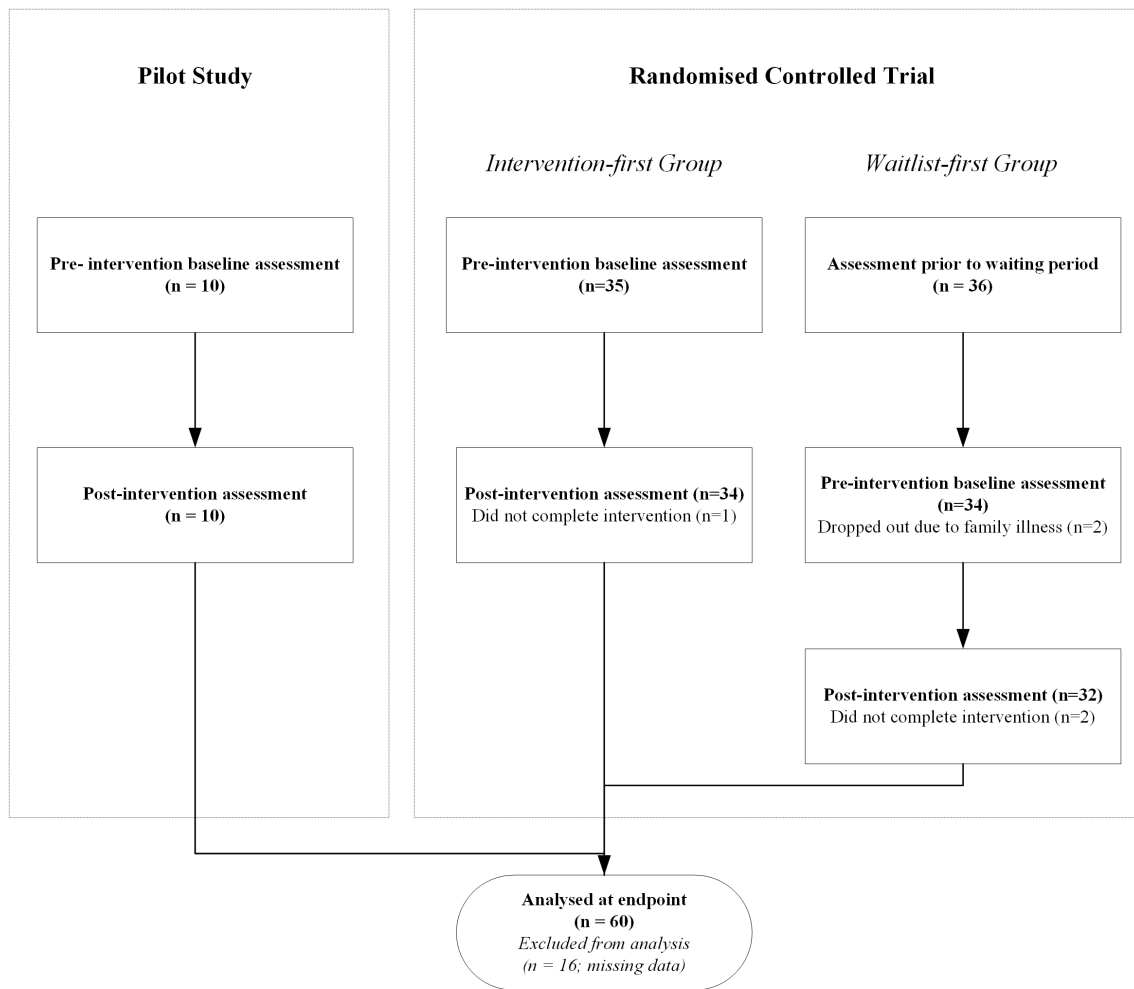
Figure 6.1. Participant flow through the pilot study and randomised controlled trial.

Table 6.1. Child characteristics and pre-intervention variables used to predict intervention response.

Child characteristics	Mean	SD	Range
Child age (years)	8.7	1.4	6.0-11.9
Child gender (male)	51/60 (85%)		
CCC-2 scores			
Speech	6.82	3.93	0-13
Syntax	5.38	3.42	0-12
Semantics	4.63	2.68	0-14
Coherence	3.70	2.36	0-13
Inappropriate Initiation	4.80	2.03	2-13
Stereotyped Language	4.68	2.73	0-13
Use of Context	2.70	2.49	0-14
Nonverbal Communication	2.23	1.73	0-10
Social Relations	1.82	2.17	0-8
Interests	4.33	1.96	2-13
General Communication Composite	34.77	15.63	7-96
Social Interaction Deviance Composite	-7.17	9.67	-31-10
EVT-2			
Standard score	102.29	14.21	75-132
TACL-4			
Elaborated Phrases and Sentences	8.42	2.44	4-13
SEE			
Receptive Composite	-0.60	1.30	-3.00-1.50
Expressive Composite	-0.81	1.26	-3.00-1.13
Total Composite	-0.71	1.32	-3.00-1.33
CCBRS Content Scales			
Emotional Distress	78.85	12.14	48-90
Defiant Aggressive Behaviour	73.88	15.93	44-90
Academic Difficulties	69.56	17.38	4-95
Hyperactivity/Impulsivity	72.81	14.43	38-90
Separation Fears	59.56	14.40	39-90
Perfectionist/Compulsive	74.22	14.81	42-90
Violence Potential Indicator	71.41	13.98	45-90
Physical Symptoms	65.78	14.63	40-90
CCBRS Symptom Scales			
ADHD Inattentive Type	78.86	10.14	55-90
ADHD Hyperactive Type	72.77	14.33	38-90
Conduct Disorder	64.60	15.59	44-90

| Child characteristics	Mean	SD	Range
Oppositional Defiant Disorder	75.22	14.01	39-90
Major Depressive Episode	73.03	14.80	41-90
Manic Episode	75.65	15.07	41-90
General Anxiety Disorder	77.37	12.88	46-90
Separation Anxiety Disorder	61.50	16.01	39-90
Social Phobia	71.82	15.85	40-90
Obsessive Compulsive Disorder	70.27	16.86	44-90
Autism	86.33	7.20	63-90
Asperger's Syndrome	81.43	10.44	51-90

Note. CCC-2 = Children's Communication Checklist 2nd Edition, EVT-2 = Expressive vocabulary Test 2nd Edition, TACL-4 = Test for Auditory Comprehension of Language 4th Edition, SEE = Social Emotional Evaluation, CCBRS = Conners Comprehensive Behaviour Rating Scale.

6.3.4.2 Classifying participants with greatest intervention effects

This study sought to identify the characteristics of children who received the greatest benefits from the play-based intervention, so identification of children with the greatest magnitude of change was required. Cohen (1988,) provided behavioural and cognitive sciences with methods for determining effect sizes that are now widely accepted procedures for identifying magnitude of change. He also provides conventions for the classification and interpretation of effect sizes. This study utilised Cohen's *d* to identify children with the greatest gains in pragmatic language following the intervention, which is interpreted as follows: 0.2 = small, 0.5 = medium, 0.8 = large effect sizes.

To classify participants within the sample based on effect size, Cohen's *d* effect sizes were first calculated for each participant. Three effect sizes were calculated for each participant, one for each POM-2 measure score (i.e., Overall, Non-verbal Communication, Verbal Communication), using pre- and post-intervention scores and pooled standard deviations. Next, the sample was divided into two groups, informed by Cohen's conventions for classifying effect sizes (0.2 = small, 0.5 = medium, 0.8 = large; Cohen, 1988). Group 1 were participants with the greatest intervention effects, defined as those with $d \geq 0.8$ for all three POM-2 measure scores ($n = 19$). All other participants constituted Group 2 (i.e., at least one POM-2 measure score with $d < 0.8$; *n*

= 41). Figure 6.2 displays a plot of calculated effect sizes with the cut-off between groups identified.
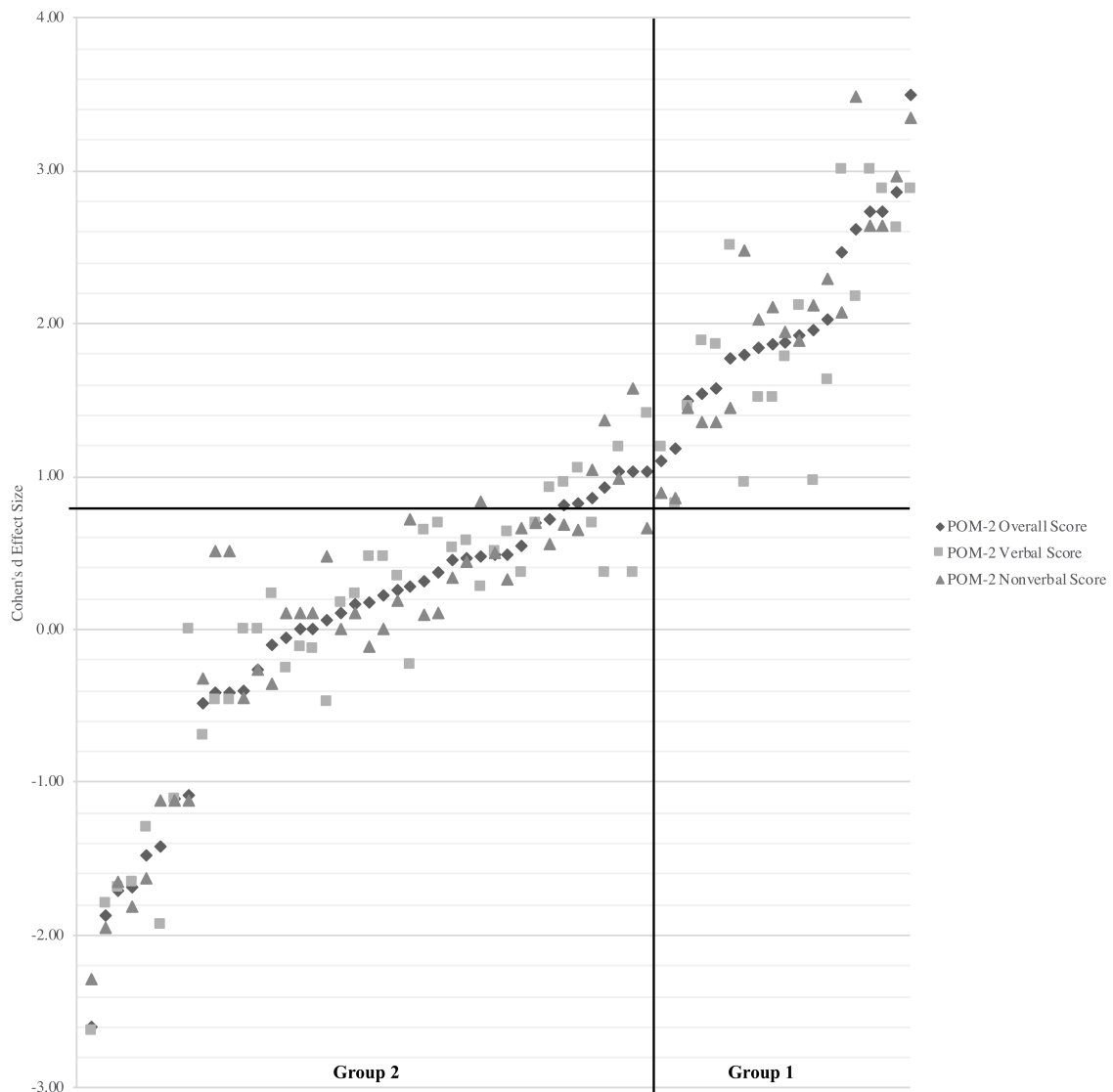
Figure 6.2. Plot of Cohen's d effect sizes for all POM-2 scores for all participants.
Note. Group 1 = participants with $d \geq 0.8$ for all three POM-2 measure scores; Group 2 = participants with at least one POM-2 measure score $d < 0.8$.

Children with a large effect size for all three POM-2 scores were selected as the target group for this analysis, as they represent a subgroup of children whom we can confidently identify as unequivocally having benefitted in all elements of pragmatic language following participation in the intervention. While some participants in the remaining group also received notable intervention effects in some elements of pragmatic language, the decision was made to combine those with medium, small, and negligible effect sizes, as effect sizes within this subgroup group

were more varied. Classification of Group 2 into further subgroups would have created a large number of small subgroups, which would conceptually be meaningless and ultimately hinder the interpretation of results. Moreover, the purpose of the analysis was to determine the factors that would predict those participants who *most benefitted* from the pragmatic language intervention.

6.3.4.3 Determining variables that best predicted intervention benefits

The large number of scale scores produced by the pre-intervention measures ($n = 37$) in relation to the sample size did not allow for concurrent analysis of all scores at the outset. So, binary logistic regression was performed to screen for baseline pre-intervention variables that might best predict membership in the group with the largest intervention effects. As there was no a priori rationale to enter scores into the model, backwards elimination was used to build six models (i.e., one model per measure) using the scale scores produced by each baseline pre-intervention measure (i.e., CCC-2, EVT-2, TACL-4, SEE, CCBRS Content Scales, CCBRS Symptom Scales). Goodness of fit was tested against a constant only model and variables in models that were approaching significance ($p < 0.10$) were used in the next stage of analysis.

Next, variables from logistic regression models approaching significance ($p < 0.10$) were combined and entered into a discriminant function analysis to determine the combination of variables that best predict membership in the group with the largest effect (i.e., intervention effect >0.80 for all POM-2 scores). Variables were entered and removed from the analysis to determine the model that maximises sensitivity, specificity, positive predictor and negative predictor values.

Lastly, a discriminant function equation was created using the unstandardised discriminant analysis coefficients of the discriminant function analysis model. The discriminant function equation is used by the model to classify participants within the sample and so can be used to classify future cases. The weighted average of the mean discriminant function scores for each group in the analysis was calculated for each model to establish the cut-off for determining group membership using the discriminant function equation.

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6.4 Results

6.4.1 Logistic regression

Models approaching significance were determined for: a) CCC-2 scales, $\chi^2(3)=8.33$, $p=0.039$; b) EVT-2 standard score, $\chi^2(1)=2.86$, $p=0.091$; and c) CCBRS symptom scales, $\chi^2(1)=2.94$, $p=0.086$. *Coherence*, *Use of Context* and *Nonverbal Communication* within the CCC-2 model explained 18.3% of the variance (Nagelkerke $R^2 = 0.183$). *Separation Anxiety* disorder explained 6.8% of the variance in the CCBRS content scales (Nagelkerke $R^2 = 0.068$), and the EVT-2 standard score explained 6.6% of the EVT-2 model variance (Nagelkerke $R^2 = 0.066$). Final models did not approach significance for the TACL-4 scale score ($p = 0.499$), SEE composite scores ($p = 0.172$), or CCBRS content scales ($p = 0.651$). Statistics for models that approached significance are displayed in Table 6.2.

Table 6.2. Significant final binary logistic regression models for predicting membership in the greatest intervention effect group.

Model Predictor	B	Wald χ^2	p	Odds ratio (95% CI)
CCC-2 Model				
Constant	-0.25	0.17	0.677	0.78
Coherence	-0.32	2.48	0.115	0.72 (0.49-1.08)
Use of Context	0.54	6.53	0.011	1.73 (1.14-2.62)
Nonverbal Communication	-0.41	2.29	0.130	0.66 (0.39-1.13)
EVT-2 Model				
Constant	2.76	1.67	0.197	15.73
EVT-2 standard score	-0.03	2.67	0.102	0.97 (0.93-1.01)
CCBRS Symptom Scales Model				
Constant	-2.64	4.98	0.026	0.07
Separation Anxiety Disorder	0.03	2.83	0.092	1.03 (1.00-1.07)

Note. CCC-2 = Children's Communication Checklist 2nd Edition, EVT-2 = Expressive Vocabulary Test 2nd Edition, CCBRS = Conners Comprehensive Behaviour Rating Scale.

6.4.2 Discriminant function analyses

Variables from the binary logistic regression models that approached significance (i.e., *Coherence*, *Use of Context*, *Nonverbal Communication, EVT-2 standard score* and *Separation Anxiety*) were entered into a discriminant function analysis to determine the combination of

variables that best discriminate between the group with the largest intervention effects and the remainder of the sample. Through a process of backwards elimination, the final model was determined. The discriminant function included *Coherence*, *Use of Context*, *Nonverbal Communication*, *EVT-2* and *Separation Anxiety.* The discriminant function explained 24% of the variance within the model (Wilks' lambda = 0.76) and predicted the correct classification of 79.7% of the sample.

As use of the CCBRS is typically restricted to registered psychologists and medical practitioners, the professionals who might implement this intervention (e.g., speech pathologists) may not always have access to these scores for their clients. Therefore, a second discriminant function analysis was performed to determine the best prediction model with CCBRS scores removed. Using backwards elimination, the final model was determined and included *Coherence*, *Use of Context*, *Nonverbal Communication*, and *EVT-2* scores. The discriminant function predicted the correct classification of 76.3% of the sample and explained 21% of the variance in the model (Wilks' lambda = 0.79). Both discriminant functions, along with sensitivity, specificity, positive predictive and negative predictive values are displayed in Table 6.3.

Table 6.3. Discriminant functions and classification results.

Prediction	Discriminant function equation	Classification results
All POM-2 *d*>0.8 **(All measures)**	Predictor Score = 2.119 + 0.572 x Use of Context + 0.029 x Separation Anxiety Disorder – 0.458 x Nonverbal Communication – 0.227 x Coherence – 0.035 x EVT-2 Predictor Score > 0.00 predicts *d* >0.80	Sensitivity[a]: 57.9% Specificity[b]: 90.0% Positive Predictive Value[c]: 73.3% Negative Predictive Value[d]: 81.8%
All POM-2 *d*>0.8 **(Language measures only)**	Predictor Score = 5.644 + 0.576 x Use of Context - 0.535 x Nonverbal Communication - 0.238 x Coherence - 0.050 x EVT-2 Predictor Score > 0.00 predicts *d* >0.80	Sensitivity: 52.6% Specificity: 87.5% Positive Predictive Value: 66.7% Negative Predictive Value: 79.5%

[a] Sensitivity = proportion of true positives predicted by the discriminant function
[b] Specificity = proportion of true negatives predicted by the discriminant function
[c] Positive predictive value = probability of a positive result if the child is a suitable candidate
[d] Negative predictive value = probability of a negative result if the child is not a suitable candidate

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Using the first discriminant function (including CCBRS scores), the mean predictor score for each group was determined (largest intervention effects group = 0.804, all others = -0.382), and the weighted average of these means was calculated to ascertain the mid-point between the two groups (weighted average = 0.00). This mid-point determined the cut-off score for predicting group membership. Using the discriminant function that includes CCBRS scores to derive a prediction score; scores >0.00 predict a child likely to have a large intervention effect (all POM-2 d > 0.8) following this intervention. This process was repeated for the discriminant function that excluded CCBRS scores. Mean predictor scores for the largest intervention effects group and all others were 0.737 and -0.350 respectively, and the weighted average was 0.00. Using the discriminant function that excludes CCBRS scores to derive a prediction score; scores >0.00 predict a child likely to have a large intervention effect (all POM-2 d > 0.8) following this intervention. An application for calculating prediction scores can be downloaded from Appendix J.

6.5 Discussion

This study aimed to develop a way for therapists to identify the best candidates for a peer-mediated, play-based pragmatic language intervention. We investigated the pre-intervention characteristics of children on the autism spectrum that predicted large intervention effects following participation in the intervention, and the analysis resulted in two algorithms that clinicians can use to screen children's suitability to participate in the intervention. Given the heterogeneity of autism, clinicians and parents require evidence of intervention efficacy that includes factors associated with a positive intervention effect, to ensure the resources that families of children on the autism spectrum dedicate to intervention are optimised. This is the first study attempting to create tools to aid in this decision-making for a pragmatic language intervention for children on the autism spectrum. Results of the first discriminant function analysis suggest that relatively high *Use of Context* (CCC-2) and *Separation Anxiety* (CCBRS) scores with comparatively lower *Nonverbal Communication* (CCC-2), *Coherence* (CCC-2) and *EVT-2* scores characterise children most likely to receive the greatest benefits from this intervention. The second analysis indicated that if CCBRS scores are removed, the same CCC-2

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and EVT-2 scores characterise a suitable candidate for this intervention with similar levels of accuracy at the first analysis.

