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Efficacy of CBT-based Social Skills Intervention for School-Aged Boys with Autism Spectrum Disorders

by

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Abstract

School-aged children with Autism Spectrum Disorder (ASD) experience significant difficulty with peer interaction (Lord & Bishop, 2010), an important aspect of childhood. Unresolved social skills difficulties lead to continued dysfunction in relationships which influence long term success. Research into the most effective strategies has increased but several questions remain. One approach that appears to help school-aged children is Cognitive Behavior Therapy (CBT) which focuses on changing how a person thinks about specific social situations as well as how they behave.

This study evaluated the efficacy of a 15-week CBT-based social skills group intervention for boys aged 10-12 years diagnosed with an Autism Spectrum Disorder. Boys with average or better receptive language skills and IQ attended weekly sessions focused on teaching self-monitoring skills, social perception and affective knowledge, conversation skills, taking another person's perspective, social problem-solving, and friendship management skills. Group size varied from four to six participants. The intervention was based on two intervention programs available in the literature and was manualized.

Eight of the fifteen participants were waitlisted (Delayed Treatment group) while the remaining participants began 15 sessions of intervention immediately (Immediate Treatment group). A repeated measures ANOVA was used to compare the Delayed Treatment group to the Immediate Treatment group on pre and post measures of social perception, peer interaction, social knowledge,

pragmatic language, social responsiveness and general socialization skills. Compared to the Delayed Treatment group, the Immediate Treatment group showed significant improvements after intervention in social perception, peer interaction, and social knowledge. The Delayed Treatment group was also examined on all measures at three time points: prior to the waitlist time, pre-intervention, and post-intervention. Significant improvements only after intervention were present for peer interaction, social knowledge, and a parent report measure of socialization. The implications of these findings are discussed in relation to a model of social information-processing, the executive functioning theory of autism, and how cognitive behaviour therapy techniques may contribute to social skills intervention for children with ASD. The intervention used in this study shows promise but replication with larger samples is needed.

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Chapter 1: Introduction

Marcus is a 10-year-old boy who loves Yugio cards, knowing exactly when things will happen, and doing math calculations in his head. He learned how to read and write by the time he was three, just by sitting on his dad's lap while Dad read the Saturday paper. Marcus can memorize facts and loves math worksheets, often asking his teacher for extra ones for the weekend. He never forgets to brush his teeth or make his bed.

At school, not too many other 10-year-olds are into Yugio cards any more and some kids have started to make fun of Marcus when he loudly asks for more math "homework." Though he reads a lot, the comprehension demands of grade 5 language arts are becoming more challenging. Marcus' love for order and predictability haven't been a good fit for his new easy-going teacher to deal with and school is getting to be a place where Marcus is more and more frustrated. At home, things are still going okay as long as there aren't changes to the schedule. At home, everyone knows how Marcus likes things.

"I want to be their friend," Marcus has told his mom about the group of boys who hang out at lunch and talk about things like Star Trek, the hockey scores, and how to download videos. His attempts to join them, even with some coaching by his mom, have not been successful, even though they're nice kids and Marcus does know some things about Star Trek and a lot about how to download stuff from the computer. Some of the guys from his class bug him when the teacher isn't around about all kinds of things, his clothes, the things he says, and sometimes they say things that really make him mad.

Marcus' parents have two older children who are now in high school and they're worried about how Marcus will adjust to junior high in a few years. The diagnosis of Asperger's syndrome 4 years ago helped explain a lot of the challenges Marcus faces. They know Marcus is bright as his full scale IQ was 126, but they are most worried about how he will get along socially. He is more aware of the social difficulties he's having and his self-esteem is a concern for his mom.