A relatively strong ability to integrate spoken language with the social context to appropriately portray a communicative intent or appreciate the intentions of another (CCC-2, *Use of Context* scale), predicted children with the largest intervention effects. Relative strengths in integrating language and context would have assisted understanding, practice and assimilation of intervention concepts, both during video-feedback and free-play. Carefully chosen video clips drew children's attention to the salient pragmatic language features of previous social interactions that did or did not promote the social interaction. Through discussions with the therapists during video-feedback and -feedforward, the strategies that promoted positive social interaction were made explicit to the children. During play with their peer and therapist, children were afforded the opportunity to practise integrating the communicative, social and emotional aspects of their social environment to enact new pragmatic language skills.

Difficulties integrating spoken language with the social context to form a mental representation for comprehension is a common feature of autism (Norbury & Bishop, 2002), that has been linked to both cognitive and linguistic abilities. The weak central coherence theory suggests these difficulties arise from a bias for local information processing (Happé, 1999; Happé & Frith, 2006). Other studies suggest that forming a mental representation, by integrating language and context, relies on linguistic abilities that may be impaired in children on the autism spectrum (Norbury, 2005; Pijnacker, Hagoort, Buitelaar, Teunisse, & Geurts, 2009). Prior to the RCT, it was thought that weak structural language might hinder children's ability to understand intervention concepts, and so therapists used carefully selected, simple, unambiguous language to explain pragmatic language concepts during video-feedback. However, these results suggest that overcoming the cognitive demands of video-feedback and social play might also be important in this learning process and require further investigation. Comparing the results of children on the autism spectrum to those of children with a developmental language disorder, along with pre-intervention measurements of social cognition, might provide more insight into

the cognitive and structural language processes that underlie the change mechanisms in this intervention.

Even though the ability to use context to disambiguate meaning in language has been associated with structural language abilities (Norbury, 2005; Pijnacker et al., 2009), receptive syntax scores (*Elaborated phrases and sentences* scale of TACL-4) were not predictive of intervention outcomes in this study, and stronger expressive language scores (EVT-2 standard score) were not necessarily advantageous. One reason for this may be the cut-off inclusion criteria applied; no child had severely impaired receptive syntax or vocabulary. This decision was informed by findings of a previous pilot study with children on the autism spectrum, which suggested that young children (aged 4-5 years) had difficulty remembering the target skills highlighted by the therapist during video-feedforward (Henning, Cordier, Wilkes-Gillan, & Falkmer, 2016). Another reason why structural language did not feature as a positive predictor may be the therapists' deliberate simplification of language used to explain the intervention concepts. Further research is required to understand the components of this intervention that are least efficacious for children with weak 'use of context' and structural language, to determine whether further cognitive and linguistic supports promote greater pragmatic language gains for these children.

High *Nonverbal Communication* scores (another pragmatic scale of the CCC-2) were not necessarily characteristic of children with large intervention effects. The Nonverbal Communication item of the CCC-2 (a parent-report measure) closely align with the Nonverbal Communication subscale of the POM-2 (an observational measure), measuring use and understanding of gestures and facial expression, as well as appropriate use of space between speakers. Results of the RCT indicate that this intervention is effective for improving the nonverbal communication skills of children on the autism spectrum at a group level (Parsons et al., 2018c), and this study suggests that the intervention is particularly effective for children with lower pre-intervention scores in this area. Similarly, in a study of the same intervention for children with ADHD, Wilkes-Gillan et al. (2016) found that lower baseline scores in their primary outcome measure were predictive of greater intervention benefits. When considering

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these results collectively, this intervention appears particularly effective for improving the nonverbal communication abilities of children with particular difficulties in this pragmatic language domain.

Similarly, relative strengths in *Coherence* (overall organisation of discourse to create meaning) were not advantageous in terms of predicting intervention benefits. *Coherence* is a structural language scale of the CCC-2, with items related to ambiguous use of pronouns for reference and overall organisation of discourse during spontaneous speech. Consensus has not been reached on the processes that underlie reference selection in the discourse of children on the autism spectrum. Initial theories focus on specific deficits in theory of mind (e.g., Hale & Tager-Flusberg, 2005), but more recently, the role of discourse processing load has been a focus (e.g., Arnold, 2010). The combined components of this intervention had the potential to support both the cognitive load related to discourse processing and deficits in theory of mind. Video-feedback discussions make explicit that consideration of a playmate's perspective is an important aspect of a positive social-play interaction. Therapists also adapted play activities if required, to reduce complexity and free up cognitive resources for discourse processing. A discourse analysis of children's conversations during play combined with measures of social cognition might contribute further to the empirical debate about the cognitive processes that underlie the social challenges associated with autism.

Relatively high *Separation Anxiety Disorder* scores predicted children with large intervention effects. Similar to these findings, Antshel et al. (2011) found that intervention effects following social skills training for children autism were greater for those with a comorbid anxiety disorder, compared with those without an anxiety disorder (mean age = 9.2 years). It is possible that the structured video-feedback and -feedforward, focus on practical strategies to promote positive interactions, and opportunities to practise new pragmatic skills in a supported, naturalistic environment catered well to the needs of these children. Play as a context for practicing and assimilating social interaction skills may also be especially beneficial for children with social anxiety, as continued engagement in play activities requires children to feel physically and emotionally safe (Bundy, 2004; Cordier et al., 2009). Furthermore, positive

social play interactions require 'up-regulation' of positive emotions and 'down-regulation' of negative emotions (Schwartz & Badaly, 2010), and the play-based aspects of the intervention might have been especially beneficial for anxious children who tend towards engagement in solitary play. Future research might consider evaluating whether the intervention also reduces anxiety and whether this leads to greater improvements in pragmatic language, or vice versa.

We did not investigate the predictive value of children's verbal or nonverbal IQ scores within this study. A diagnosis of autism without an accompanying intellectual disability was a criterion for inclusion in the study, and so it is possible that had we formally measured IQ, it may not have been a significant predictor in the context of this study. Vivanti et al. (2014) suggest that measures of IQ as a predictor create a circular logic that is not helpful in clinical decision-making. That is, children with lower IQ by definition have difficulty learning, and therefore it is unsurprising that children with lower pre-treatment IQ scores have more difficulty learning during interventions. Findings from this study suggest that in the context of social skill interventions, proximal measures of the cognitive processes that underlie targeted social skills and change processes (such as social cognition or central coherence) might be more meaningful as predictors than broader IQ scores.

6.5.1 Limitations

The findings from this study can be used to predict children with autism without an intellectual disability who are likely to receive a large intervention effect in all elements of pragmatic language following this intervention. Effect size scores in this study indicate there are some children for whom this intervention might be contra-indicated. The sample size within this study restricted the number of groups we were able to divide the sample into for this analysis. Ideally, the investigation would determine factors that discriminated at least three groups within the sample: 1) negative/no effect; 2) small/medium effect; 3) large effect. As this was not possible, we decided the best starting point was to explore the highest treatment responders, because knowing who to recommend for the intervention (rather than who not to) would likely have a greater influence on translating the intervention into practice. A focus on the low/non-

responders would also be informative for practice and a useful direction for future research, so that families can dedicate resources to more suitable intervention programs.

The purpose of this study was to develop a tool for screening children for suitability of the intervention. The reliability of the algorithms developed in this study have not been evaluated a priori for children who receive the intervention, thus caution is currently recommended when using the application as further replication is required. Future studies of this intervention should consider further investigations of reliability to determine whether the results of this study generalise to the broader population of children with autism without an intellectual disability.

This study investigated the child behaviour and language factors that discriminated those within the sample who received a large intervention effect, but there are other factors that could influence children's outcomes and increase the accuracy of prediction. The algorithms produced from this study had fairly strong predictive values, but specificity and negative predictive values were stronger in relation to the sensitivity and positive predictive values. That is, the algorithms are better at predicting true negatives (i.e., children with an effect size <0.8) than true positives (i.e., children with an effect size >0.8). Attempts to identify other factors that increase the sensitivity and positive predictive values of the algorithms are warranted. The intervention studied is comprised of a constellation of techniques and active ingredients, and so it is possible that there are contextual factors that predict large intervention effects. For example, it is plausible that the profile of the playmates would influence intervention outcomes. Similarly, parent factors might also influence intervention effects as parents mediate the home-based play and intervention activities. Future investigations that combine child and contextual factors required to further replicate these findings and potentially increase the accuracy of prediction.

6.6   Conclusion

The heterogeneous nature of autism requires an individualised approach to intervention selection so that time and resources are directed appropriately. Therefore, there is a need for researchers to develop tools that aid in determining an individual child's suitability for a given intervention. This study found that school aged children on the autism spectrum who have the

largest intervention effects following a peer-mediated, play-based pragmatic language intervention had relative strengths in integrating language with context and high levels of separation anxiety, combined with relatively lower nonverbal communication, expressive language and discourse organisation skills. Participants in the study did not have severely impaired receptive syntax or expressive vocabulary, which likely contributed to findings that superior structural language skills (i.e., vocabulary, discourse organisation, or syntax) were not necessarily advantageous. The two algorithms produced by this study can be used by clinicians to predict children within their service who might benefit most from participating in this intervention.

6.7   References

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Chapter 7   Discussion and Conclusion

> In both assessment and intervention, SLPs need to consider students' skills or ability to perform a task in a structured or controlled setting, and their actual use of these skills in real-life situations at home and school and in the community. Ultimately, intervention goals should be participation goals. (Westby, 2018, p. 12).

I was motivated to undertake this research after reflecting on my own clinical practice and calls within the literature for speech pathologists to extend the focus of interventions beyond discrete language tasks (Activity level goals) to include children's execution of those skills within daily life situations (Participation goals). To address this gap in practice, I sought to develop evidence for an intervention that targeted skills vital to children's participation in social interactions: the use of pragmatic language to promote positive social play interactions with a peer. The advent of the ICF (World Health Organization, 2001) provided practitioners with a framework to conceptualise functioning as an interaction between an individual's health condition and contextual factors. When viewed through the lens of the ICF, the ultimate aim of pragmatic language interventions for children should be to maximise functioning within social situations that are important to the child with pragmatic language difficulties. Pragmatic language interventions should therefore not only target a child's understanding of pragmatic language rules, but to also consider: 1) how children enact those skills when participating in daily social interactions; 2) the people with whom they interact; 3) the environments in which those interactions occur, and 4) personal factors that are unique to each child so that a client-centred approach to intervention selection and delivery can be accomplished. This research aimed to increase children's functioning in peer-peer play by applying all the aspects of the ICF to pragmatic language intervention procedures and evaluation (Figure 7.1).
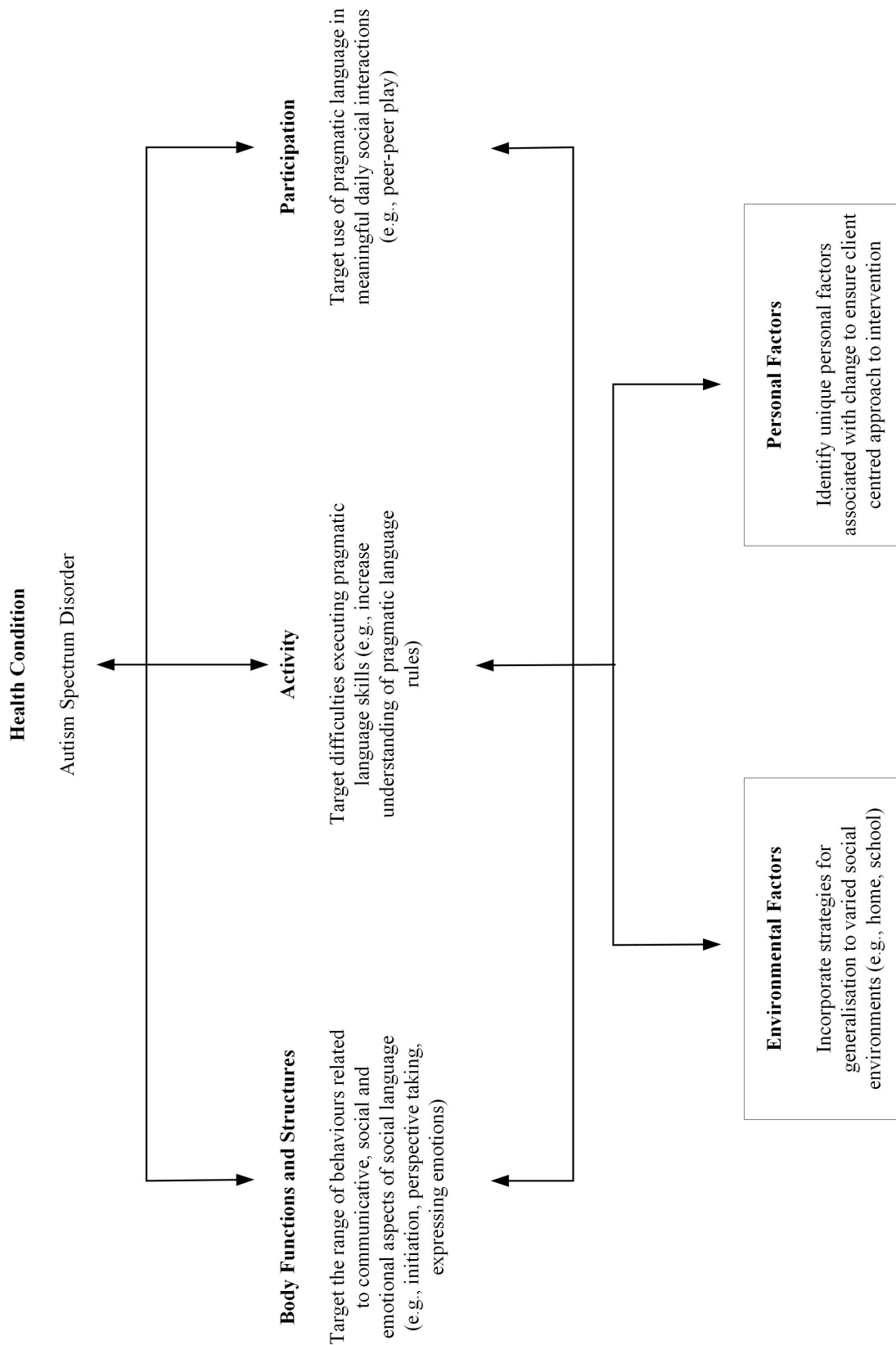
Figure 7.1. Application of the ICF to a peer-mediated, play-based pragmatic language intervention for children with autism.

The intervention studied in this research originated as an occupational therapy intervention for children with ADHD. Using the UKMRC guidelines for the development and evaluation of complex interventions (Craig et al., 2008), this research was conducted across three phases to: 1) understand existing approaches to pragmatic language intervention for children with autism; 2) identify feasible outcomes measures and adapt the intervention to ensure its appropriateness for children with autism; and 3) evaluate the effectiveness of the intervention for all children involved (children with autism and typically-developing peers) and elucidate individual child-factors that predict the largest intervention effects.

In this final chapter, the ICF will be used as a lens for the interpretation of findings from this research. The Body Functions and Structure element will assist in unpacking the pragmatic language skills addressed through the intervention. The elements of Activity and Participation will address the pragmatic language skills children use to participate in play with a peer and the techniques within the intervention that targeted these elements. Generalisation of skills between the clinic and children's homes will be addressed through the element of Environmental Factors, and child factors that influence intervention outcomes will be considered under the banner of Personal Factors. Within each subsection the new evidence generated by this study and implications will be highlighted. Limitations of the research and recommendations for future research will conclude the chapter.

7.1   Body Functions and Structure

Effective pragmatic language interventions for children with autism are essential. Pragmatic language difficulties are a hallmark of the communication profile of children with autism (American Psychiatric Association, 2013) and these difficulties can lead to life-long challenges with participation and social inclusion (Müller, Schuler, & Yates, 2008; Tobin, Drager, & Richardson, 2014). The definition of pragmatic language I have adopted for this thesis recognises pragmatic language as a complex and multifaceted construct with an interconnection between communicative skills, social cognition and emotional understanding (Adams, Baxendale, Lloyd, & Aldred, 2005). All domains of pragmatic language (i.e., verbal and nonverbal communication) can be difficult for children with autism, thus the discussion around

Body Function and Structure in this chapter will focus on the specific pragmatic language skills addressed within this research.

The systematic review in Chapter 2 found that existing pragmatic language interventions for children with autism focused on a narrow suite of skills. Within the interventions appropriate for school-aged children ($n = 10$), there was a strong focus on the communicative aspects of pragmatics and little focus on related social and emotional understanding. The most commonly targeted domain of pragmatics in interventions for school-aged children (6-11 years) was nonverbal communication (9 of the 10 interventions) and most of those ($n = 5$) targeted nonverbal communication exclusively. The meta-analysis findings suggested that, to date, tailored pragmatic language interventions evaluated through RCT designs have been more effective than no intervention, but no more effective than 'alternative treatments' (i.e., attending therapy with the same frequency as active treatment group, but engaging in activities thought not to treat targeted skills) or 'usual treatments' (e.g., typical preschool program, alternative social skills program with procedures differing to the intervention studied) studied as comparisons. This may be due to the fact that the narrow skill set targeted by the interventions overlooked the connections between communication, social cognition and emotional understanding. The multifaceted construct of pragmatic language likely necessitates interventions with active ingredients that target all elements within the construct to maximise benefits beyond those of existing interventions.

The intervention trialled in this research adopted a broader approach to targeting pragmatic language skills as the peer-mediated, play-based intervention had the required active ingredients to target the range of skills encompassed by the definition of pragmatic language adopted for this research. The pilot study described in Chapter 3 found that an all-encompassing approach to pragmatic language intervention was feasible for therapists to implement and evaluate, and appropriate for children with autism and their families to participate in. The RCT described in Chapter 4 evaluated the effectiveness the intervention, and results showed that the intervention was effective for improving the overall pragmatic language of children with autism (POM-2 Overall Score), particularly in the area of nonverbal communication (POM-2 Nonverbal

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Communication score). The pragmatic language domain of nonverbal communication, as evaluated in this study, included those communication skills targeted by existing pragmatic language interventions for school aged children with autism (e.g., understanding and using gesture, facial expression and body postures). Importantly, however, nonverbal communication within this study also included socioemotional skills such as perspective taking, engagement in an interaction, cooperation and self-regulation. These are skills that, to date, have not been targeted or evaluated in pragmatic language interventions for school-aged children with autism. These findings indicated that, contrary to the convention of targeting pragmatic language skills in isolation, it may be necessary for pragmatic language interventions to target a broader range of pragmatic language skills in children with autism for interventions to effect significant change. Interventions that target skills in isolation are likely to be implemented in a sequential fashion, thus requiring substantial family resources (e.g., time, money) to effect change across the range of pragmatic language skills that are difficult for children with autism. A complex intervention that has the capability to target multiple skills concurrently may represent a more efficient model of intervention delivery, as change can be affected on multiple skills over a single intervention period.

While the RCT found that children's verbal communication skills improved significantly across the study (POM-2 Verbal Communication Score), those who received the intervention first did not make significantly greater improvements in the verbal communication aspect of pragmatic language compared with children who were waitlisted for 10-weeks. This finding was surprising, as anecdotal observations of children in the clinic saw children engaging in verbal exchanges with their peers with increasing frequency over the duration of the intervention. The rating scale of the POM-2 was designed to evaluate pragmatic skills based on the frequency with which children use the skills, but importantly, it also evaluates the quality of those skills. It is possible that while children were talking more frequently with their peers, the quality of the verbal exchange did not increase significantly. Intervention dose may also explain the difference in intervention effects between verbal and nonverbal communication skills. The Verbal Communication items within the POM-2 are the most difficult items on the scale (Cordier et al.,

2018), and might therefore represent skills that are not easily changed through intervention. Therefore, it is possible that a longer intervention period is required to significantly increase verbal communication skills.

7.2   Activity

Child language interventions have almost exclusively focused on remediating the discrete, specific language skills children require to participate in daily life situations (i.e., language *capacity*). Common approaches to intervention include modelling, role-play, drill tasks, parent training, and 'meta' discussions about particular language skills (Gerber, Brice, Capone, Fujiki, & Timler, 2012). These approaches are a good fit for structural language domains (i.e., syntax, phonology, semantics), but seem unlikely to have an impact on social functioning implemented as pragmatic language interventions. Pragmatic language interventions logically require the addition of techniques to address a child's *performance* of targeted skills in a meaningful social interaction to reach their full potential. The discussion around Activity within this chapter focuses on the how pragmatic language intervention was approached and evaluated in this research.

7.2.1   Targeting pragmatic language performance through play

The need for pragmatic language interventions to target the enactment of targeted skills in naturalistic activities was highlighted in the findings of the systematic review reported in Chapter 2. Specific to pragmatic language interventions for school-aged children with autism, most interventions focused on increasing children's *capacity* for pragmatic language though didactic instruction and structured tasks. Tasks included computerised applications (e.g., Baron-Cohen, 2003), manualised activities or workbooks (e.g., Beaumont & Sofronoff, 2008; Lopata et al., 2010), or a scripted and rehearsed theatre performance (Corbett et al., 2015). Distinctly absent from interventions for school-aged children included in the systematic review was a component to target the *performance* of pragmatic language skills within a *naturalistic* social context. These approaches were in stark contrast to the interventions for younger children that often focused on parent-child social interactions during daily routines within the home (e.g.

Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Kasari et al., 2014). Social participation becomes more complex as children develop and this presents a challenge for intervention design. As children's social worlds expand to include people outside of the family unit, so should the naturalistic social interactions included within interventions.

The inclusion of child-led, peer-peer play within the intervention studied in this research meant that children's *performance* of pragmatic language skills was targeted in an unstructured, ecologically valid social context. The model of play adopted for the intervention included four elements: intrinsic motivation (children engage in the interaction because they want to), internal control (children are free to decide on their actions and how they influence the interaction); freedom to suspend reality (the usual constraints of the everyday do not apply), and framing (giving and receiving of social cues; Bundy, 2004). Pragmatic language goals were largely assimilated into child-led play through to the play element of framing. However, children also needed to recruit a range of pragmatic language skills to initiate and maintain the play transaction through other aspects of the play model (e.g., making suggestions and negotiating with a playmate to maintain internal control, remaining engaged in the social interaction to sustain intrinsic motivation, and engaging in playful joking or maintaining a topic with contingent utterances to enable the suspension of reality).

7.2.2   Video-feedback on pragmatic language performance

A unique aspect of this intervention was the feedback children received on their targeted pragmatic language performance in the form of video-feedback. The video self-modelling coupled with therapist-led discussion provided children with a lens through which to self-monitor their pragmatic language *performance* in the playroom each week and discuss what to do in instances when the play transaction broke down. Self-monitoring has been identified as an important conduit to generalisation and the results of the RCT in this research (Chapter 4) affirmed the generalisation of pragmatic language skills from the clinic to the home environment. Further, viewing their own play-sessions in combination with verbal feedback from the therapist, assisted in increasing children's *capacity* for the pragmatic skills needed to promote positive play interactions with a peer. Video self-modelling allowed therapists to

provide detailed feedback specific to each dyad without disrupting the play transaction within the playroom. Video-feedback also bridged the gap between *capacity* and *performance* by providing children with relatable, personalised real-life examples of when and why targeted skills are best applied to a play interaction with a peer.

Anecdotally, I observed many examples of the power that video-feedback and -feedforward had on children's learning and motivation to change their communication to make playing with a peer more enjoyable. Children were motivated to engage in the video-feedback process and enjoyed seeing themselves on screen. One powerful example comes to mind of two girls, Alicia an 8-year-old diagnosed with autism and Belinda, her typically developing friend who is the same age: Alicia had a meltdown at the end of a play session because her peer (Belinda) did not engage in a game in the way that Alicia had wanted. Alicia was getting ready to play her game by moving toys around the playroom, while Belinda scanned the room for a new game to play. Belinda invited Alicia to play a range of different games, to which Alicia provided no response; she was already preparing the next game to play and wanted Belinda to help her get it ready. As time passed Alicia became more and more frustrated with Belinda, because Belinda was suggesting other ideas and did not join the game that she was getting ready to play. While viewing the footage of the interaction (or lack thereof) the following week, Alicia turned to me and said with amazement in her voice "I know what happened… I didn't share my idea". Alicia, Belinda and I had spoken about the importance of telling a friend about the game you wanted to play, but the significance of the skill was not truly realised for Alicia until she viewed that video. Viewing her own social interaction enabled her to pin-point exactly what had gone wrong the previous week. She was motivated to continue having positive play experiences with Belinda and that learning opportunity solidified for Alicia exactly when 'sharing ideas' was required for positive social interactions to start and be maintained. This example substantiated the observations of the parents of children who participated in the pilot study (Chapter 3); it was the combination of personalised video-feedback and -feedforward, followed by an immediate opportunity to put feedback into practice in a naturalistic social context that contributed to the effectiveness of the intervention.

7.2.3 Verbal feedback on pragmatic language performance

The verbal feedback children received from therapists about their pragmatic language performance was also an important active ingredient within the intervention. A therapist-led discussion about observed pragmatic language skills was combined with video-feedback and -feedforward. The discussion assisted children in learning when a play transaction was being promoted, when a play transaction had been interrupted, and the specific pragmatic language skills children needed to use to continue a positive play interaction with their peer. To increase its suitability for children with autism, an important way that the intervention procedures were adapted within this research was through careful consideration of the language that researchers used when talking to the children during these discussions. A previous pilot study had identified that younger children (children with autism and typically-developing peers alike) had struggled with the cognitive demands of the intervention (Henning, Cordier, Wilkes-Gillan, & Falkmer, 2016). While no child within this research had an intellectual disability, we knew that the structural language abilities of children within the sample varied greatly. As such, researchers needed to simplify the language used to speak with children during the intervention, to reduce the likelihood of structural language difficulties impacting upon children's understanding of intervention principles and techniques.

Key phrases present within the intervention were 'green play' and 'red play'. These terms signposted for children play transactions that were being promoted (i.e., green play) and play transactions that were breaking down (i.e., red play). The sequence of clips children viewed during video-feedback were preceded with red or green screens (to indicate to children whether the clip to follow contained red or green play) and those coloured screens contained text in the form of short phrases describing the pragmatic language skill most pertinent to the video. At the end of the video sequences, 'reminders' about the pragmatic language skills viewed were presented as a form of video-feedforward (see Appendix G.2 for an example of the video-feedback/feedforward sequence). Children with autism and peers could very quickly identify whether the videos they watched contained green play or red play and even used these phrases with each other to self-monitor while playing (e.g., "Liam, that's red play"). The challenge for

children was to know why the play would be considered green or red and which pragmatic language strategies to recruit to continue green play or repair red play. The challenge for researchers was to develop child-friendly phrases to display on the green or red screens that described the relevant pragmatic language concepts using age-appropriate language.

During the pilot study (Chapter 3), we carefully considered the utterance length of the phrases presented on screen and the use of positive statements to describe the pragmatic language that promoted green play, or what could be done to resolve red play. Prior to the RCT (Chapter 4), we revised the phrases developed during the pilot study to ensure ambiguous terms were avoided (e.g., "we can *think* of new ideas", rather than "we can *come up with* new ideas"). As children's baseline POM-2 performance informed tailored intervention goals for each dyad, we also mapped the phrases to the items within the POM-2 to ensure the bank of phrases would cover all possible intervention goals. As a therapist in the playroom, I noticed that the language used in video-feedback and -feedforward became play 'mantras' for children, reminding them of the communication behaviours they could use to promote social play with their playmate. For example, if a child was unresponsive to their playmate's initiations and had difficulty maintaining a conversation, the language used to talk to the child about their pragmatic language skills would have been "answer your friend's questions" or "keep talking about the game" or "add new ideas" or "say yes to your friend's ideas". These phrases gave children concrete ways to understand the relevant communication behaviours that promote social play situations. If children understood the behavioural principle behind the phrase, they could then implement the principle to increase their pragmatic language performance during play with their playmate. The phrases became a conduit through which children could monitor their social interactions in the moment and a strategy to use to repair breakdowns in play. During Phase 2 (Chapter 3), parents also reported finding the language used by therapists as easy to adopt and translate into use at home. This aspect of the feedback would likely have had an influence on children's ability self-monitor pragmatic language use during play and then generalise skills to the home environment.

7.2.4   Evaluating pragmatic language capacity and performance

Prior to this research it was largely unknown whether existing pragmatic language intervention approaches for school-aged children with autism were truly capable of improving children's pragmatic language performance in authentic social activities. The systematic review reported in Chapter 2 highlighted that this gap in the literature is a function of the types of outcome measures utilised within the studies reviewed. Of the ten RCTs relevant to school-aged children, eight utilised either a standardised assessment task or parent proxy report, and one utilised both. Standardised assessments provide insight into a child's pragmatic knowledge; however, findings from Lockton, Adams, and Collins (2016) show that we cannot assume a child's knowledge about pragmatic skills is equivalent to how they perform those skills in social situations. Parent-proxy assessments of pragmatics can provide a window into understanding a child's performance in daily social situations, but when used as outcome measures following intervention, they are open to bias as parents cannot be blinded to interventions. Compared with trained clinicians, parents are also unskilled observers and may not detect subtle demonstrations of or improvements in specific pragmatic language behaviours. The remaining study in the review, relevant to school-aged children with autism, used a parent-proxy report in combination with an observational account of children's interactions in the playground (Hopkins et al., 2011). Unfortunately, the observation schedule utilised in the study only evaluated children's social initiations with peers, so it is unclear as to whether the intervention studied had an effect on the range of pragmatic language skills children require to initiate, promote and maintain a peer-peer social interaction.

Prior to the RCT, the pilot study (Chapter 3) investigated the feasibility of pragmatic language outcome measures. Important to the selection of outcome measures was the likelihood of a measure being responsive to detect an intervention effect, feasible to administer, and able to capture children's pragmatic language *capacity* and *performance*. The Pragmatics Observational Measure (POM; Cordier, Munro, Wilkes-Gillan, Speyer, & Pearce, 2014) was selected for as the primary outcome measure within the RCT as it was able to detect change over time during the pilot study and has demonstrated strong psychometric properties. The POM addressed a

previously identified limitation as it is the only standardised observational measure of children's pragmatic language *performance* within a naturalistic context (play), while participating with a real-life social partner (peer). The observational nature of the assessment meant children's pragmatic language could be assessed across different environments to evaluate generalisation and the assessment could be filmed and appraised by a blinded rater to reduce measurement bias. The Social Emotional Evaluation (SEE; Wiig, 2008) was selected as a secondary outcome measure as it assessed children's *capacity* for pragmatic language in skill areas that spaned the definition of pragmatic language adopted in this thesis (i.e., understanding reasons for the emotional reactions of another, perspective taking, integrating spoken language with the social context to create meaning). In addition, the POM and SEE were both feasible to administer and reduced the burden of assessment for the children. The use of both measures also meant that pragmatic language *performance* (POM) could be evaluated as distinct from pragmatic language *capacity* (SEE).

Results of the RCT showed that the intervention significantly improved children's *performance* of pragmatic language skills (as assessed by the updated POM-2), but did not significantly improve children's pragmatic language *capacity* (as assessed by the SEE). This result around children's pragmatic language capacity was unexpected. Children became increasingly aware of and could verbalise during video-feedback discussions what needed to happen for a previous play interaction to be promoted, or why a peer might have reacted in certain way during play. Moreover, they could explain reasons why a play interaction might not be positive for all involved and what someone could do to repair a breakdown in play. While possible, it is unlikely that this finding was a result of developmental maturation. Measurements were taken 10-weeks apart, a duration not likely to be long enough for a control group to make gains in pragmatic language development that are equally as large as the intervention group; particularly in a language domain that was delayed at the outset. A more plausible explanation for the result might be that items within the SEE did not capture the same pragmatic knowledge promoted through the intervention. Another explanation is practice effects. Children in the intervention and waitlisted control groups were presented with the same set of questions 10-weeks apart and

performance in the second instance (i.e., post-intervention period for intervention group and post-waitlisted period for waitlisted group) may have improved simply because they were already familiar with the test. Unfortunately, this was unavoidable as the SEE does not have an alternative form. Conversely, the observational nature of the POM-2 meant that children could not become familiar with test items and therefore practice effects could not confound results.

Findings from the RCT showed that interventions that include personalised feedback, child-friendly descriptions of pragmatic language skills, and practise of targeted skills within an ecologically valid childhood social context improved how children with autism enacted pragmatic language skills during that social activity. The reflective practice of video-feedback in combination with the video-feedforward techniques may have also helped to facilitate the resultant pragmatic language outcomes. The terminology used by therapists to discuss pragmatics provided children with a means for monitoring their pragmatic language performance thorough concepts of 'green play' and 'red play'. Also, the disparity in results pertaining to pragmatic language performance vs. pragmatic language capacity highlighted the importance of differentiating between the two when selecting outcome measurement tools.

7.3   Participation

The ultimate goal of pragmatic language interventions for children with autism is to increase children's ability to take part in daily social interactions. Play is an important context for social interaction during childhood, supporting the development of social, emotional and language skills, and fostering the development and maintenance of friendships (Gifford-Smith & Brownell, 2003; Parham, 2008). Social play interactions during early childhood are typically facilitated and supported by adults (i.e., parents and caregivers). Same-aged peers become an increasingly important part of children's social interactions during school years, as children socialise with increasing independence from their once supportive caregivers (Cordier, Bundy, Hocking, & Einfeld, 2010; Gifford-Smith & Brownell, 2003; Stocker & Dunn, 1990). For school-age children with autism, the expansion of their social world requires interventions that can: 1) target the pragmatic language skills required to engage in, promote and maintain social play with peers, and 2) impart strategies to their peers that also support and promote the social

interactions of the children with autism. Participation within this chapter will be used to reflect on how play was used as both context of intervention delivery and an outcome, the outcomes for peers who mediated the intervention delivery, and the transactional nature of pragmatic language performance in context.

7.3.1   Participation in play as a means and an outcome

This chapter opened with a quote from Westby (2018) that highlights the need for child language interventions to contextualise language skills for children and incorporate Participation-level goals into intervention planning and delivery. The systematic review (Chapter 2) identified several approaches to pragmatic language intervention for preschool-aged children with autism, all of which included participation focussed practice to increase children's participation in important age-appropriate social contexts; namely parent-child social interactions. Within those interventions, parents were trained in intervention techniques, or mediated the intervention with feedback from the therapist and outcomes measured were typically frequency of social initiations with a parent or the duration of engagement in a parent-child interaction. However, known peers, the most common and desirable social partners of school-aged children, were not included in any of the existing interventions reviewed. This finding highlighted a need for a new intervention that included the usual social partners of school-aged children with autism to mediate the delivery of the intervention and promote participation in daily social interactions as an outcome.

A 10-week intervention was unlikely to address all the daily life situations where pragmatic language is required for participation, however, a social context most relevant to children's social participation required selection. The intervention studied in this research addressed the pragmatic language skills children required to participate in peer-peer play. The intervention did this through the inclusion of a typically-developing peer in every intervention session. The purposes for including known typically-developing peers in the intervention were threefold. Firstly, peers assisted in creating the naturalistic social context for therapists to address how children with autism used pragmatic language skills during play interactions with their regular peers. Secondly, therapists could impart skills to the peers to support the play interactions of the

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children with autism. Lastly, the combination of participation focussed practice for children with autism and the upskilling of peers facilitated the participation-based goal for children with autism, namely increased pragmatic language performance during play with that peer outside of the clinical context.

Play provided children with a motivating context to practise performing pragmatic language skills, while at the same time using appropriate pragmatic language skills during play with peers. Results reported in Chapters 3 and 4 supported this notion. During the pilot study, parents reported that their children enjoyed attending the intervention, evidenced by their child's enthusiasm to attend. Parents attributed that enthusiasm to the fun children experienced playing in the playroom each week. The primary outcome measured following the RCT (Chapter 4) was the enactment of pragmatic language skills during peer-peer play. Results showed that children's pragmatic language performance improved with a moderate effect and intervention benefits were maintained 3-months later. Furthermore, for children with autism, intervention benefits also generalised between the clinic and home environments. The inclusion of peers *known* to the children with autism was crucial to the purpose and was a likely contributor to the success of the intervention.

The success of this play-based intervention highlights the important relationship between pragmatic language and playfulness during social play. A previous study identified that the intervention is an effective approach for improving the playfulness of children with ADHD (Wilkes-Gillan, Bundy, Cordier, Lincoln, & Chen, 2016), however it was beyond the scope of this thesis to also evaluate playfulness as an outcome for children with autism. The notion that improved playfulness facilitated improved pragmatic language skills during peep-peer play, or vice versa, is plausible. Another consideration is that the interaction between playfulness and pragmatic language is bidirectional, with mutual reinforcement occurring between both constructs as pragmatic language and playfulness develop through the intervention. The interaction between pragmatic language and play as both a means for delivering this intervention and the overarching outcome of the intervention requires further verification.

7.3.2 Outcomes for typically-developing peers

The use of pragmatic language to participate in daily-life situations requires the inclusion of at least one other person. Novel to pragmatic language interventions for school-aged children with autism, this research required usual peers of children with autism to participate in every intervention session. Peers received the same feedback and opportunities to practice pragmatic language skills during peer-peer play as the children with autism. To date, studies of peer-mediated interventions have focused on the peers' experiences, academic outcomes, and the attitudes of typically-developing peers towards their peers with a disability. Section 7.3.1 has already identified that no pragmatic language intervention for school-aged children with autism evaluated using an RCT design included the usual peers of children with autism. Largely absent from the broader literature on peer-mediated interventions is evidence for the impact of the interventions on the skills that the peers are expected to mediate. This research attempted to address that gap by evaluating the pragmatic language outcomes of the typically-developing peers who participated in the RCT. The siblings and friends of children with autism who attended the intervention as playmates were also likely to benefit from participation in this intervention as some are were at risk of also experiencing pragmatic language difficulties (Bauminger et al., 2008; Gamliel, Yirmiya, Jaffe, Manor, & Sigman, 2009; Locke, Ishijima, Kasari, & London, 2010), albeit at a sub-clinical level. Results from Chapter 5 suggested that while the pragmatic language of the playmates improved significantly over the duration of the RCT, the changes in the pragmatic language performance during the intervention period could not be attributed to the intervention. A treatment effect could not be concluded as POM-2 and SEE change scores were not significantly greater for those who participated in the intervention than those who did not.

Given that peers were a crucial agent of change within the intervention, it was important to also investigate the characteristics of the dyads and how these influenced the results for children with autism. Results from the RCT (Chapter 4) revealed that the age difference between the children (i.e., whether playmates were older or younger than the child with autism) and the relationship-type between children within a dyad (e.g., sibling or non-sibling) did not confound the

pragmatic language performance outcomes of the children with autism. An age difference of no more than two years was applied as a criterion for inclusion in the research a priori, to increase the likelihood that children would have similar play interests and be at a similar developmental level. Had there been a larger age difference within some dyads it is possible that age difference might have had a greater influence on the pragmatic language performance outcomes for children with autism.

Siblings are often the most common playmates of children with autism, and most parents in this research (Chapter 3) reported a preference for including siblings as playmates in the intervention, because they did not feel comfortable asking a child from another family to commit to the 10-week intervention period. The fact that the nature of the relationship between children within the dyads (sibling or non-sibling) did not significantly influence the pragmatic language performance of children with autism in this research, reinforced the appropriateness and the ecological validity of the intervention for families. These findings have important practical implications for this intervention and peer-mediated interventions more broadly. Peers who are of a similar age (within two years) are the most suitable for inclusion and there is no evidence to suggest that the inclusion criteria for playmates should be restricted any further based on their relationship to the child with autism. Practically, the evidence suggests children and families can invite the playmate they feel most comfortable with to participate in the intervention.