The challenges Marcus faces and the concerns of his family are typical of children with Autism Spectrum Disorder (ASD) in middle childhood. ASD is an umbrella term, which under proposed criteria for the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V; American Psychiatric Association, 2010) encompasses autistic disorder (autism), Asperger's disorder (or syndrome, AS), childhood disintegrative disorder, and pervasive developmental disorder, not otherwise specified. ASD is a neurodevelopmental disorder, which is present from infancy. According to proposed criteria, diagnosis of the disorder requires the presence of social/communication deficits, and fixed interests and repetitive behaviours. A change in terminology is proposed in the DSM-V because a spectrum more accurately represents the state of knowledge about the various disorders, and improves specificity of diagnosis (American Psychiatric Association, 2010). Children who have average or above IQ are considered to have High-Functioning Autism (HFA) or Asperger's Syndrome (AS) but strong evidence suggests that HFA and AS are not discrete phenotypes of ASD and represent quantitative rather than qualitative differences (Kamp-

Becker et al., 2010; Lewis, Murdoch, & Woodyatt, 2007; Macintosh & Dissanayake, 2006; Ring, Woodbury-Smith, Watson, Wheelright, & Baron-Cohen, 2008; Saulnier & Klin, 2007). Thus, in this paper they are referred to as ASD. Specific reference to HFA or AS is made only when a research paper refers to the participants in this specific way.

Studies of children in Marcus' age group who have ASD have indicated that they often have few friends (Koning & Magill-Evans, 2001a); have difficulty defining what a friend is (Bauminger & Kasari, 2000); experience feelings of rejection without the ability to change behaviours, feel picked on and bullied by peers (Church, Alisanski, & Amanullah, 2000, National Autistic Society, 2006) and experience loneliness (Bauminger & Kasari, 2000), anxiety (Brereton, Tonge, & Einfeld, 2006), depression, (Stewart, Barnard, Pearson, Hasan, & O'Brien, 2006), and decreased participation in recreational activities (Potvin, Prelock, & Snider, 2008). With increased social demands in middle school and junior high, they also experience increased levels of anxiety (Adreon & Stella, 2001), which are often associated with the decreased structure in junior high and high school (Howlin, 2007). Interestingly, Howlin found that children with an IQ over 100 did less well socially than children with an IQ between 70 and 100. Children who are "higher functioning" may be at greater risk for socio-emotional difficulties and require more support. Well-documented concerns about children with ASD in middle childhood include bullying experiences (National Autistic Society, 2006).

Lord (2007) examined indices of optimal functioning in adolescence and suggested that depression and anxiety emerge as significant barriers even though

problem behaviours decrease as children with typical IQ reach adolescence. Both Howlin (2007) and Lord suggest that improved peer interactions during middle to later adolescence are important factors in overall adaptive functioning for older children with ASD.

It is important to address the needs of children in middle childhood because there is a growing body of research examining the long-term outcome for children like Marcus. Howlin and colleagues' study (Howlin, Goode, Hutton, & Rutter, 2004) of 68 adults who had been diagnosed with ASD as children showed that, even with an IQ in the typical range, adult outcome was variable. Quality and number of friendships, independent living, and overall social outcome were poor despite continued academic progress, and many of the study participants remained dependent on support offered by families and social agencies. Adult outcome studies also provide additional support for an increased susceptibility to psychiatric conditions for adolescents and young adults with persistent social difficulties (Eaves & Ho, 2008; Muller, Schuller, & Yates, 2008).

Although our understanding of the strengths and difficulties of children with autism has grown enormously, we know relatively little about how best to support their development so that they are able to function well in their community. Only one recent longitudinal study by Anderson and colleagues (Anderson, Oti, Lord, Welch, & 2009) provides support for social skills intervention as an important predictor of social trajectories and verbal abilities over time. Numerous studies (e.g., Downs & Smith, 2004; Gutstein & Whitney, 2002; Klin, Jones, Shultz, Volkmar, & Cohen, 2002) identify specific social

difficulties but few provide definitive answers about the effects of specific interventions, particularly for children with normal range IQs.

Two recent literature reviews of social skills intervention for school-aged children with ASD (Rao, Beidel, & Murray, 2008; Williams White, Koenig, & Scahill, 2006) provide direction for improving methodology in intervention studies and suggest promising avenues for treatment content and delivery. These authors have begun the process of defining successful strategies. Both of these reviews and a recent paper examining a paradigm for evaluating efficacy (Koenig, De Los Reyes, Cicchetti, Scahill, & Klin, 2009) suggest that we need to move towards a clear understanding of the nature of social deficits in individuals with ASD and an understanding of why one intervention might be more effective than another. The research described in this dissertation begins the process of addressing 1) how intervention might be linked to theories about the development of social competence and executive functioning in autism and 2) methodological concerns identified by previous reviews.