Contrary to the findings in Chapter 4 that suggested that the relationship status between children within the dyads (i.e., siblings vs. non-siblings) did not influence the pragmatic language scores of children with autism, results from Chapter 5 indicated that the relationship status between children within the dyads *did* influence the pragmatic language scores of the peers. The change in pragmatic language scores for non-sibling playmates was greater than the change in the scores of siblings. This finding reinforced my observations while working with children in the playroom. Anecdotally, non-sibling dyads tended to engage in and accept cooperative play more easily than sibling dyads and could therefore grasp intervention concepts at a faster pace and progress to new target skills. Siblings often appeared to fall back into an ingrained dynamic

within their relationship that was less apparent in the non-sibling dyads. One sibling tended to dominate the play transaction and it varied as to whether this was the child with autism or the playmate. One explanation for this might be that the social comparison, competition, jealousy and power dynamics that occur within sibling relationships due to sibling rivalry are less likely to occur within non-sibling relationships. Thus, non-sibling dyads are potentially more likely to cooperate and support each other to reduce conflict and maintain their relationship; a relationship entered into voluntarily and founded on an cooperation, intimacy and trust (Gifford-Smith & Brownell, 2003).

The frequency of contact children have with each other might be another explanation. Siblings were likely to spend more time playing together than non-siblings and so siblings had a developed communication style before commencing the intervention. Conversely, non-siblings were less likely to have as much contact as siblings a priori and so were afforded more opportunities to develop communication strategies during the intervention. Related to contact time, non-siblings may have found it easier to accommodate the challenging behaviours of their peer with autism for a few hours each week compared with siblings who likely encounter these behaviours daily. Regardless of the reason, aiming to shift the nature of the play transaction to one where children shared control, cooperated and contributed equally was a therapeutic challenge for some sibling dyads; a dynamic that was less apparent for non-sibling dyads. Future development of the intervention should focus on feasible, appropriate and effective variations in playmate selection to optimise the intervention for children with autism and their peers.

These findings have important implications for this intervention and peer-mediated interventions in general. In its current form, this intervention consists of play-interactions with the same peer over 10-weeks. While observing children within the playroom it became clear that for some dyads this was appropriate, but for others, gains could likely have been optimised by including an alternative playmate in the intervention. For example, some older children within the sample seemed to reach maximum gains early in the intervention period and those dyads would have benefitted from being introduced to more complex social dynamics within

the playroom, such as an extra or different playmate. Further to this point, the aforementioned ingrained dynamic within some sibling dyads seemed to obstruct progress, and children with autism in those dyads may have benefitted from replacing the sibling with a more flexible playmate. A more flexible option for playmate enrolment might enhance benefits for these dyads. Such options could involve a new peer joining the intervention part-way through the intervention period to maximise benefits for older children who progress quickly during the early stages, or ameliorate the sibling dynamic which might be hampering progress for both children in the dyad. Families may also feel more comfortable inviting children outside of the family into the intervention if the time commitment for peers was shorter than 10-weeks. Further, some parents noted during the interviews (Chapter 3) that including a new peer within the intervention mid-way might have increased the benefits of the intervention for their child, but this is yet to be evaluated.

Including typically-developing peers in interventions may positively influence the peers' perspectives of the children with autism and therefore their motivation to engage in and support the play of that child with autism. Following the pilot study (Chapter 3), parents recounted during the interviews that over the course of the intervention the peers' perspectives towards their sibling or friend with autism had changed for the better. Peers realised that their sibling or friend with autism needed help to play and that they could be the ones to help them. For example, one parent described during the interviews that:

> It's taught Phoebe as well to be more inclusive of what he's doing, and also in what
> she's doing, so she's suggesting ideas about how he can join in, and even then, it's just
> playing on the iPads together – they take turns and keep scores and do stuff like that.
> How to help him play as well.

In turn, parents reported that peers benefitted from providing that assistance, both in terms of the emotional benefit of being altruistic, as well as experiencing enjoyable play transactions with their peer with autism. Overwhelmingly, parents reported that typically-developing peers enjoyed participating in the intervention and were observed to happily engage in play with their

peer with autism and the therapist. When play is experienced as joyful, peers are motivated to seek each other out to continue social engagement (Schwartz & Badaly, 2010) and this intervention has the potential to provide peers and children with autism the skills required to continue to foster their bond through playful interactions; a line of enquiry that needs future substantiation.

7.3.3   Pragmatic language as a transaction between two individuals

Play is considered a transaction between an individual and their environment, and I postulate the same applies to the construct of pragmatic language. To date, the construct of pragmatic language has been conceptualised as skills possessed by an individual. However, when pragmatic language is used to participate in a social interaction it requires at least two individuals to use pragmatic language skills concurrently to promote the interaction. Those individuals might bring different levels of pragmatic language 'expertise' to the transaction and the skill level of one individual might influence the proficiency with which the other can use their pragmatic language skills. The difficulties one social partner may have with pragmatic language could compromise the abilities of their partner in such a way that they are unable to perform to their fullest capacity. On the other hand, more skilled social partners might also use their expert skills (relative to their social partner) to support the pragmatic language of a lesser skilled partner.

The integrated results from Chapters 4 and 5 provided emerging evidence for the notion that pragmatic language is a transaction between at least two individuals when used to participate in naturalistic social contexts. The baseline pragmatic language performance scores (POM-2) of the typically developing peers, who were not expected to have pragmatic language difficulties, were not starkly different to the baseline scores of the children with autism who were expected to have significant difficulties with pragmatics. In addition, the POM-2 scores of children with autism and their peers increased at a similar rate between assessment time-points (Figure 7.2). Cordier et al. (2010) reported similar findings when comparing playfulness scores of children with ADHD and their typically-developing playmates. This intervention addressed the skills of both children in the play interaction by targeting the pragmatic language performance abilities

of the children with autism, and imparting strategies to peers to support and promote the

pragmatic language of their peers with autism. In turn, the transactional nature of pragmatic

language (i.e., children's concurrent use of pragmatic language to promote an interaction) was

addressed to influence a similar trend in change for both children within he dyads.
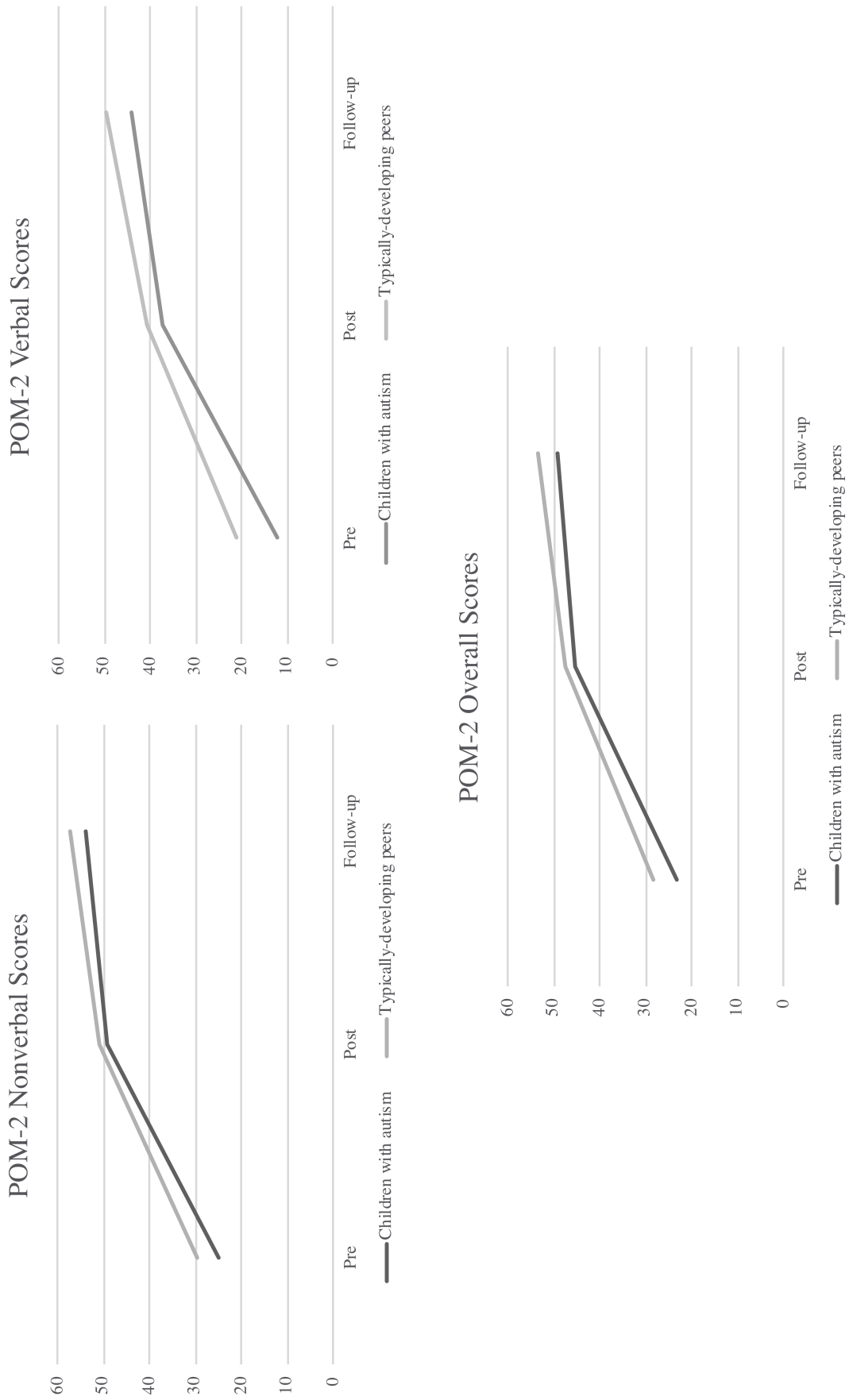
Figure 7.2. Mean POM-2 scores of children who participated in the RCT at each time point.

7.4 Environmental Factors

The environments where individuals participate in daily social interactions are an important consideration when using the ICF to guide the design and evaluation of a pragmatic language intervention. Relevant to this research are the places where school-aged children's social interactions occur: their homes, the homes of friends, the classroom, the school playground, and other extra-curricular or community-based settings. Yet, a common limitation of many psychosocial interventions for children with autism is a lack of generalisation of skills away from the clinical setting (Rao, Beidel, & Murray, 2008). The discussion around Environmental Factors in this chapter will focus on the strategies embedded within interventions to encourage generalisation, and the measurement of generalisation following interventions.

7.4.1 Strategies to promote generalisation of pragmatic language skills

The results of the systematic review (Chapter 2) found that of the 10 existing RCTs investigating pragmatic language interventions for school-aged children with autism included in the review, all occurred within a clinical environment facilitated by a therapist, apart from one technology-based intervention that occurred in the home. The clinic-based approaches also included 'homework' between clinic sessions, but overall, the activities completed at home reinforced new pragmatic knowledge rather than the use of pragmatic language skills in a range of environments. The intervention evaluated in Phases 2 and 3 of this research addressed the issue of generalisation between the clinic and home environments in three key ways: 1) arranging regular playdates with a typically-developing peer who is known to the child with autism; 2) training of parents to support their child's social play interactions; and 3) providing a parent manual and videos to reinforce treatment strategies for use at home. The inclusion of a peer known to the child with autism, who in most cases were siblings, increased the likelihood of continued play and interactions in the home both during the intervention period and once the intervention sessions had stopped.

The weekly playdates also provided children, who were not siblings, with regular opportunities to practise pragmatic language performance in a non-clinical environment. The role of the

parents as a crucial part of the child's social environment in the home was essential to the intervention. While they were not the social partner of focus, parents were trained to support their child's social interactions by: 1) preparing their child to use and monitor targeted pragmatic language skills prior to play-dates; 2) creating a physical environment that is conducive to positive social play; and 3) facilitating their child's social play interactions if required. Central to this intervention, parents identified that the language used by therapists contributed to the ease with which they were able to continue to embed intervention concepts at home. Parents took ownership of the intervention and implemented intervention techniques within the home environment and identified that they were able to do this because the terminology used by therapists to describe pragmatic language skills to children became a common 'language' between parent and child. The short, unambiguous and syntactically simple phrases allowed parents to implement strategies that allowed their child with autism to become more independent in starting social interactions and cooperate with their playmate to solve problems during play at home. The findings in Chapter 3 revealed that parents felt they were a more effective part of their child's social environment as their role changed from 'referee' to 'facilitator'.

7.4.2 Measuring generalisation

If interventions are to target generalisation of skills between social settings, generalisation should also be measured. Findings from the systematic review (Chapter 2) showed that evaluating generalisation of targeted pragmatic language skills between specific environments has largely been neglected following existing pragmatic language interventions for children with autism. Pragmatic language intervention outcomes for school-aged children with autism were mostly evaluated using standardised assessments of nonverbal communication (e.g., understanding of facial expressions), or parent-proxy questionnaires. When used in isolation, these methods of assessment are problematic for intervention evaluation; standardised measures do not evaluate children's skill enactment in social interactions, and parent-proxy measures tend to be broad in the way they measure a particular construct and might not differentiate skills across specific environments. This finding emphasised a need for researchers to use assessments

that allow for the comparison of children's pragmatic language use in different environments to evaluate if the intervention effects generalised.

To address the previously identified limitations in evaluating generalisation following pragmatic language interventions, this research included an observational measure of pragmatic language (POM and POM-2) because it could be administered across multiple environments (i.e., clinic and home). The results reported in Chapter 4 revealed that children with autism demonstrated equivalent levels of pragmatic language performance in the clinic and their homes following the intervention. These findings mirrored the results of the children with ADHD following an intervention that included a similar combination of components and techniques to encourage generalisation (Wilkes-Gillan et al., 2016). The ability to measure generalisation effects provided evidence to support the notion that the combination of strategies included in the intervention were able to facilitate generalisation of new or refined pragmatic language skills between environments. While evaluating and detecting generalisation was novel in pragmatic language intervention research for school-aged children with autism, this research has only begun to unravel the complex issue of evaluating generalisation. There is an imperative that researchers evaluate generalisation of skills between multiple important environments and multiple peers of children with autism.

7.5   Personal Factors

The influence of individual child attributes on intervention outcomes has received limited attention in pragmatic language research. Autism is highly heterogeneous in nature, it is life long, and concomitant with other neurodevelopmental disorders or emotional and sensory difficulties (Jeste & Geschwind, 2014; Simonoff et al., 2008). Therefore, it is highly unlikely that all children with autism will respond to the same intervention in the same way. The discussion around Personal Factors in this chapter will focus on the child-factors that influenced children's response to the pragmatic language intervention studied.

The interventions reviewed in Chapter 2 reported results at a group level and mediating and moderating factors were not investigated in any study included in the systematic review.

However, the meta-analysis reported that child age did not mediate the effect of existing interventions. This was the only child-factor that was consistently reported across all included studies, so other factors related to language, cognitive, social and emotional development could not be included in the meta-analysis. I have also been unable to locate any follow-up publications that aimed to establish the children most likely to benefit from the range of intervention approaches reviewed. From a methodological perspective, most studies lacked the sample sizes required for such analysis. The dearth of evidence for personal factors that influence intervention outcomes for pragmatic language interventions highlighted an urgency for researchers to identify the most suitable candidates for interventions that have established efficacy.

To identify the children who benefit most from an intervention, researchers must assess constructs related to the mechanisms that underlie change (Vivanti, Prior, Williams, & Dissanayake, 2014). Findings from an earlier pilot (Henning et al., 2016) identified that to engage in and benefit from video-feedback and -feedforward, children would need a requisite level of receptive and expressive language skills to comprehend intervention concepts. Knowing this, researchers were mindful of the language used within video-feedback discussions with children. The purpose of this strategy was to increase the likelihood that, through discussions with the therapist in the clinic and their parents at home, children with mild or moderate expressive or receptive language difficulties could comprehend what were often complex and abstract concepts. Findings reported in Chapter 4 confirmed that structural language, specifically receptive syntax, moderated children's pragmatic language performance (POM-2) during the RCT; children with higher receptive syntax scores also had higher pragmatic language scores. When considering individual differences in intervention effects, the findings in Chapter 6 indicated that high expressive language scores were not advantageous in terms of predicting children who benefited most from the intervention. I postulate that had the language used by therapists not been considered during the pilot and then adapted prior to the RCT, then high structural language scores might have also predicted the children who benefited most. This assertion should be investigated in future studies of the intervention.

The results from Chapter 6 indicated that high levels of anxiety, particularly separation anxiety, predicted children who benefited the most from the intervention. Children were required to engage in peer-peer play to benefit from the intervention, and this finding highlighted the mounting evidence within the literature about the interconnection between the communicative aspects of social language and emotional understanding (e.g., Matthews, Biney, & Abbot-Smith, 2018; Rodas, Eisenhower, & Blacher, 2017; St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). To engage in play, children are required to regulate emotions adequately, specifically, to up-regulate positive emotions and down regulate negative emotions (Schwartz & Badaly, 2010). It is therefore plausible that a requisite level of emotional regulation might have been required for children to engage in the peer-peer play interactions and benefit from the intervention. However, the results of this research suggested the opposite was true. The play-based context of the intervention may have been particularly beneficial to children with emotional difficulties. Developmental theorists have long avowed the emotional benefits of play (e.g., Vygotsky, Piaget, Freud), asserting that through play, children are afforded learning opportunities to discover emotions, rehearse emotional regulation, and allay anxieties. In addition, the model of play adopted for this research states that children must feel safe, both physically and emotionally, to continue playing (Bundy, 2004). The play-based approach adopted within the intervention may therefore have facilitated emotional regulation in children with emotional difficulties, thus reducing anxiety and allowing them to use pragmatic language and engage in social play with increasing competency. The opposite may also be true; as children's pragmatic language skills improved, they were better able to express their own emotions and recognise the emotions of their playmate during play and video-feedback, thus facilitating greater emotional competence during play. An alternative explanation is that the relationship between pragmatic language and anxiety within the intervention was bidirectional; decreased anxiety afforded through the play context facilitated increased pragmatic language competency and vice versa. The relationship between pragmatic language and social anxiety as it pertains to this intervention should be investigated in future research.

Results from Chapter 6 also indicated that to receive the greatest benefit from this peer-peer play-based intervention, children with autism required a prerequisite level of pragmatic language skills related to verbal communication (e.g., integrating language with context), though a requisite level of nonverbal communication skills was not essential. Findings from Chapter 4 indicated that the intervention was particularly effective for improving children's nonverbal communication and Chapter 6 found that lower nonverbal communication abilities at baseline predicted children who benefited most from the intervention. Nonverbal communication skills, as measured by the POM-2, represent the easiest skills to master within the construct of pragmatic language and therefore are likely to be most easily attained during intervention, even for children with the lowest baseline scores. Relative strengths in children's ability to integrate spoken language with the social context to appropriately portray a communicative intent or appreciate the intentions of another (CCC-2 *Use of Context* subscale score) also predicted children with the largest intervention effects. During video-feedback, children were required to reflect on past social interactions and develop new understandings of those interactions through discussions with the therapist. The ability to integrate language and context to infer meaning has been linked to both structural language ability (Norbury, 2005; Pijnacker, Hagoort, Buitelaar, Teunisse, & Geurts, 2009) and broader skills related to social understanding (Arnold, 2010). These findings further highlighted the relationship between communication and socioemotional understanding and a need for interventions to consider the breadth of social, emotional and communicative skills that fall under the umbrella of pragmatic language.

7.6 Limitations

The studies reviewed in Chapter 2 only included interventions that had been evaluated through randomised controlled trials. As such, interventions under development and not yet evaluated using RCT methodology were not included in the review. This parameter was implemented deliberately for the review to ensure that only interventions with NHMRC Level 2 evidence were included, as the highest level of evidence for single intervention studies.

Most studies reviewed in this thesis excluded children with an intellectual disability and minimally verbal children. We too excluded these children from the intervention studied as the cognitive demands of the intervention were unsuitable for children with low language and cognitive skills. As the children with autism who participated in this research did not have an intellectual disability nor a severe structural language impairment, findings of the research cannot be generalised to all school-aged children with autism. As is the case for many structural language interventions, there is no evidence-based pragmatic language intervention for children with autism who are minimally verbal and there is an urgent need for such interventions. However, the cognitive skills required to engage in social play and the video-feedback discussions meant that this intervention could not address this gap.

There is a possibility that the children with autism who participated in the RCT reported in Chapter 4 benefitted simply from the opportunity to play regularly with a peer. Many of the children in the study were not engaging in regular playdates and participation in the study gave these children the opportunity for social interaction that may not have occurred otherwise. Conversely, had the therapist not facilitated the play within the playroom in the initial stages of the intervention, then it is also likely that minimal social play would have occurred over the course of the 10-weeks. This research was unable to determine whether regular social play dates alone was the agent of change due to the waitlisted control design. An 'active' control group who played regularly but did not receive the intervention would have helped to understand the impact of the intervention's active ingredients.

This research measured whether children with autism generalised their pragmatic language performance between clinic and home environments. The thesis was unable to determine whether children also generalised those skills to other important social contexts, such as school. Similarly, this research established that the intervention is effective for increasing the pragmatic language performance of children with autism while playing with the peer who also attended the intervention. The research was unable to determine whether children with autism also generalise those skills while playing with peers who did not attend the intervention, or when engaging in play with a larger group of children.

The analysis conducted in Chapter 6 could not establish variables that predicted children who are likely to receive medium intervention effects. Nor could it determine predictors for children who are likely to receive a small or negligible intervention effect. As this was the first study to begin exploring the factors that explain the variability of results amongst participants, this thesis cannot rule out other factors (e.g., attendance, intervention fidelity, contextual factors such as peer or parent skills) that may influence the magnitude of change that individual children achieved. Fidelity data in relation to therapists' use of techniques during video-feedback and free play, and parents' implementation of the home-based components were not collected within this research, so the thesis could not address implementation fidelity as a predictive variable.

7.7   Recommendations for future research

The findings from this research lead to several recommendations for future research with regards to this intervention, but also for pragmatic language interventions for children with autism more generally. More specific recommendations for future research are reported here, in addition to earlier references made to further research. Firstly, pragmatic language is a complex construct, comprised of multiple related verbal and nonverbal communication skills that are strongly associated with social and emotional development. Interventions that can target all skills under the umbrella of pragmatic language (per the definition adopted for this research) are going to be of greatest benefit to children's daily social functioning. Therefore, the development and evaluation of future interventions must consider targeting all domains of pragmatic language. This intervention aimed to improve both the verbal and nonverbal communication skills of children with autism, but a significant intervention effect was not measured for verbal communication. As verbal communication skills (as measured by the POM-2) are the most difficult pragmatic language skills to master, one option to consider for this intervention is the extension of the intervention period to increase the potential for the intervention to have an effect the verbal communication domain of pragmatic language.

The conceptualisation of pragmatic language relevant to intervention and evaluation should consider the transactional nature of the pragmatic language. Findings from Chapters 4 and 5 suggested that the pragmatic language performance enacted by an individual child was reliant

on the pragmatic language performance of their social counterpart. To date, pragmatic language has been described as a set of communication skills executed by an individual. Expansion on the construct of pragmatic language is required for the purpose of intervention planning and evaluation to recognise the transactional nature of pragmatic language; the way an individual enacts pragmatic language is an interaction between the performance abilities of two individuals. To further investigate this notion, a comparison of pragmatic language performance data from typically-developing children while playing with peers with a range of pragmatic language abilities (i.e., other typically developed peers through to peers with disordered pragmatic language) is required. Such a comparison would elucidate how much variance in children's pragmatic language performance is explained by the abilities of their social counterpart.

To date, the effectiveness of this intervention has only been evaluated in children without severe expressive or receptive language impairments. Pragmatic language difficulties also impact the social functioning of children with developmental language disorders and the efficacy of this intervention for children with more severe expressive or receptive language disorders is warranted. Consideration has already been given to the language used to discuss pragmatic language concepts with children, through the development of child-friendly phrases to describe pragmatic language concepts within this research. However, additional supports might be required to support the comprehension of children with severe structural language difficulties. Piloting would first be required to understand the appropriate adaptations required to support children's comprehension of intervention concepts (e.g., more visual supports for comprehension), prior to conducting larger definitive trials of effectiveness.

Playmates are a key active-ingredient within the intervention and this research explored the influence of the playmates on intervention outcomes. Families should continue to select a playmate who is the most consistent and important playmate for their child with autism; however, future studies might consider investigating the demographic, behavioural and language profiles of playmates that optimise intervention outcomes for children with autism. In addition, a more flexible model of playmate enrolment may maximise the intervention benefits

for some children within the 10-weeks. For example, a sibling playmate could be replaced by a non-sibling playmate part way through the intervention period for sibling dyads who adopt an ingrained dynamic where one sibling dominates the social discourse. However, such a model of playmate selection introduces a range of confounding variables and would complicate measurements of effectiveness. Another option to consider optimising the intervention for some children might be a small group implementation within the clinic. The inclusion of multiple playmates in the play transaction increases the complexity of the interaction. To maintain a positive social interaction in a small group, a child must monitor their own interactions with each playmate, as well as the interactions their playmates have with each other. This increased complexity could be beneficial for children who reach maximum gains early in the intervention period. Another possibility for augmenting the intervention for children with autism is a whole class program where school peers are involved as part of the class curriculum. In this way, classmates of the child with autism are also exposed to pragmatic language concepts and supportive strategies, thus increasing the reach of the intervention within the child's social network. A school-based intervention could also afford children with autism the opportunity to generalise targeted skills to play interactions in the school environment and to multiple peers concurrently.

This research addressed the issue of measuring generalisation of intervention effects following pragmatic language interventions for children with autism, however, it has only begun to explore this crucial aspect of pragmatic language interventions for children with autism. Children play with peers in a multitude of social environments; their own home, school, homes of friends or other family members. Future research should consider evaluating generalisation of pragmatic language skills to play interactions in environments important to children that were not included within the intervention (e.g., school). Post-intervention outcome measures in future research should include an observational assessment of children's pragmatic language during play with a known peer who did not attend the intervention. Observational assessments are advantageous because they not only address the limitations of standardised assessment tasks and parent proxy reports, but they can be evaluated by a blinded expert to provide an informed

account of children's abilities in context, while reducing measurement bias. Such observations would contribute to an understanding of whether the effect of this intervention is specific to play with the peer who also received the intervention, or whether children with autism generalise their pragmatic language performance to play with different peers following the intervention.

The intervention studied in this research was originally developed to target playfulness skills in children with ADHD. This thesis project adapted the intervention to target pragmatic language in children with autism, as pragmatic language is situated within one of the core elements of play (i.e., framing). Play was the context for delivering the intervention, so the presence and directionality of any interaction between changes in playfulness and changes in pragmatics are currently unclear. Pragmatic language skills might have improved because play skills improved, or vice versa, or there may be a bidirectional relationship between the two. Given that children with autism have difficulties with both pragmatic language and play, future evaluation of the intervention should investigate the interaction between play and pragmatic language on intervention effects, for example, the relationship between the four elements of play (internal control, intrinsic motivation, suspension of reality and framing) and the two elements of pragmatic language (verbal and nonverbal communication). The directionality of the interaction should also be elucidated.

Given the high concomitance of anxiety in children with autism and children with pragmatic language difficulties more generally, future research should consider evaluating the effect of pragmatic language interventions on children's anxiety. Adults with autism describe pragmatic language difficulties as a source of stress during social interactions (Müller et al., 2008). If an intervention is effective for improving pragmatic language performance in naturalistic social contexts, then it is possible that social anxieties could be decreased because the difficulties children might have had with engaging in social interactions were decreased. Conversely, if the social context of the intervention has inherent properties that facilitate emotional regulation for play, then it may also be the case that the facilitation of emotional regulation influences changes in pragmatic language. Measuring anxiety as an intervention outcome would determine whether pragmatic language interventions are effective for reducing children's social anxiety. Such

research would also contribute to an understanding of the directionality of the relationship between pragmatic language and emotional difficulties, or the presence of additional factors that govern both.

Research related to this intervention to date has focused on proximal outcomes using measures related to the constructs directly targeted by the intervention (e.g., pragmatic language, playfulness). The overarching aim of this intervention is to improve children's social functioning with a peer so that they can develop and maintain friendships. Future studies should include measurement of distal outcomes related to social functioning more broadly, such as friendships and bonding. This measurement of downstream outcomes should occur in conjunction with longer-term follow-ups, as children will require time engaging in play with peers after the intervention period to foster new friendships or strengthen existing ones.

The UKMRC guidelines for evaluating complex interventions (Craig et al., 2008) include process evaluations to understand why an effective intervention worked and how it can be optimised. This research began evaluating factors that account for the variability in results, by evaluating the Personal Factors that were predictive of a large intervention effect. However, this intervention was also comprised of several active ingredients and future research should seek to evaluate the fidelity and quality of implementation of each component to identify areas that require further optimisation. Evaluating the fidelity of implementation of complex interventions can be difficult, especially when there is a degree of tailoring to individual circumstances, as was the case for this intervention. Several specific aspects of the intervention that could be evaluated come to mind. First, an analysis of consistency of therapist discussions with children during video-feedback and -feedforward would determine the influence of therapist language on intervention effects. Findings from this analysis would inform adaptations suitable to optimise the intervention for children with structural language disorders. Next, the strategies used by the therapist within the playroom should be analysed in relation to the magnitude of change children achieved to determine which strategies are most effective for targeting which elements of pragmatic language. Understanding parent adherence to reading the manual on a weekly basis would assist in developing an appreciation for the contribution the manual content made to

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generalisation. Parent discussion with their child while watching the pre-recorded videos at home could also be evaluated to understand the fidelity of this discussions and the contribution the discussions make to skill improvement and generalisation. Lastly, an analysis of variables related to peer-peer playdates between clinic sessions (e.g., frequency, duration, location, types of play activities, routines for preparation and feedback on the play) would highlight the contribution of the play-dates to generalisation. Understanding the fidelity of these active ingredients would assist in the development of a standardised intervention protocol, outlining how much and the types of adaptations to individual child circumstances are permissible to maintain effectiveness.

This research has focused on three of the four phases of complex intervention development and evaluation: development, feasibility and piloting, and evaluation. The final phase, dissemination, is yet to be undertaken. Once the contribution of the active ingredients has been identified and optimised, training for therapists should be formed and evaluated to progress dissemination of the intervention. Such training would translate the intervention into clinical practice to develop the clinical skills of therapists and increase the accessibility of the intervention for children with autism and their families.

7.8   Conclusions

This research makes an important contribution to the evidence-base by determining that embedding pragmatic language within peer-peer free-play was a feasible, appropriate and effective way of targeting pragmatic language in children with autism. The opportunity to practise enacting pragmatic language skills in an ecologically valid social context with an authentic social partner meant that key elements of the ICF were incorporated into the intervention approach with the overarching aim to maximise children's participation in social interactions on a daily basis.

Prior to this research, the existing evidence base for pragmatic language interventions for children with autism (aged 0-18) was promising, but in need of further development. Overall, the approaches reviewed in this thesis were more effective than no intervention, but no more

effective than treatment as usual practices. Existing pragmatic language interventions for children with autism targeted a narrow range of discrete pragmatic language skills, tending to focus on communicative behaviours, while overlooking their connection to social emotional understanding. Including parents in the intervention process mediated the intervention effect of the interventions reviewed, but the intervention setting, mode of delivery (i.e., group, individual), child's age, or type of outcome measure used did not. These findings suggested that pragmatic language interventions for children with autism are required throughout childhood as children's social contexts evolve, and interventions might need to target a broader range of pragmatic language skills in ecologically valid practice contexts to increase effectiveness.

The intervention studied in this research attempted to address the identified limitations in existing interventions and was deemed an appropriate approach for children with autism and their families. Parents continued to implement intervention strategies in the home following the intervention period, and reported benefits were observed in their child's play-based interactions in the home. Furthermore, play as a medium for delivering a pragmatic language intervention was motivating for children and parents alike. The use of play engaged children in the intervention and parents valued play as a social context for their child, making it achievable for parents to implement the intervention techniques within the home.

Through piloting, two pragmatic language measures were deemed feasible as outcome measures for this intervention; an observational measure of pragmatic language during peer-peer play that evaluated children's pragmatic language *performance* and a standardised assessment task evaluating children's understanding of social and emotional language (i.e., *capacity* for pragmatic language). These measures addressed recommendations for pragmatic language outcome measurement following the review of existing pragmatic language interventions for children with autism: 1) blinded assessments of intervention effects, and 2) assessment of a broad range of pragmatic language skills. In addition, the inclusion of a performance and a capacity measure allowed for the measurement of these two distinct aspects of functioning.

Findings from the RCT indicated that a peer-peer play-based intervention was effective for improving the pragmatic language performance of children with autism during peer-peer play, particularly in the domain of nonverbal communication. Intervention effects for pragmatic language performance were maintained three months following the 10-week intervention period and children with autism generalised pragmatic language skills between the clinic and home environments. Children's receptive syntax moderated their pragmatic language performance during the study, while expressive vocabulary and receptive syntax moderated pragmatic language capacity scores. Our findings suggest that the constellation of techniques utilised in the intervention are effective for improving the pragmatic language performance skills required of children with autism to participate in peer-peer social play-based interactions.

This play-based approach also targeted key social partners within the lives of children with autism, providing those playmates with the skills to support the social interactions of the child with autism, which, in turn, is rewarding for those playmates and increases the likelihood of future positive social interactions. While the pragmatic language of playmates in this study did not increase at a significantly greater rate than the pragmatic language of waitlisted playmates, the pragmatic language skills of peers did increase significantly across the duration on the study. These findings align with the skills of their peers with autism, highlighting the transactional nature of pragmatic language. Furthermore, the relationship status between children in the dyads (i.e., siblings or non-siblings) contributed to the pragmatic language performance of typically-developing children, but not children with autism in this study. Changes in pragmatic language scores of non-sibling peers were greater than for sibling peers, highlighting a need for further research into the ideal playmate combination or combinations to optimise outcomes for both children through this intervention.

Novel to pragmatic language interventions for children with autism, this research evaluated the child-factors that predicted the children in the sample who obtained the largest intervention effects. Children with relative weaknesses in coherence and nonverbal communication, with relative high levels of separation anxiety, and with relative strengths integrating language and the social context for comprehension benefitted most from this intervention. Findings

highlighted an imperative for researchers to identify the children whom benefit most from various interventions, so that clinicians can make client-centred decisions about intervention selection and each family's time and resources are optimised for the maximum benefit to their child

Future research into this intervention for children with autism should focus on maximising intervention benefits in the verbal communication domain of pragmatic language and investigate the fidelity of active ingredients to optimise overall intervention effects. Alternative models of playmate inclusion should also be considered to augment the intervention for some children. Future outcome evaluation should also include measures of social anxiety and playfulness to assess the interactions between the three constructs and their contributions to the success of the intervention for children with autism. There is also a need for longer-term follow-up to evaluate generalisation to other important social environments and downstream effects on friendship development, maintenance and bonding. Consideration should also be given to adapting the intervention for other clinical populations with pragmatic language disorders. More broadly, there is a need for researchers and clinicians to conceptualise pragmatic language as a transaction between at least two individuals for the purpose of intervention development and evaluation. Children use pragmatic language to participate in everyday social interactions. By incorporating a naturalistic social transaction (i.e., play) between two familiar children, this intervention approach was able to have a true effect on children's participation in daily life.

7.9 References

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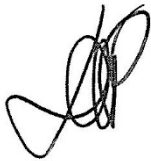
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Every reasonable effort has been made to acknowledge the owners of the copyright material used in this thesis. The original authors of the questionnaires and model used were contacted and written approval was obtained for their use in the PhD research. I would be pleased to hear from any copyright owner who has been omitted or incorrectly acknowledged.

February 22, 2019

Appendix A   Human Research Ethics Committee approval

MEMORANDUM

Curtin University

To:	A/Prof Reinie Cordier	Office of Research and Development
	Occupational Therapy	Human Research Ethics Office
CC:		
From	Professor Peter O'Leary, Chair HREC	TELEPHONE 9266 2784
		FACSIMILE 9266 3793
Subject	Ethics approval	EMAIL hrec@curtin.edu.au
	Approval number: HR04/2015	
Date	12-Jan-15	

Thank you for your application submitted to the Human Research Ethics Office for the project: 4886

Trial of peer-to-peer play-based intervention for children with Autism Spectrum Disorder to improve social play skills and pragmatic language

Your application was reviewed by Human Research Ethics Committee at Curtin University at their meeting on the   9/12/2014

Thankyou for providing the additional information requested by the Human Research EThics Committee. The information you provided was satisfactory and your proposal is now approved.

Please note the following conditions of approval:

1. Approval is granted for a period of four years from   **13-Jan-15**   to   **13-Jan-19**

2. Research must be conducted as stated in the approved protocol.

3. Any amendments to the approved protocol must be approved by the Ethics Office.

4. An annual progress report must be submitted to the Ethics Office annually, on the anniversary of approval.

5. All adverse events must be reported to the Ethics Office.

6. A completion report must be submitted to the Ethics Office on completion of the project.

7. Data must be stored in accordance with WAUSDA and Curtin University policy.

8. The Ethics Office may conduct a randomly identified audit of a proportion of research projects approved by the HREC.

Should you have any queries about the consideration of your project please contact the Ethics Support Officer for your faculty, or the Ethics Office at hrec@curtin.edu.au or on 9266 2784. All human research ethics forms and guidelines are available on the ethics website.

Yours sincerely,

Professor Peter O'Leary
Chair, Human Research Ethics Committee

Appendix B   Systematic Review PRISMA Reporting Checklist

App Table B-1. PRISMA Checklist.