Theories of autism have sought to define the underlying cognitive deficits associated with autism. Three cognitive deficit theories are currently prominent, each suggesting a different fundamental area of impairment as explanatory of core deficits in language and social reciprocity in ASD. These three, the theory of mind hypothesis, weak central coherence theory and the theory of executive functioning deficits are explained briefly. In addition, a well-known theory, social information-processing, developed to understand how typically developing children develop social information-processing skills, provides additional

direction for considering how components of social interaction such as social perception and problem-solving work with environmental context to influence the child's ability to interact effectively with others. Cognitive behavioural therapy (CBT), founded on the theory that effective behavioural change is based on linking thoughts, feelings, and behaviours, and changing these factors by primarily focusing on changing thoughts provides a method for addressing how positive changes in social interaction might be taught to children with ASD.

In the review of the literature that follows, three prominent theories about the source of social difficulties in ASD are examined. Executive functioning theory is explained in greater detail because research that examines components of executive functioning provides a strong explanation for understanding the underlying deficits contributing to social interaction difficulties. This theory also can be used to understand why an intervention based on CBT may prove effective. Links between executive functioning, social information-processing, and CBT may provide some insight into where social interaction intervention should be targeted and why change might be anticipated in some areas and not others.

Statement of the Problem/Research Question

This study contributes to understanding the efficacy of social skills intervention by measuring changes in social interaction skills after the delivery of a 12-week group-based intervention. Boys aged 10 to 12 years, who had IQ scores in the normal range and have a diagnosis of Autism Spectrum Disorder are the focus of this study. There is a growing body of research on social skills

intervention for this group but many questions remain regarding whether interventions aimed primarily at changing a child's social skills are effective. This study examined the effectiveness of CBT – a cognitive behavioural intervention that focuses on changing the child's behaviour by helping the child learn to modify the way the child thinks about his/her behavior, which may be a critical factor in the development of social skills for children with ASD. Evidence for the use of CBT for social skills intervention for children with ASD is just emerging. Children aged 10 to 12 years old were chosen because research suggests that this is a time when children with ASD show a greater interest in peer interaction and there are negative implications of not being competent at this age (Bauminger & Kasari, 2001; Rutter, 1970; Schopler & Mesibov, 1983).

Chapter 2: Review of the Literature

In order to understand the context for this research, several theoretical areas need to be addressed. The first area is how social processes are conceptualized within theories of autism. This provides a framework for understanding what the targets of intervention should be. The second area concerns how the concept of social information-processing is understood in typically developing children and the contribution that this makes to how we understand specific deficits in children with ASD. This provides some direction for how change can be measured and areas where intervention might be focused. The third area examines a way of conceptualizing the actual intervention. Research examining CBT and why it might be a particularly effective method for providing social skills intervention is discussed, especially in relation to aspects of executive functioning.

In addition to theories of autism, social information-processing and its relationship to areas of difficulty in ASD, and CBT, this chapter provides an overview of current research examining efficacy of social skills intervention for school-aged children. Methodological concerns of previous research are identified, with the goal of providing a framework for improved rigor and increased bias control in this research.

Theories of Autism and Social Processes

From Kanner's (1943) first description of "early infantile autism," social difficulties have been a hallmark of the diagnosis. Current classification criteria for ASD include deficits in social interaction [World Health Organization, 1993;

Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision; DSM-IV TR (American Psychiatric Association, 2000)]. Researchers have used a variety of theoretical models to explain the nature and foundation of social difficulty in children with ASD (Carter, Ornstein-Davis, Klin, & Volkmar, 2005). Because our understanding of the basis for social dysfunction in autism has significant implications for the strategies used to provide social skills intervention, the three most applicable theoretical models of autism that focus on cognitive explanations for ASD (theory of mind, weak central coherence, and executive functioning) are reviewed. Considerable research has attempted to explain the unique contribution each theory makes to understanding social processes in autism as well as the relationships among these theoretical models (e.g., Burnette et al., 2005; Hoy, Hatton, & Hare, 2004; Pellicano, Maybery, Durkin, & Maley, 2006; Joseph & Tager-Flusberg, 2003). A greater emphasis is placed on the executive functioning theory because recent evidence provides strong support for its value in understanding how people with ASD process information. Examining all three theories provides valuable insights about the nature of social skills deficits in ASD and how to appropriately provide intervention.