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	24
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	25
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	26-27
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	27-28
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	28
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	29
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	28
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix C
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	29

Section/topic	#	Checklist item	Reported on page #
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	30
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	30
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	30
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	31
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	31-32
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	32
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	31-32
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	32-34
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	35-67
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	67-74
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	75-76
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	76-82

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	68
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	76-82
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	83-87
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	87-88
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	88
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	N/A

Appendix C   Systematic review search strategy

App Table C-1. Search Terms

	Database and Search Terms	Limitations
Subject Headings	**CINAHL**: ((MH "Speech and Language Assessment/CL/ED/EV/MT/PF/TD/UT") OR (MH "Rehabilitation, Speech and Language/CL/UT/TD/PF/MT/EV/ED") OR (MH "Nonverbal Communication/CL/ED/EV/MT/PC/TD/UT") OR (MH "Impaired Verbal Communication (NANDA)/EV/UT") OR (MH "Communication Disorders/CL/DI/ED/TH/RH/PF/PC/TD") OR (MH "Social Behavior/CL/ED/EV/PC/TD") OR (MH "Social Behavior Disorders/CL/DI/ED/PC/PF/TH/TD/RH") OR (MH "Social Skills/CL/ED/EV/PC/TD") OR (MH "Communication/CL/ED/EV/MT/PC/TD/UT") OR (MH "Communication Methods, Total/CL/ED/EV/MT/PF/TD/UT") OR (MH "Impaired Verbal Communication (NANDA)/EV/UT") OR (MH "Communication Skills/ED/CL/EV/MT/PC/TD/UT") OR (MH "Communication Impairment (Saba CCC)/ED/EV/TH/UT") OR (MH "Communication Ability (Iowa NOC)/EV/UT") OR (MH "Communication: Receptive Ability (Iowa NOC)/EV/UT") OR (MH "Communication: Expressive Ability (Iowa NOC)/EV/UT") OR (MH "Communicative Disorders/CL/ED/PF/PC/TD/TH/RH") OR (MH "Language Development/ED/EV/PC/TD") OR (MH "Speech and Language Assessment/CL/ED/EV/MT/TD/UT") OR (MH "Research, Speech-Language-Hearing Therapy/CL/ED/EV/MT/TU/TD/UT") OR (MH "Verbal Behavior/ED/EV/PC/TD") OR (MH "Language/CL/ED/EV/TD/UT/MT/PC") OR (MH "Language Tests/ED/EV/MT/PF/TU/TD/UT/CL") OR (MH "Language Therapy/CL/ED/EV/MT/PF/UT/TD") OR (MH "Language Disorders/CL/ED/TD/TH/RH/PF/PC") OR (MH "Speech-Language Pathology/CL/ED/EV/MT/PF/TD/UT") OR (MH "Speech and Language (Omaha)/EV/UT") OR (MH "Speech Therapy/CL/ED/EV/MT/PF/TD/UT")) AND ((MH "Autistic Disorder") OR (MH "Child Development Disorders, Pervasive") OR (MH "Pervasive Developmental Disorder-Not Otherwise Specified") OR (MH "Asperger Syndrome") OR (MH "Rett Syndrome")) AND (pragmatic* OR paralinguistic* OR (TI(social AND communication) OR AB(social AND communication))	Narrow by Subject Age: all infant; adolescent:13-18 years; child preschool: 2-5 years; child: 6-12 years; all child
	Embase: (social learning/ OR social competence/ OR social behavior/ OR nonverbal communication/ OR social adaptation/ OR communication skill/ OR language ability/ OR nonverbal communication/ OR verbal communication/ OR communication disorder/di, dm, pc, rh, th [Diagnosis, Disease Management, Prevention, Rehabilitation, Therapy] OR language ability/ OR language delay/ OR language development/ OR language disability/ OR language processing/ OR verbal behavior/ OR verbal communication/ OR language/ OR language test/ OR OR speech rehabilitation/ OR speech therapy/ OR developmental language disorder/di, pc, rh, th [Diagnosis, Prevention, Rehabilitation, Therapy]) AND (autism/ OR "pervasive developmental disorder not otherwise specified"/ OR Rett syndrome/ OR childhood disintegrative disorder/) AND (pragmatic* OR paralinguistic* OR (social AND communication)).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword]	English; infant <to one year> or preschool child <1 to 6 years> or school child <7 to 12 years> or adolescent <13 to 17 years>
	Eric: (DE "Autism" OR DE "Pervasive Developmental Disorders" OR DE "Asperger Syndrome") AND (DE "Pragmatics" OR DE "Paralinguistics")	English
	PsycINFO: (autism/ OR aspergers syndrome/ OR pervasive developmental disorders/ OR rett syndrome/) AND (pragmatics/)	English; infant <to one year> or preschool child <1 to 6 years> or school child <7 to 12 years> or adolescent <13 to 17 years>
	PubMed: (Therapy/education"[Mesh] OR "Speech Therapy/instrumentation"[Mesh] OR "Speech Therapy/methods"[Mesh] OR "Speech Therapy/psychology"[Mesh] OR "Speech Therapy/trends"[Mesh] OR "Speech Therapy/utilization"[Mesh] OR "Specific Language Impairment 4" [Supplementary Concept] OR "Child Language"[Mesh] OR "Language Development/classification"[Mesh] OR "Language Development/prevention and control"[Mesh] OR "Language	English; Child: birth-18 years

	Database and Search Terms	Limitations
	Development/psychology"[Mesh] OR "Language Development/therapy"[Mesh] OR "Language Development Disorders/classification"[Mesh] OR "Language Development Disorders/diagnosis"[Mesh] OR "Language Development Disorders/prevention and control"[Mesh] OR "Language Development Disorders/psychology"[Mesh] OR "Language Development Disorders/rehabilitation"[Mesh] OR "Language Development Disorders/therapy"[Mesh] OR "Language Disorders/classification"[Mesh] OR "Language Disorders/diagnosis"[Mesh] OR "Language Disorders/education"[Mesh] OR "Language Disorders/prevention and control"[Mesh] OR "Language Disorders/psychology"[Mesh] OR "Language Disorders/rehabilitation"[Mesh] OR "Language Disorders/therapy"[Mesh] OR "Language Tests/classification"[Mesh] OR "Language Tests/instrumentation"[Mesh] OR "Language Tests/methods"[Mesh] OR "Language Therapy/classification"[Mesh] OR "Language Therapy/education"[Mesh] OR "Language Therapy/instrumentation"[Mesh] OR "Language Therapy/methods"[Mesh] OR "Language Therapy/psychology"[Mesh] OR "Language Therapy/therapeutic use"[Mesh] OR "Language Therapy/trends"[Mesh] OR "Rehabilitation of Speech and Language Disorders/classification"[Mesh] OR "Rehabilitation of Speech and Language Disorders/education"[Mesh] OR "Rehabilitation of Speech and Language Disorders/instrumentation"[Mesh] OR "Rehabilitation of Speech and Language Disorders/methods"[Mesh] OR "Rehabilitation of Speech and Language Disorders/psychology"[Mesh] OR "Rehabilitation of Speech and Language Disorders/therapeutic use"[Mesh] OR "Rehabilitation of Speech and Language Disorders/therapy"[Mesh] OR "Rehabilitation of Speech and Language Disorders/trends"[Mesh] OR "Rehabilitation of Speech and Language Disorders/utilization"[Mesh] OR "Speech-Language Pathology/classification"[Mesh] OR "Speech-Language Pathology/education"[Mesh] OR "Speech-Language Pathology/instrumentation"[Mesh] OR "Speech-Language Pathology/methods"[Mesh] OR "Speech-Language Pathology/trends"[Mesh] OR "Language/classification"[Mesh] OR "Language/diagnosis"[Mesh] OR "Language/education"[Mesh] OR "Language/instrumentation"[Mesh] OR "Language/methods"[Mesh] OR "Language/psychology"[Mesh] OR "Language/therapy"[Mesh] OR "Language/trends"[Mesh] OR "Verbal Behavior/classification"[Mesh] OR "Verbal Behavior/education"[Mesh] OR "Verbal Behavior/psychology"[Mesh] OR "Verbal Behavior/therapy"[Mesh] OR "Communication Barriers"[Mesh] OR "Communication Methods, Total"[Mesh] OR "Communication Disorders/classification"[Mesh] OR "Communication Disorders/diagnosis"[Mesh] OR "Communication Disorders/education"[Mesh] OR "Communication Disorders/prevention and control"[Mesh] OR "Communication Disorders/psychology"[Mesh] OR "Communication Disorders/rehabilitation"[Mesh] OR "Communication Disorders/therapy"[Mesh] OR "Manual Communication"[Mesh] OR "Communication/classification"[Mesh] OR "Communication/diagnosis"[Mesh] OR "Communication/education"[Mesh] OR "Communication/instrumentation"[Mesh] OR "Communication/methods"[Mesh] OR "Communication/prevention and control"[Mesh] OR "Communication/psychology"[Mesh] OR "Communication/therapy"[Mesh] OR "Communication/trends"[Mesh] OR "Social Skills"[Mesh] OR "Social Behavior"[Mesh] OR "Social Behavior Disorders"[Mesh] OR "Speech Production Measurement/instrumentation"[Mesh] OR "Speech Production Measurement/methods"[Mesh] OR "Speech Production Measurement/psychology"[Mesh] OR "Speech Production Measurement/therapy"[Mesh] OR "Nonverbal Communication/classification"[Mesh] OR "Nonverbal Communication/diagnosis"[Mesh] OR "Nonverbal Communication/education"[Mesh] OR "Nonverbal Communication/instrumentation"[Mesh] OR "Nonverbal Communication/methods"[Mesh] OR "Nonverbal Communication/prevention and control"[Mesh] OR "Nonverbal Communication/psychology"[Mesh] OR "Nonverbal Communication/therapy"[Mesh] OR "Nonverbal Communication/trends"[Mesh] OR "Language Development Disorders"[Mesh] OR "Pragmatic Clinical Trial" [Publication Type] OR "Pragmatic Clinical Trials as Topic"[Mesh]) AND ("Autistic Disorder"[Mesh] OR "Child Development Disorders, Pervasive"[Mesh] OR "Rett Syndrome"[Mesh] OR "Asperger Syndrome"[Mesh]) AND ((pragmatic* OR paralinguistic*) OR (social AND communication Field: Title/Abstract)) AND (English[lang] AND (infant[MeSH] OR child[MeSH] OR adolescent[MeSH]))	
Free Text Words	**CINAHL:** (child* OR toddler* OR infant* OR schoolchild* OR youth* OR baby OR babies OR pediatr* OR paediatr* OR neonat* OR newborn* OR	*Initial search:* Publication date from

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Database and Search Terms	Limitations
postneonat* OR postnat* OR suckling* OR juvenile* OR adolescent* OR teenager* OR teen-ager* OR pubescent* OR pubertal OR youngster* OR minor*) AND (autism OR autistic OR ASD OR PDD OR PDD-NOS OR pervasive OR Asperger OR Rett OR (childhood AND disintegrative AND disorder*)) AND ((social AND communication) OR (pragmatic* OR paralinguistic*))	2014/04/08 to 2016/05/31; Field: Title/Abstract)
Embase*: As per CINAHL Free Text*	2015 to current
Eric: *As per CINAHL Free Text*	*Initial search:* Publication date from 2014/04/08 to 2016/05/31; Field: Title/Abstract)
PsycINFO: *As per CINAHL Free Text*	Publication year 2015-2016
PubMed: *As per CINAHL Free Text*	Publication date from 2014/04/08 to 2016/05/14; Field: Title/Abstract

Appendix D Telephone screening schedule

The following schedule of questions was used by researchers to screen children with autism for study eligibility during phone calls with their parents.

SCREENING SCHEDULE

Title of Project: Trial of a peer-to peer play-based intervention with children with autism spectrum disorder to improve social play skills and pragmatic language

Child Name:	
Child Number:	
Parent Name:	
Parent Number:	
Interview Conducted by:	
Date and Time of Interview:	
Intervention Week:	

- Introductions.
- Thank you for calling me about the research project. It's great that you're interested in exploring whether your son or daughter is suitable to take part in the project. To find this out, firstly I need to ask you some questions. There's no guarantee that, even once we've gone through these questions, your child will be able to take part in the study. If we think they may be suitable we will then need to meet face-to-face and complete a couple of short assessments to see if they are able to take part. Does that sound ok?
- Would you be happy to answer some questions now in a semi-structured interview? (If yes, continue with next question. If no, discontinue the interview and thank them for their time).
- If yes – You are free to answer the questions I ask you however you choose. If you do not want to answer any of the questions, you do not have to. If you're not sure what I mean, please let me know and I will try and explain it another way. Does that sound ok? Do you have any questions before we start?

1) Firstly, can you tell me a bit about why you are interested in your son or daughter being involved in this research project?

2) I'm going to ask you some questions about your son or daughter's ASD, and their communication and language skills? Is that ok? ☐ Yes ☐ No

- Does your child have ASD? ☐ Yes ☐ No

If so, what kind? _____

(If they have high functioning ASD, continue with the interview).

(If they have low functioning ASD, or ASD and an intellectual disability the children will not match the selection criteria. Gently inform the parent that this project is firstly being trialled with children with high functioning ASD. This is not to discriminate against children who do not have high functioning ASD. Researchers try to have children who are similar within the study. This makes it easier to work out if the treatment works or not. Once the researchers know it works with one group of children, they can then trial it on other groups of children with ASD. At this time however, their child does not match the criteria to take part in the study).

- Has your child been officially diagnosed with high functioning ASD? ☐ Yes ☐ No

    If yes, how old were they when they were diagnosed? _____

    If no, discontinue the interview, explaining that at this time their child does not match the criteria to take part in the study).

- Do they have any other conditions related to their ASD? ☐ Yes ☐ No

    - Can you tell me more about the condition(s)? ☐ Yes ☐ No

    - How do these conditions affect them? (Check gently if these conditions will influence their ability to take part in the study).

    - If they have epilepsy – is it controlled well with medication? If yes, continue the interview. (If no, discontinue the interview, explaining that at this time their child does not match the criteria to take part in the study).
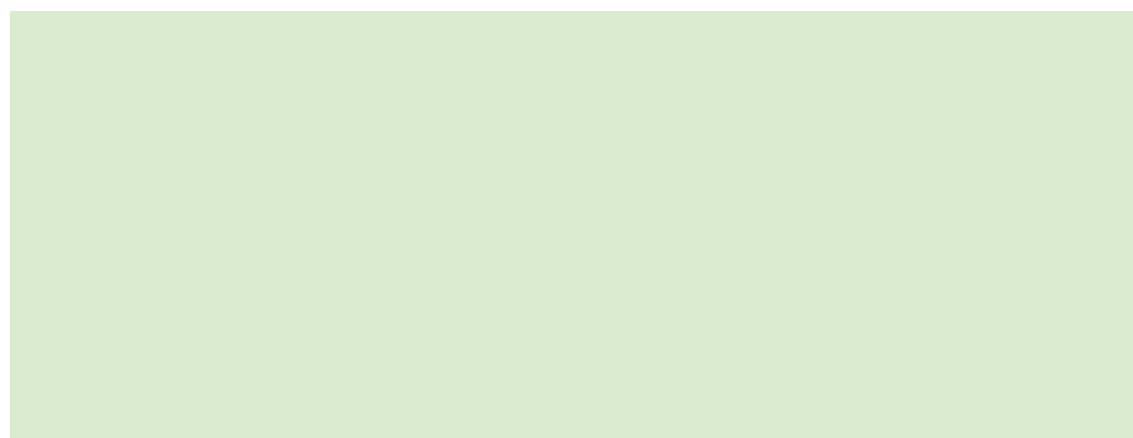
3) Does your son or daughter attend mainstream school? ☐ Yes ☐ No

    - If yes, what year are they in? _____

    - Have they always attended mainstream school? ☐ Yes ☐ No

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-   Are they in mainstream classes? ☐ Yes ☐ No
-   Do they have any significant learning problem? ☐ Yes ☐ No
    If no, continue the interview.
    If yes, please explain that at this stage, their child does not match the criteria to take part in this study.

4) Do you and your son or daughter speak English at home? ☐ Yes ☐ No

    Does your son or daughter have a significant speech or verbal communication problem? ☐ Yes ☐ No
    If no, continue the interview.
    If yes, discontinue the interview, explaining that at this time their child does not match the criteria to take part in the study.

5) Do you think your child has a problem playing, socialising or talking to other children their age?

☐ Yes ☐ No

If no, discontinue the interview, explaining that at this time their child does not match the criteria to take part in the study. They need to have a problem with social play and social communication skills.

If yes, ask the parent to describe the problem(s).

-   Have you read the information letter that was sent to you that described the study? ☐ Yes ☐ No

-   Do you understand what the project involves? ☐ Yes ☐ No

-   Would you like me to talk it through with you? ☐ Yes ☐ No
    Take the opportunity to explain more about the study.

-   Do you think that you would like to be involved in this study? ☐ Yes ☐ No

If no, discontinue the interview.

- Do you think your son or daughter would like to be involved in this study? ☐ Yes ☐ No

  If no, discontinue the interview.

- Do you think you would be able to commit to the clinic and home based parts of the project?
  ☐ Yes ☐ No

  If no, discontinue the interview.

- Do you think you would be able find a playmate for your child to join in the study for 10 weeks? ☐ Yes ☐ No

  If no, discontinue the interview.

- Would you be happy to meet at Curtin University, to have a look at the playroom and to discuss the study in more detail? ☐ Yes ☐ No

  If no, discontinue the interview.

- If you would still like for you and your child to participate in the study, you will be asked to fill out some forms and your child will be screened for language and communication problems. Your child's playmate will also need to attend and be screened for language and communication problems. If your child and their playmate match the criteria and you all consent to participate in the study, you will then be placed in the control or intervention group. How does this sound?

- Do you have any questions? ☐ Yes ☐ No

Arrange appointment times.

Thank you very much for participating in the interview

Appendix E Participant information letters and consent forms

E.1 Parents of children with autism

E.1.1 Parent information letter

Project Title: Helping children with autism spectrum disorder improve their social play and

social communication skills

Our names are Cally Smith and Lauren Parsons and we are from Curtin University. We work in a research team that is developing a way to help children with autism spectrum disorder (ASD) improve their ability to play and talk with others. You and your child are invited to take part in this research project, which Cally is completing as part of her Doctor of Philosophy – Occupational Therapy, and Lauren as part of her Masters – Occupational Therapy.

What is this study about?

Research has shown that many children with ASD, including very high functioning children, can have problems with social play and social communication skills. These children may have difficulty making or keeping friends. Good social play skills and good social communication skills are necessary for childhood development. These skills help develop good quality relationships and the ability to cope better with changes and challenges. This project aims to help children with ASD develop their social play and social communication skills. What you and your son or daughter will be asked to do with us, has worked very well in previous studies with children who do not have ASD. The children in those studies enjoyed the process and developing their social skills through play.

We invite you to take part

We are asking you and your son or daughter to take part in this project because they are aged 6 to 11 years, attend mainstream school and have ASD. A playmate i.e., a friend, brother, sister or cousin who is of similar age to your son or daughter- whom you choose -will also be asked to take part. Taking part in this project is completely voluntary and you can stop taking part in the project at any time without giving a reason and without any disadvantage. If you do stop, you can ask to have any information you have provided taken out of the project, unless we have already grouped that information with other children's information. Once all of the information is grouped together, we cannot tell one child's information from the other. This is usually within 2 to 3 weeks of the end of the project.

What will you be asked to do?

If you decide to take part in the project, you will be asked to bring your son or daughter to Curtin University once a week for a total of 10 weeks. Each visit will be for approximately 1 hour, during which time your son or daughter and their playmate will have a 30 minute free-play session in a well-equipped playroom. You will be watching the play session alongside an occupational therapist via a computer monitor in the room next door to the playroom. While

the children are playing the therapist will provide you with ideas and training on how to help your son or daughter develop their social play and social communication skills at home. At times the therapist will join the children in the playroom while they are playing.

Each play session will be videotaped and edited prior to the next week's play session. At the beginning of each play session, the children will sit with the therapist to watch and reflect on how they performed in the last week's play session. The therapist will encourage a problem-solving discussion, which will help the children to develop ways to improve their social play and social communication skills. The video footage will also be used by the research team to assess the development of these skills. The video footage will be securely stored on a password protected computer or external hard drive in a secure location at Curtin University. You have the opportunity in the consent form to opt for the video footage to be destroyed after the study is completed or for the footage to be used for future research. Please note that there is no funding available for your travel expenses, however parking permits will be provided for use at Curtin University.

You will also be asked to conduct the home-based part of the study. This involves an interactive DVD and training manual that looks at the most common social skills problems. The DVD and manual has 12 short modules covering: understanding play and social skills, promoting good social behaviour, dealing with conflict and competition, and making and keeping friends. You will receive training in week 1 on how to use the DVD and manual. Each week you will be asked to watch the DVD with your son or daughter and discuss the social skills being focused on by following the prompts in the manual. This will take you about half an hour. You will also be asked to provide a 45-60 minute play session each week with your son or daughter's playmate and encouraged to give your son or daughter feedback after the play session. The home-based part of the study will help your child practice the skills they learn in the clinic-based part. For more information on what the study involves, please see the attached document called 'Intervention Structure'.

To assist with the study, we will ask to see documentation confirming your child's diagnosis of ASD, prior to starting the study. You will also be asked to complete some questionnaires/forms at the first and last sessions. Finally, three months after the last play session, another researcher will visit your home to interview you about you and your son or daughter's experience of the study. The interviewer will also videotape a play session of your child with their playmate. This video will be assessed to check how your son or daughter's social play and social communication skills have continued to develop.

Are there any risks?

The risks involved in this study are no greater than those related with any supervised play. In the clinic, all toys are chosen with safety in mind. The researchers are qualified therapists who have extensive experience in dealing with children with challenging behaviours. They are well equipped to deal with minor worries that sometimes happen when young children separate from their parents for short periods of time. If your child has particular difficulties in areas being assessed, the researcher will explain the results to you and provide information about follow up services.

What might be the benefits?

We anticipate that your son or daughter's social play and social communication skills will improve. However, we cannot guarantee or promise you that you or your son or daughter will receive any benefits from taking part in the study. We also anticipate that the results from this study will contribute to what is known about children with ASD's social play and social

communication difficulties and help us understand how we can best help children with ASD to improve these skills. This may help therapists and future researchers plan social skills interventions or research. If you and your child take part in this study, if you would like, you can receive a report on the study's results.

Confidentiality

All information will be stored and used confidentially. Results will be presented so that your son or daughter's name and personal details will not be linked to the information. The information that is collected will be published as scientific articles, as theses and presented at relevant conferences.

Further information

If you have any questions or concerns, would like more information about the study or wish to take part in the study, please contact the research team on the details below.

Thank you for taking the time to read this information letter and for considering taking part in the study.

Kind regards,

Cally Smith	**Lauren Parsons**	**Dr Reinie Cordier**
Therapist/Co-Researcher	**Co-Researcher/ Therapist**	**Senior Researcher**
PhD Candidate, Occupational Therapist	PhD Candidate, Speech Pathologist	Senior Research Fellow
School of Occupational Therapy and Social Work	School of Occupational Therapy and Social Work	School of Occupational Therapy and Social Work
Curtin University	Curtin University	Curtin University
Phone: 9266 3600	Phone: 9266 3600	Phone: 9266 3600
Email:	Email:	Email:
cally.smith@curtin.edu.au	lauren.parsons@curtin.edu.au	reinie.cordier@curtin.edu.au

E.1.2   Consent Form

PARENTAL INFORMED CONSENT FORM

PRINCIPAL RESEARCHER	**Assoc Prof Reinie Cordier**
CO-RESEARCHER/THERAPIST	**Cally Smith**
CO-RESEARCHER/THERAPIST	**Lauren Parsons**
PROJECT TITLE:	**Helping children with autism spectrum disorder improve their social play and social communication skills**
SCHOOL	**School of Occupational Therapy and Social Work**

I, ...agree to participate in the research and to permit my child ....………........................,who is aged .... years, to also participate in the research project

"*Helping children with autism spectrum disorder improve their social play and social communication skills".*

I understand the aim of this research project is to find out if a peer-to-peer play-based intervention will help children with autism spectrum disorder to improve their social play and social communication skills.

I consent to participate in this project, the details of which have been explained to me, and I have been provided with a written information letter to keep. I understand that my participation will involve an interview, parent questionnaires, clinic visits and a single follow-up home visit and I agree that the researcher may use the results as described in the Parent Information Letter.

In giving my consent I acknowledge that:

1. I have received the Parent Information Letter.

2. I have read the Parent Information Letter and understand the time and nature of the activities involved for my child and me to participate in the project.

3. The researcher has given me the opportunity to discuss the information and ask any questions I have about the project and my questions have been answered to my satisfaction.

4. I understand that my child and I can withdraw from the study at any time without prejudice to my or my child's relationship with the researcher/s or Curtin University now or in the future.

5. I understand that if I have any questions relating to my or my child's participation in this research project, I may contact the researcher/s who will be happy to answer them.

6. The use of videotape has been explained to me and its use is also outlined in the Parent Information Sheet. By signing the consent form I give permission for my child to be videotaped. This decision will not otherwise affect my child's treatment.

7. I agree that research data gathered from the results of the study may be published provided that neither my child nor I can be identified.

Select from the following options. I agree to the following (tick applicable box):

I consent to be interviewed	☐ Yes	☐ No
I consent for the interview to be audio taped	☐ Yes	☐ No
I consent to complete the questionnaires	☐ Yes	☐ No
I consent to my child's play sessions being video recorded for this study	☐ Yes	☐ No

I consent to the researcher using the video recording for future research purposes ☐Yes ☐No

Name:(printed)	
Relationship to Child **(printed):**	
Signature:	Date:

This research has been reviewed and given approval by the Curtin University Human Research Ethics Committee (approval number OTSW-05-2014). Should you wish to make a complaint on ethical grounds, please contact the Human Ethics Committee (Secretary), phone: 9266 2784, email: hrec@curtin.edu.au, mail: C/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth WA 6845

E.2 Children with autism

E.2.1 Child information letter

Project Title: Helping children with autism spectrum disorder improve their social play and social communication skills

Our names are Cally Smith and Lauren Parsons and we are from Curtin University. We work with a team of people trying to find fun ways for kids with ASD to play and talk with their friends.

What is this study about?

Lots of kids with ASD can have problems talking and playing with other kids. Sometimes they have problems making and keeping friends. My team is trying to help kids with ASD with these problems.

You're invited!

You and your parent are invited to join in this project. If you want to join the project we will ask you to bring a playmate along with you as well. This could be a friend or maybe a brother, sister or cousin about the same age as you. It's up to you if you want to join in or not. Even if your Mum or Dad wants you to join in but you don't want to, you don't have to. Your Mum or Dad has to agree to you joining in as well. If you start the project and then want to stop, you can. You won't get in trouble for it. It's up to you.

What will you be asked to do?

You and your playmate will visit the playroom at Curtin University once a week for 10 weeks. Each play session will be video recorded. When you come in the next week, you get to watch how you and your playmate played in the session the week before. You and your playmate will have a chat about it with the therapist for a while, before having 30 minutes free-play time in the play room. Sometimes a therapist will join you in the playroom and sometimes it will just be you and your playmate. Your Mum or Dad and the therapist will be in the room next to the playroom but they will be able to see you through a computer monitor.

Playing at home

As well as coming to the Curtin playroom, your Mum or Dad will also be helping you at home. You will get to watch a movie about an alien called Oober. Oober isn't very good at talking or

playing with kids and doesn't know how to make friends. But some Superheroes and a really nice boy help him learn. Once a week you will be able to play with your playmate at home.

What is good about this project, for you?

We hope that by joining in this project, you will feel better about talking and playing with other kids your age. We also hope that we can find out more about kids with ASD so that we can help them if they are having these problems. But we can't say for sure that we will be able to help.

Will other people know you took part in this?

What you or your parents tell us, and any videos of you playing will be kept safe. Only members of the team from Curtin University will see it. When we talk or write about what you have helped us learn, we will not use your name or anything else that might tell people who you are.

Want to know more?

Please get your Mum or Dad to contact us if you have any questions or if you would like to know more about the project. Our emails are cally.smith@curtin.edu.au and lauren.parsons@curtin.edu.au, and our telephone is 9266 3600. You can also contact the other team members (see below).

Thank you for your thinking about joining the project. Please keep this letter so that you can check what we have told you.

Thanks,

Cally Smith	**Lauren Parsons**	**Dr Reinie Cordier**
Therapist/Co-Researcher	**Co-Researcher/ Therapist**	**Senior Researcher**
PhD Candidate, Occupational Therapist	PhD Candidate, Speech Pathologist	Senior Research Fellow School of Occupational
School of Occupational Therapy and Social Work	School of Occupational Therapy and Social Work	Therapy and Social Work Curtin University
Curtin University	Curtin University	Phone: 9266 3600
Phone: 9266 3600	Phone: 9266 3600	Email:
Email:	Email:	reinie.cordier@curtin.edu.au
cally.smith@curtin.edu.au	lauren.parsons@curtin.edu.au	

PRINCIPAL RESEARCHER:	Associate Professor Reinie Cordier
CO-RESEARCHER/THERAPIST	Cally Smith
CO-RESEARCHER/THERAPIST	Lauren Parsons

Child Consent to Participate Form (under age 7)

Project title: Helping children with autism spectrum disorder improve their social play and social communication skills

This will be read to the child:

(Name of clinician) has explained to me that I will be playing for about 30 minutes when I come here to play. I have seen what the playroom with all the toys and activities looks like. I have been shown the video recorder that will be used to tape me while I play. I know that I will talk with the therapist before each play session and that I will do some tests for about 1 hour. Some will happen before the play sessions start and some after they are all over. I know I will also get to watch a DVD about Oober and the superheros at home with my Mum or Dad and then talk about it. I also know that my parents will organise for my friend and I to play together once a week. I had a chance to ask as many questions as I'd like about what is going to happen. It all seems fine to me.

(Verbal assent will be obtained from the child)

……………………………………………………………………………………………
Name of Child (please print)

………………………………………………………………………………
Date

PRINCIPAL RESEARCHER:	Associate Professor Reinie Cordier
CO-RESEARCHER/THERAPIST	Cally Smith
CO-RESEARCHER/THERAPIST	Lauren Parsons

Child Consent to Participate Form (over age 7)

Project title: Helping children with autism spectrum disorder improve their social play and social communication skills

.... has explained to me that I will be playing for about 30 minutes when I come here to play. I have seen what the playroom with all the toys and activities looks like. I have been shown the video recorder that will be used to tape me while I play. I know that I will talk with the therapist before each play session and do some assessments to learn about my language skills. These will take about 1 hour. Some will happen before the play sessions start and some after they are all over. I know I will also get to watch a DVD about Oober and the superheros at home with my Mum or Dad and then talk about it. I also know that my parents will organise for my friend and I to play together once a week. I had a chance to ask as many questions as I'd like about what is going to happen. It all seems fine to me.

……………………………………………………………………………………….
Signature of Child

……………………………………………………………………………………….
Please PRINT name

…………………………………………………………………..
Date

E.3 Parents of typically-developing playmates

E.3.1 Parent information letter

Title of Project: Helping children with autism spectrum disorder improve their social play and

social communication skills

Our names are Cally Smith and Lauren Parsons and we are from Curtin University. We work in a research team that is developing a way to help children with autism spectrum disorder (ASD) improve their ability to play and talk with others. Your son or daughter has been asked to take part in this research project because they have a friend or family member who has ASD who would like to take part in this project.

What is this study about?

Research has shown that many children with ASD, including very high functioning children, can have problems with social play and social communication skills. These children may have difficulty making or keeping friends. This project aims to help children with ASD develop their social play and social communication skills with the help of a playmate. What your son or daughter will be asked to do with us, has worked very well in previous studies with children who do not have ASD. The children in those studies enjoyed developing their social skills through play.

Who can take part?

Any typically developing child above the age of 6 that has been invited by the child with ASD.

Taking part in this project is completely voluntary and you can stop taking part in the project at any time without giving a reason and without any disadvantage. If you do stop, you can ask to have any information you have provided taken out of the project, unless we have already grouped that information with other children's information. Once all of the information is grouped together, we cannot tell one child's information from the other. This is usually within 2 to 3 weeks of the end of the project.

What will you be asked to do?

If you decide to take part in the study, your son or daughter and their playmate (friend/family member with ASD) will be asked to attend Curtin University once a week for a total of 10 weeks. Each visit will be for approximately 1 hour, during which time your son or daughter and their playmate will have a 30-minute free-play session in a well-equipped playroom. At times, a therapist will join the children while they are playing. If the therapist is not in the playroom with the children, the therapist will be watching the children at all times via a computer monitor in the room next door to the playroom along with the playmates parent. You are also welcome to watch the children play alongside the therapist.

Each of the children's play sessions will be videotaped and edited prior to the next week's play session. At the beginning of each play session, the children will sit with the therapist to watch and reflect on how they performed in the last week's play session. The therapist will encourage a problem-solving discussion, which will help the children to develop ways to

improve their social play and social communication skills. The video footage will also be used by the research team to assess the development of these skills. <u>The video footage will be securely stored on a password protected computer or external hard drive in a secure location at Curtin University. You have the opportunity in the consent form to opt for the video footage to be destroyed after the study is completed or for the footage to be used for future research.</u>

During the first and last visits to Curtin University, your son or daughter's language and communication skills will be screened by a member of our research team and you will be asked to complete questionnaires/forms about your son or daughter's development, behaviour and communication skills. This is to help the researchers work out if the children have improved over the play sessions. Please note that there is no funding available for your travel expenses, however parking permits will be provided for use at Curtin University.

In addition to the clinic-based sessions, your son or daughter will be asked to take part in weekly play sessions at the home of their playmate. These will be organised at times convenient to both families. You will be welcome to stay for the duration of the play session (approximately 45-60 minutes) or collect your child at the end of the play session. There will also be a follow-up play session 3 months after the 10 week intervention has been completed. At this time your child will be required to attend the home of their playmate for a play session. This play session will be video-recorded by another researcher. The video footage will be used to assess the playmate's social play and social communication skills. For more information on what the intervention involves, please see the attached document called ('Intervention Structure').

Are there any risks?

The risks involved in this study are no greater than those related to any supervised play. In the clinic, all toys are chosen with safety in mind. The researchers are qualified therapists who have extensive experience in dealing with children with challenging behaviour. They are well equipped to deal with minor worries that sometimes happen when young children separate from their parents for short periods of time. If your son or daughter has particular difficulties in areas being assessed, the researcher will explain the results to you and provide information about follow up services.

What might be the benefits?

We anticipate that this study will help your son or daughter develop their play and social skills. We also hope that your son or daughter will become a skilled playmate to the child with ASD, by displaying appropriate behaviours during play. However, we cannot and do not guarantee or promise that you or your son or daughter will receive any benefits from the study. We also anticipate that the results from this study will contribute to what is known about children with ASD's social play and social communication difficulties and help us understand how we can best help children with ASD to improve these skills. This may help therapists and future researchers plan social skills interventions or research. If your son or daughter takes part in this study, if you would like, you can receive a report on the study's results.

Confidentiality

All information will be stored and used confidentially. Results will be presented so that your son or daughter's name and personal details will not be linked to the information. The

information that is collected will be published as scientific articles, as theses and presented at relevant conferences.

Further information

If you have any questions or concerns, would like more information about the study or wish to take part in the study, please contact the research team on the details below.

Thank you for taking the time to read this information letter and for considering taking part in the study.

Kind regards,

<table>
<tr>
<td>Cally Smith
Therapist/Co-Researcher
PhD Candidate, Occupational Therapist
School of Occupational Therapy and Social Work
Curtin University
Phone: 9266 3600
Email:
cally.smith@curtin.edu.au</td>
<td>Lauren Parsons
Co-Researcher/ Therapist
PhD Candidate, Speech Pathologist
School of Occupational Therapy and Social Work
Curtin University
Phone: 9266 3600
Email:
lauren.parsons@curtin.edu.au</td>
<td>Dr Reinie Cordier
Senior Researcher
Senior Research Fellow
School of Occupational Therapy and Social Work
Curtin University
Phone: 9266 3600
Email:
reinie.cordier@curtin.edu.au</td>
</tr>
</table>

E.3.2   Consent form

PARENTAL INFORMED CONSENT FORM– PLAYMATE

PRINCIPAL RESEARCHER	**Assoc Prof Reinie Cordier**
CO-RESEARCHER/THERAPIST	**Cally Smith**
CO-RESEARCHER/THERAPIST	**Lauren Parsons**
PROJECT TITLE:	**Helping children with autism spectrum disorder improve their social play and social communication skills**
SCHOOL	**School of Occupational Therapy and Social Work**

I, ...permit my child who is aged

.... years, to participate in the research project "*Helping children with autism*

spectrum disorder improve their social play and social communication skills".

I understand the aim of this research project is to find out if a peer-to-peer play-based

intervention will help children with autism spectrum disorder to improve their social play and

social communication skills.

I consent to participate in this project, the details of which have been explained to me, and I

have been provided with a written information letter to keep. I understand that participation

will involve my child attending clinic visits at Curtin University and weekly play sessions at the

home of their playmate, and that I will complete questionnaires/forms at the first and last

sessions. I agree that the researcher may use the results as described in the Parent

Information Letter - Playmate.

In giving my consent I acknowledge that:

1.   I have received the Parent Information Letter - Playmate.

2. I have read the Parent Information Letter – Playmate, and understand the time and nature of the activities involved for my child and I to participate in the project.

3. The researcher has given me the opportunity to discuss the information and ask any questions I have about the project and my questions have been answered to my satisfaction.

4. I understand that my child and I can withdraw from the study at any time without prejudice to my or my child's relationship with the researcher/s or Curtin University now or in the future.

5. I understand that if I have any questions relating to my child's participation in this research project, I may contact the researcher/s who will be happy to answer them.

6. The use of videotape has been explained to me and its use is also outlined in the Parent Information Letter - Playmate. By signing the consent form I give permission for my child to be videotaped.

7. I agree that research data gathered from the results of the study may be published provided that neither my child nor I can be identified.

Select from the following options. I agree to the following (tick applicable box):

I consent to complete the questionnaires	☐ Yes	☐ No
I consent to my child's play sessions being video recorded for this study	☐ Yes	☐ No
I consent to the researcher using the video recording for future research purposes	☐ Yes	☐ No

Name:(printed)	
Relationship to Child (printed):	
Signature:	Date:

This research has been reviewed and given approval by the Curtin University Human Research Ethics Committee (approval number OTSW-05-2014). Should you wish to make a complaint on ethical grounds, please contact the Human Ethics Committee (Secretary), phone: 9266 2784, email: hrec@curtin.edu.au, mail: C/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth WA 6845

E.4 Typically-developing playmates

E.4.1 Child information letter

Project Title: Helping children with autism spectrum disorder improve their social play and social communication skills

Our names are Cally Smith and Lauren Parsons and we are from Curtin University. We work with a team of people trying to find fun ways for kids with Autism Spectrum Disorder (ASD) to play and talk with their friends.

What is this study about?

Lots of kids with ASD can have problems talking and playing with other kids. Sometimes they have problems making and keeping friends. My team is trying to help kids with ASD with these problems.

You're invited!

You're invited to join in the project because you have a friend or family member who has ASD and who wants to join in the project. Each child with ASD needs a playmate and they have asked if you would like to join them. It's up to you if you want to join in or not. Even if your Mum or Dad wants you to join in but you don't want to, you don't have to. At the same time, your Mum or Dad has to agree to you joining in as well. If you start the project and then choose you want to stop, you can. You won't get in trouble for it. It's up to you.

What will you be asked to do?

You and your playmate will come and visit the playroom at Curtin University once a week for 10 weeks. Each play session will be video recorded so that when you come in the next week, you get to watch how you went in the play session the week before. You and your playmate will have a chat about it with the therapist for a while, before having 30 minutes free-play time in the play room. Sometimes a therapist will join you in the playroom and sometimes it will just be you and your playmate. Your friend's Mum or Dad and the therapist will be in the room next to the playroom but they will be able to see you through a computer monitor. Your Mum and Dad are also welcome to come too.

Playing at your playmates home

As well as coming to the Curtin playroom, you will also be asked to play with your playmate at their house once a week for the 10 weeks.

What is good about this project, for you?

We hope that by joining in this project, you will feel better about talking and playing with other kids your age. We also hope that we can find out more about kids with ASD so that we can help them if they are having these problems. But we can't say for sure that we will be able to help. There aren't any real risks involved in joining the project. Only the same risks you take when you're playing with a playmate.

Will other people know you took part in this?

All of the information you and your parents tell us and the videos we take of you will be stored on a computer with a password and only the research team will be able to see them. When we talk about the kids in the project with other people, we never use the kids' names so that your privacy is respected.

Want to know more?

Please get your Mum or Dad to contact me if you have any questions or if you would like to know more about the project. Our emails are cally.smith@curtin.edu.au and lauren.parsons@curtin.edu.au, and our telephone is 9266 3600. You can also contact the other team members (see below).

Thank you for your thinking about joining the project. Please keep this letter so that you can check what we have told you.

Thanks,

Cally Smith	**Lauren Parsons**	**Dr Reinie Cordier**
Therapist/Co-Researcher	**Co-Researcher/ Therapist**	**Senior Researcher**
PhD Candidate, Occupational Therapist	PhD Candidate, Speech Pathologist	Senior Research Fellow
School of Occupational Therapy and Social Work	School of Occupational Therapy and Social Work	School of Occupational Therapy and Social Work
Curtin University	Curtin University	Curtin University
Phone: 9266 3600	Phone: 9266 3600	Phone: 9266 3600
Email: cally.smith@curtin.edu.au	Email: lauren.parsons@curtin.edu.au	Email: reinie.cordier@curtin.edu.au

This research has been reviewed and given approval by the Curtin University Human Research Ethics Committee (approval number OTSW-05-2014). Should you wish to make a complaint on ethical grounds, please contact the Human Ethics Committee (Secretary), phone: 9266 2784, email: hrec@curtin.edu.au, mail: C/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth WA 6845

E.4.2   **Verbal assent form**

PRINCIPAL RESEARCHER:	Associate Professor Reinie Cordier
CO-RESEARCHER/THERAPIST	Cally Smith
CO-RESEARCHER/THERAPIST	Lauren Parsons

Child Consent to Participate Form (under age 7)- Playmate

Project Title: Helping children with autism spectrum disorder improve their social play and social communication skills

This will be read to the child:

(Name of clinician) has explained to me that I will be playing for about 30 minutes when I come here to play. I have seen what the playroom with all the toys and activities looks like. I have been shown the video recorder that will be used to tape me while I play. I know that my friend/family member and I will talk with the therapist before each play session and that I will do some tests for about an hour. Some will happen before the play sessions start and some after they are all over. I also know that my parents will organise for my playmate and I to play together once a week. I had a chance to ask as many questions as I'd like about what is going to happen. It all seems fine to me.