Theory of mind. The theory of mind hypothesis proposes that a primary underlying deficit in autism involves the ability to interpret and use mental states to predict others' actions and respond appropriately (Baron-Cohen, 2000). Attributing mental states to oneself and to others is termed theory of mind (Premack & Woodruff, 1978) and the ability to make these cognitive attributions is considered to be a critical social cognitive skill. Proponents of this theory

suggest that deficits in theory of mind provide a persuasive argument for the communication and reciprocal social interaction impairments seen in autism (Baron-Cohen, 1988; Happé, 1994). Baron-Cohen, Leslie, and Frith (1985) first demonstrated theory of mind deficits in children with autism by comparing them to children with Down's syndrome and typically developing children on a task which required them to determine where a puppet would believe a marble was located after it had been moved while the puppet was gone. Twelve of 14 children with Down's syndrome of similar chronological age but lower verbal and nonverbal IQ than the children with autism gave the correct answer. Similarly, 23 out of 27 typically developing children whose chronological age was lower than the mental age of the children with autism were correct. In contrast, 16 out of the 20 children with autism answered incorrectly, guessing that the puppet would think the marble was in the place to which it had been moved and where the child with autism had seen it placed. This suggested that 80% of the children with autism were unable to accurately impute beliefs to others; they could not determine that the puppet, not having seen the marble being moved, would think the marble was where it had been placed originally. This deficit in the ability to judge the mental states of others was subsequently replicated by other researchers as reported in a comprehensive review by Baron-Cohen (2000). The impairments related to theory of mind demonstrated by many children with ASD provide a possible cognitive explanation for deficits in social reciprocity such as difficulty taking the perspective of another person, lack of empathy, and problems in

recognizing and responding to the emotions of others (Baron-Cohen, 1988; Baron-Cohen, Knickmeyer, & Belmonte, 2005; Frith, 1989).

Questions regarding the children with autism who were able to pass theory of mind tasks remained unresolved. A thoughtful review of theoretical models for autism by Happé (1994) suggested that theory of mind deficits were not characteristic of all children with autism and that other cognitive deficits might precede difficulties with attributing mental states. In response, several researchers (e.g., Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001; Kleinman, Marciano, & Ault, 2001) demonstrated that higher functioning children with ASD do have difficulties with theory of mind if the measures correspond to their intellectual functioning. Considerable controversy remains regarding the view that all children with ASD have deficits in theory of mind and whether measures that do not find deficits are sensitive enough (Rajendran & Mitchell, 2007).

Efforts relating difficulties passing theory of mind tasks, even when they are developmentally challenging, to symptom severity in social or communicative functioning have not been successful. In Joseph and Tager-Flusberg's (2004) study, language ability accounted for the largest portion of the variance in the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 1999) communication score. Relationships between theory of mind measures and severity of communication impairments were no longer significant once the effects of language were controlled, suggesting that impairments in language and language acquisition may at least partially account for difficulties with theory of mind. In addition, these researchers also found that theory of mind was not related

to ADOS social interaction scores, supporting the idea that an impaired ability to represent mental states is insufficient to explain social interaction deficits.

Weak central coherence theory. A second cognitive theory proposed originally by Frith (1989) suggested that persons with autism have a core weakness in information-processing manifested in difficulties understanding global meaning. Weak central coherence theory (WCC) originally proposed that a primary difference in children with autism was the inability to process incoming information in context for the gist or higher-level meaning (Happé & Frith, 2006). Frith had suggested that children with autism showed a preference for detail-focused processing, at the expense of global understanding of meaning. Several studies failed to demonstrate superior performance by persons with autism on various tasks expected to favor local processing (e.g., Brian & Bryson, 1996; Ozonoff, Pennington, & Rogers, 1991), so the validity of Weak Central Coherence theory as the fundamental deficit has been questioned. Recently, Happé and Frith (2006) reviewed the research examining central coherence theory, and made revisions to the original theory to focus on the possible superiority of detail-focused processing existing alongside social deficits, rather than specifically causing social difficulties.