(Verbal assent will be obtained from the child)

....
Name of Child (please print)

....
Date

PRINCIPAL RESEARCHER:	Associate Professor Reinie Cordier
CO-RESEARCHER/THERAPIST	Cally Smith
CO-RESEARCHER/THERAPIST	Lauren Parsons

Child Consent to Participate Form (over age 7) - Playmate

Project Title: Helping children with autism spectrum disorder improve their social play and social communication skills

.... has explained to me that I will be playing for about 30 minutes when I come here to play. I have seen what the playroom with all the toys and activities looks like. I have been shown the video recorder that will be used to tape me while I play. I know that my playmate and I will talk with the therapist before each play session and I will do some assessments to learn about my language skills. These will take about 1 hour. Some will happen before the play sessions start and some after they are all over. I also know that my parents will organise for my playmate and I to play together once a week. I had a chance to ask as many questions as I'd like about what is going to happen. It all seems fine to me.

....
Signature of Child

....
Please PRINT name

....
Date

Appendix F   Demographics form

PROJECT TITLE: Helping children with autism spectrum disorder to improve their social play and social communication skills

PRINCIPAL RESEARCHER	Associate Professor Reinie Cordier reinie.cordier@curtin.edu.au Tel: (08) 9266 3600
CO-RESEARCHER/THERAPIST	Cally Smith cally.smith@curtin.edu.au Tel: (08) 9266 3600
CO-RESEARCHER/THERAPIST	Lauren Parsons lauren.parsons@curtin.edu.au Tel: (08) 9266 3600

DEMOGRAPHIC INFORMATION

Primary Caregiver Information

Surname   First Name

Address

Home Phone   Mobile

Email   Fax

Car 1 registration   Car 2 registration

Date of Birth [   ][   ][   ]   Sex   Male [   ]   Female [   ]

Day   Month   Year

Relationship to Child (e.g. mother/father, etc.)

Current Occupation

Highest level of education (completed)

Mother's highest level of education (if not you)

Ethnicity   Aboriginal/ TSI

Is English your first language?   Yes   No   Other language(s) spoken

Country of Birth   Length of stay in Australia   Years

Child Information		

Surname   Name

Date of Birth [ ] [ ] [ ]   Sex   Male [ ]   Female [ ]
Day Month Year

	Yes	No
Are you/or is anyone concerned about your child's intellectual development?	Yes	No
Are you/or is anyone concerned about your child's behaviour at school or at home?	Yes	No
Are you/or is anyone concerned about your child's spoken communication skills at school or at home?	Yes	No
Is your child currently attending any other services (e.g. speech pathology, occupational therapy)?	Yes	No

If Yes, please list: Service attending and reason for referral (e.g. occupational therapy, for fine and gross motor skills)

Has your child been formally diagnosed

with ASD?   [Yes] [No]   If yes, by whom?

Does your child have any other diagnoses?   [Yes] [No]   Please list

Is English your first language?   [Yes] [No]   Other language(s) spoken

Is the playmate a sibling?   [Yes] [No]   Does your child take medication?   [Yes] [No]

If *Yes*, what date did you child start taking medication for his/her ASD? (dd/mm/yyyy)

What type and dosage of medication is your child currently taking and for what reason?

_____

Has your child changed the type of medication s/he was prescribed since s/he was first diagnosed?	Yes	No

If *Yes*, what date did you child change the type of medication? (dd/mm/yyyy)

Ethnicity _____   Postal code where child is living

Country of Birth _____   Length of stay in Australia _____
Years

For Office Use Only		

Identifying number allocated [ ] [ ] [ ]   Group 1 [ ]   Group 2 [ ]

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Appendix G   Intervention materials

G.1   Playroom set up

G.2   Video feed-back and feed-forward

Video-feedback occurred in a room adjacent to the playroom. Children viewed their video on a

laptop with the therapist and parents observed the discussion (see App Figure G-1).

App Figure G-1 Children viewing video-feedback with therapist

Videos contained examples of play interactions from the previous week's play session. The

therapist paused the sequence at the end of each clip to discuss relevant pragmatic language

skills. App Table G-1 contains an example of the video-feedback video structure.

App Table G-1. Video-feedback and -feedforward example.

1. Title screen

2. Reminder: definition of 'red play' and 'green play'

3. Video sequence preceded by feedback on pragmatic langauge skills(s) relevant to the video.

4.   Video sequence preceded by feedback on pragmatic langauge skills(s) relevant to the video.
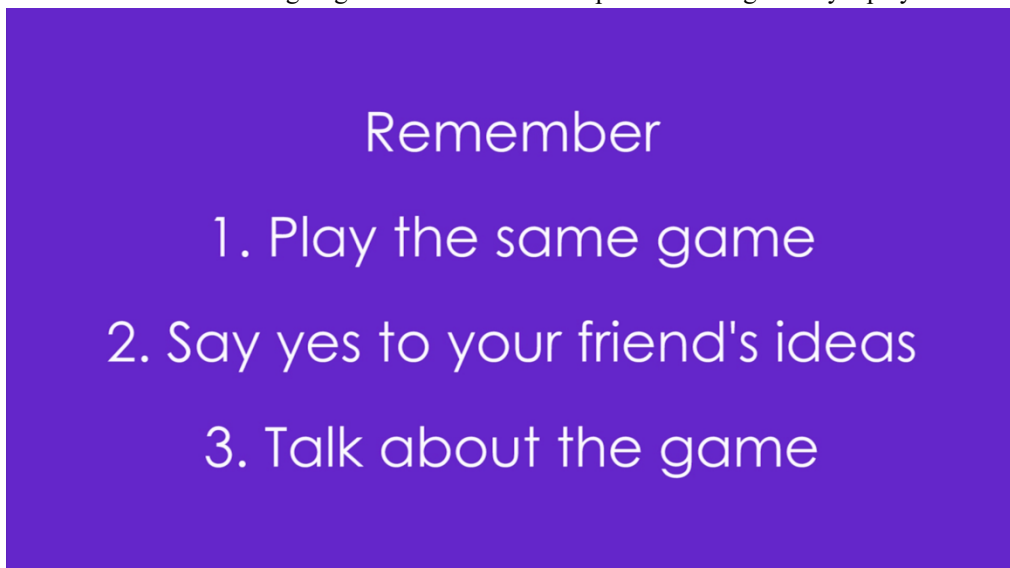

We can **talk about the game**

5. Video sequence preceded by feedback on pragmatic langauge skills(s) relevant to the video.

6. Feed-forward denoting target skills for children to practice during the day's play session

G.3 Parent Manual - *Oober Discovers the World of Play: The Ultimate Guide to Making Friends*

The contents of the Parent Manual used during Phases 2 and 3 of this research were depicted in App Figure G-2 and App Figure G-3.

The Ultimate Guide to Making Friends

Oober Discovers the World of Play

Curtin U

Contents

App Figure G-2 Front cover and contents page of parent manual

App Figure G-3. Parent manual chapter contents

Appendix H   Interview Schedule

The following schedule of questions was used by an independent researcher to conduct interview with parents of children with autism as part of the pilot study reported in this thesis.

INTERVIEW SCHEDULE: 3 MONTHS POST INTERVENTION

Project Title: "Trial of a Peer-to-Peer Play-Based Intervention for Children with Autism spectrum disorder to Improve Social Play Skills and Pragmatic Language"

Parent Name:	
Parent Number:	
Interview Conducted by:	
Date and time of interview:	

- **The purpose of the interview is to see how you found the intervention and to learn how we can improve it**
- **Ask – is it OK to record the interview in person using a voice recorder?**
- **So, tell us a bit about why you were interested in this project to start with?**

Introduce concept of 10-point scale – we're going to get you to rate some things on a 10-point scale, 10 being fantastic and 0 being not so great and then get you to explain your score.

- **What would you give out of 10 for your <u>child's experience</u>?**
- **Did they enjoy coming?**
- **What did they enjoy about it / what do you think made it enjoyable for them?**
- **What did they enjoy the most?**
- **What didn't they enjoy?**

0--5--10

- **What would you give out of 10 for <u>your experience</u>?**
- **What did you enjoy (or not enjoy) about it / what do you think made it enjoyable?**
- **What would have made it more enjoyable for you (if not enjoyable)?**

0--5--10

- **What would you give out of 10 for <u>your child's benefits</u>?**
- **Do you think your child benefited from attending the intervention?**
- **How did you notice it at home?**
- **At school? In the playground? Did the teachers notice any changes?**
- **Did you find any changes in the way they communicated?**
- **What was it about the program that you think caused the changes?**

0--5--10

- **What would you give out of 10 for <u>benefits to you</u>?**
- **Do you think you benefited from attending the intervention?**
- **What do you do / how do you think differently since attending the intervention?**
- **Are you still using the strategies from the intervention? How could these be improved?**

0--5--10

- **What would you give out of 10 for <u>logistics (how easy or hard was it to do the intervention)</u>?**
- **How did you find attending/getting to the clinic?**
- **Bringing the playmate?**
- **Completing home modules (using the DVD and manual)?**

0---5---10

- **How do you think we could improve the intervention?**
- **What did you think about the length of the intervention? Did you need more or less sessions?**
- **Any changes to the DVD or manual?**

- **Do you think there have been any changes in the relationship between you and your child during or after the intervention?**
- **If so, how do you think the intervention affected the relationship between you and your child?**

- **What do you think is needed after the intervention to take your child to the next level in terms of their play and social skills?**
- **What supports do you think you and your child would benefit from over time?**
- **Would you and your child benefit from a top-up of sessions?**
- **Is a longer duration needed?**

Anything else you would like to add?

Appendix I   Pragmatics Observational Measure items

App Table I-1. Pragmatics Observational Measure items and descriptors.

| POM Items	Summative Item Description
Select and introduce	Selects and introduces a range of conversational topics
Maintain and change	Maintains and changes conversational topics appropriately
Contingency	Shares or adds information to the previously communicated content
Initiate	Initiates verbal communication appropriate to the context
Respond	Responds to communication given by another
Repair and review	Repairs and reviews conversation when a breakdown in communication occurs
Facial expression	Uses and responds to a variety of facial expressions to express consistent meanings
Gestures	Uses and responds to identifiable, clear, intentional body actions or movements
Body posture	Uses and responds to clear, identifiable body positioning and stance
Distance	Use of physical space between speakers
Emotional attunement	Being aware of and responsive to another's emotional needs
Self-regulation	Regulate own thinking, emotions and behaviours
Perspective taking	Considers/integrates another's viewpoint/emotion
Integrating communicative aspects	Appropriate use of social language within context
Environmental demands	Adapts behaviour to environmental demands
Attention, planning, initiation	Attends to communicative content, plans and initiates appropriate responses
Communication content	Interprets, plans, organises and delivers content
Creativity*	Versatile ways to interpret/connect/express ideas
Thinking style*	Thinks and articulates abstract and complex ideas
Conflict resolution	Uses appropriate methods for resolving disagreement
Cooperation	Works together; mutually beneficial exchange
Engagement/ Interaction	Consistently gets along well with another peer while engaged
Assertion	Makes clear own opinions, viewpoints and emotions
Express feelings*	Expresses feelings appropriate to the context
Suggests	Makes suggestions and offers opinions
Disagrees	Disagrees in an effective way that promotes the interaction
Requests*	Requests explanations/more information in an effective way

*Item removed from revised POM-2 instrument.

Appendix J   Prediction score calculator

The application for calculating prediction scores, referred to in Chapter 6, can be downloaded from https://bit.ly/2PaJMBX.

An example of the application is provided in App Figure J-1. Instructions for downloading and using the application are as follows:

1. Click the link above or paste it into your browser, then follow the prompts to download and save the Predictor.exe file to a location on your computer (e.g., Desktop).

2. Go to that location on your computer and double click the Predictor.exe file to open.

3. Click the "How to…" button for instructions on how to enter scores and calculate a prediction score.

4. Click "Stop" to close the application.
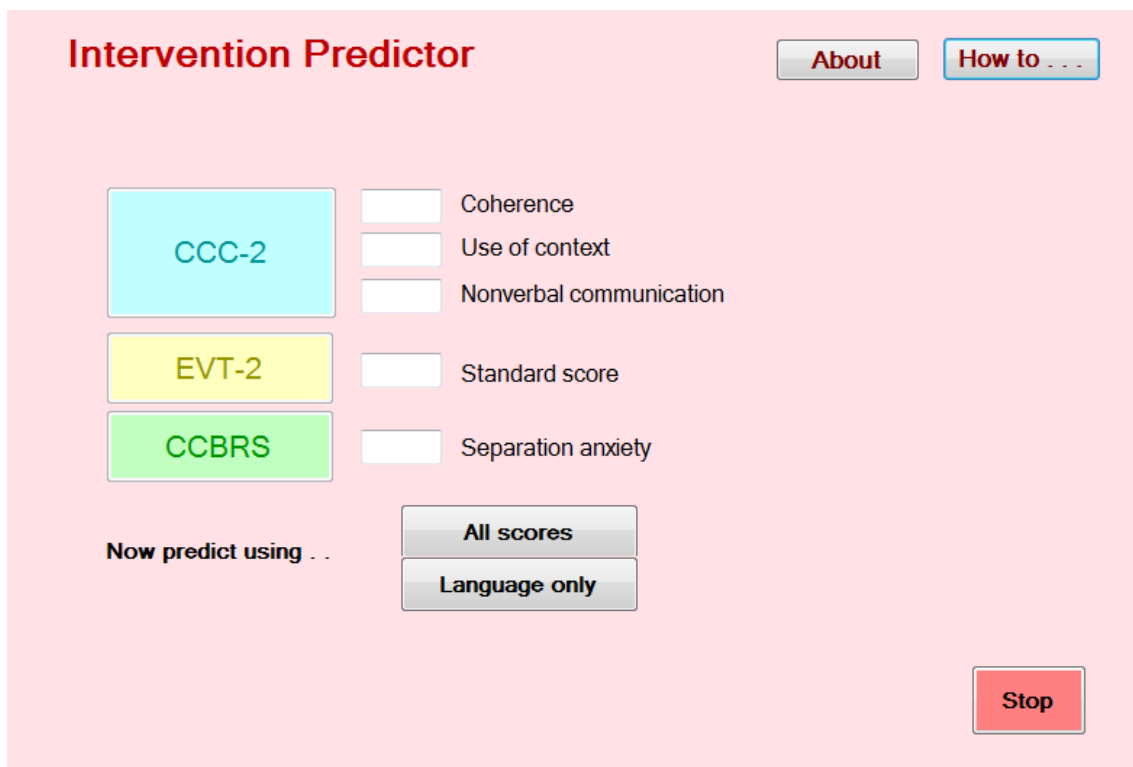
App Figure J-1. Application for predicting children's suitability for the intervention.

Appendix K   Author contribution statements

K.1   Author Contribution Statement: Chapter 2

As co-authors of the paper entitled, '*A systematic review of pragmatic language interventions for children with autism spectrum disorder*', we confirm that Lauren Parsons has been the principal researcher and has made the following contributions:

- Conceptualisation and design of the research;
- Data collection, analysis and interpretation;
- Writing the manuscript and critical appraisal of the findings;
- Corresponding author for communication with the journal

My contribution to the paper was consistent with co-author and involved the

following contributions:

- Assistance with conceptualisation and design of the research;
- Assistance with data collection; and
- Review and editing of the manuscript.

Signed: Renee Speyer   Date: 22/02/2019

Our contribution to the paper was consistent with the role of supervisors and involved the following contributions:

- Assistance with conceptualisation and design of the research;
- Assistance with data analysis and interpretation; and
- Review and editing of the manuscript.

Signed: Reinie Cordier   Date: 22/02/2019

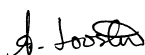*Signed*:   Natalie Munro   Date: 22/02/2019

Signed: Annette Joosten   Date: 22/02/2019

K.2   Author Contribution Statement: Chapter 3

As co-authors of the paper entitled, "*The feasibility and appropriateness of a peer-to-peer, play-based intervention for improving pragmatic language in children with autism spectrum disorder*", we confirm that Lauren Parsons has been the principal researcher and has made the following contributions:

- Conceptualisation and design of the research;
- Data collection, analysis and interpretation;
- Writing the manuscript and critical appraisal of the findings;
- Corresponding author for communication with the journal

Our contribution to the paper was consistent with the role of supervisors and involved the following contributions:

- Assistance with conceptualisation and design of the research;
- Assistance with data analysis and interpretation; and
- Review and editing of the manuscript.

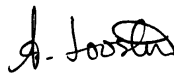*Signed*:   Reinie Cordier   Date: 22/02/2019

Signed: Natalie Munro   Date: 22/02/2019

Signed: Annette Joosten   Date: 22/02/2019

K.3　　　　Author Contribution Statement: Chapter 4

As co-authors of the paper entitled, "*A randomised controlled trial of a play-based, peer-mediated pragmatic language intervention for children with autism*", we confirm that Lauren Parsons has been the principal researcher and has made the following contributions:

- Conceptualisation and design of the research;
- Data collection, analysis and interpretation;
- Writing the manuscript and critical appraisal of the findings;
- Corresponding author for communication with the journal

Our contribution to the paper was consistent with the role of supervisors and involved the following contributions:

- Assistance with conceptualisation and design of the research;
- Assistance with data analysis and interpretation; and
- Review and editing of the manuscript.

Signed:　　　　　　　Reinie Cordier　　　　Date: 22/02/2019

Signed:　　　　　　　Natalie Munro　　　　Date: 22/02/2019

Signed:　　　　　　　Annette Joosten　　　　Date: 22/02/2019

K.4 Author Contribution Statement: Chapter 5

As co-authors of the paper entitled, "*Peer's pragmatic language outcomes following a peer-mediated intervention for children with autism: a randomised controlled trial*", we confirm that Lauren Parsons has been the principal researcher and has made the following contributions:
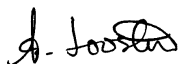
- Conceptualisation and design of the research;
- Data collection, analysis and interpretation;
- Writing the manuscript and critical appraisal of the findings;
- Corresponding author for communication with the journal

Our contribution to the paper was consistent with the role of supervisors and involved the following contributions:

- Assistance with conceptualisation and design of the research;
- Assistance with data analysis and interpretation; and
- Review and editing of the manuscript.

Signed: Reinie Cordier   Date: 22/02/2019

Signed: Natalie Munro   Date: 22/02/2019

Signed: Annette Joosten   Date: 22/02/2019

K.5 Author Contribution Statement: Chapter 6

As co-authors of the paper entitled, "*A play-based, peer-mediated pragmatic language intervention for school-aged children on the autism spectrum: predicting who benefits most*", we confirm that Lauren Parsons has been the principal researcher and has made the following contributions:

- Conceptualisation and design of the research;
- Data collection, analysis and interpretation;
- Writing the manuscript and critical appraisal of the findings;
- Corresponding author for communication with the journal

Our contribution to the paper was consistent with the role of supervisors and involved the following contributions:

- Assistance with conceptualisation and design of the research;
- Assistance with data analysis and interpretation; and
- Review and editing of the manuscript.

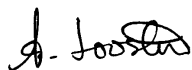*Signed*:   Reinie Cordier   Date: 22/02/2019

Signed: Natalie Munro   Date: 22/02/2019

Signed: Annette Joosten   Date: 22/02/2019