Executive functioning theory. The body of research in executive functioning processes in autism (for reviews see Hill, 2004; Kenworthy, Yerys, Anthony, & Wallace, 2008; Robinson, Goddard, Dritschel, Wisley, & Howlin, 2009) provides one of the most promising explanations for linking cognitive function and behaviour in autism. Executive functioning is defined as "the ability

to maintain an appropriate problem-solving set for attainment of a future goal; it includes behaviours such as planning, impulse control, inhibition of prepotent but irrelevant responses, set maintenance, organized search, and flexibility of thought and action" (Ozonoff et al., 1991, p. 1083).

Across many diagnostic categories, research has found links between executive dysfunction and difficulties in domains of social-emotional function including impulsivity, understanding of mental states, recognition of consequences of actions, distractibility, and action selection (Hughes, 2002; Morgan & Lilienfeld, 2000; Stuss & Benson, 1984). Research on the social cognitive processes related to executive functioning has provided insight into differences between children with ASD and typically developing children (Lopez, Lincoln, Ozonoff, & Lai, 2005; Ozonoff et al., 1991; Pennington et al., 1997). Many researchers have suggested that executive functioning deficits may underlie other cognitive deficits seen in children with autism, including theory of mind (e.g., Carlson & Moses, 2001; Hughes and Russell, 1993, Ozonoff et al., 1991; Pellicano, 2007).

The universality of executive functioning deficits in children with autism has been addressed in many studies, with varied results. A comprehensive review by Hill (2004), and a more recent review of research published since 2004 by Kenworthy et al. (2008) reveal mixed results regarding deficits in executive functioning in autism. In 2004, Hill concluded that research on executive functioning impairments in autism was only just beginning and that a greater focus on the neuroanatomical framework of executive systems and the

developmental pattern of executive dysfunction might provide a clearer picture of the role of executive functioning in autism. She also suggested that inconsistencies in results might be attributed to methodological differences, particularly because many studies included children with cognitive impairments, which might itself explain executive functioning difficulties. Kenworthy and colleagues' review (2008) confirmed the continued mixed results but also provided a clear explanation for why results might be mixed. They suggested that measuring executive functioning in the lab does not provide an ecologically valid measure of executive functioning. More conclusive evidence from "ecologically valid" measures, designed to tap real-life scenarios, might provide stronger evidence for the universality of executive functioning deficits (White, Burgess, & Hill, 2009). These ecologically valid measures of executive functioning are "open-ended" in that they are designed to allow for a number of different ways of completing a task (White et al., 2009). White and colleagues suggest that one explanation for why children with ASD fail more open-ended tests of executive functioning is that these tests present situations where the child needs to make choices based on an implicit understanding of what is expected as well as the ability to respond according to social norms, which is a more difficult executive functioning task.

Research has examined many aspects of executive functioning in order to understand those most affected in autism. Evidence for differences in planning, mental or cognitive flexibility, inhibition, generativity, and self-monitoring are examined and implications for social skills are suggested.

Planning. The ability of persons with ASD to sequence actions to achieve a goal based on monitoring, re-evaluating, conceptualizing, and anticipating changes has been examined (e.g., Bennetto, Penninton, & Rogers, 1996; Booth, Charlton, Hughes, & Happé, 2003; Ozonoff & Jensen, 1999). Children with ASD and IQ scores at the lower end of the normal range show significant impairments on tasks such as the Tower of London and Tower of Hanoi where participants move beads from a prearranged order to a goal that the researcher determines (Geurts, Verte, Osterlann, Roeyers & Sergeant, 2004; Hughes, Russell, & Robbins, 1994; Ozonoff & Jensen, 1999; Ozonoff & McEvoy, 1994). However, when using computerized versions of the same measures, children whose IQ was in the average range had less difficulty (Happé, Booth, Charlton, & Hughes, 2006). Kenworthy et al. (2008) postulated that children with ASD pass computer versions versus human administered measures because it is the socially-mediated response to feedback and adherence to socially-presented arbitrary rules that are difficult for children with autism. These findings provide additional support for global deficits in executive functioning of children with ASD.

The inconsistent results of research measuring planning both as part of a more complex task addressing other areas of executive functioning and as a unitary construct for children with ASD and IQs in the normal range, led to Kenworthy and colleagues' (2008) call for ecologically valid measurement. They suggest that planning is particularly difficult for individuals with autism when the task requires more complex problem-solving (Hughes et al., 1994) and real-life planning is inherently complex. Furthermore, they propose that ecologically valid

measurement of executive functioning may lead to more consistent results that demonstrate the difficulty children with ASD have in this area.

Few research studies have addressed the application of planning difficulties to "real-life" social problem-solving difficulties. One study examining social problem-solving, which includes aspects of planning, in children and adolescents with ASD found difficulties in the ability to identify a specific social goal, generate socially appropriate solutions, and make comparative judgments in order to evaluate future actions (Channon, Charman, Heap, Crawford, & Rios, 2001). Embregts and van Nieuwenhuijzen (2009) examined social problem-solving using a problem solving measure which required children to respond to questions about videotaped vignettes of social problems children might encounter. They found that boys with ASD aged 10 to 14, whose IQ was in the mild to borderline IQ range, differed from typically developing boys, matched on IQ, on many skills related to social problem-solving including response generation, evaluation of solutions, and determination of an assertive response. Goddard, Howlin, Dritschel, and Patel's (2007) study included a measure of social problem-solving in adults with ASD. They also found less effective and less relevant solutions to hypothetical problems among these adults. Only one study has directly examined both executive functioning and problem-solving in individuals with ASD. Channon (2004) looked at everyday problem-solving using a measure called the "Predicaments task" (Channon & Crawford, 1999) in which the participant generates a range of solutions and selects appropriate solutions from both a practical and social point of view. Small but positive correlations between

scores on this measure and standardized measures of executive functioning were found.

Cognitive flexibility. Cognitive flexibility is particularly important in social interaction because the ability to shift to a different thought or action according to changes in a situation is necessary in order to, for example, respond appropriately when conversations shift direction or require that a different perspective be taken. The potential relationship between "qualitative impairments in social interaction and communication" (DSM-IV-TR, American Psychiatric Association, 2000) is mapped onto specific cognitive flexibility deficits by Geurts, Corbett, and Solomon (2009). Examples include an inability to shift visual attention from eyes to mouth, from one speaker to another, an inflexible application of social rules, difficulties in shifting conversation topics, perseveration on one meaning of a word, or a more general inflexible use of language.

Consistent differences in cognitive flexibility have been found when comparing children with ASD to typically developing groups (e.g., Ozonoff & Jensen, 1999) and children with other developmental disorders (e.g., Bennetto et al., 1996; Liss et al., 2001) using measures such as the Wisconsin Card Sorting Task (WCST). The WCST allows researchers to examine perseverative errors to determine whether the child or adult with ASD is able to shift to a new sorting criterion. Links between executive functioning and the ability to "plan on-line" in social contexts and quickly adapt social behaviour to changing contextual and dynamic features of social interactions seem logical, despite mixed research

results. Research directly examining these links is emerging, including findings of significant correlations between executive functioning tasks such as set-shifting and the ability to respond flexibly to context specific social demands (Berger, Aerts, van Spaendonck, Cools, & Teunisse, 2003), and between executive functioning tasks and joint attention (McEvoy, Rogers, & Pennington, 1993).

Mackinlay, Charman, and Karmiloff-Smith's (2006) study examining the ability to "multi-task" or organize and coordinate multiple activities in a manner more consistent with everyday life, taps both planning and cognitive flexibility. Their study compared boys with Asperger Syndrome (AS) and typically developing controls and applied an executive functioning paradigm to examine differences between the two groups. Boys with AS demonstrated inflexibility in switching between tasks, as well as poor planning. Interestingly, they did not have greater difficulty carrying out plans, suggesting some ability to monitor performance, a metacognitive skill that may be less impaired. These results are consistent with a study by Kleinhans and colleagues (Kleinhans, Akshoomoff, & Delis, 2005) who found that adults and adolescents with HFA had difficulty only on tasks that required generating efficient cognitive search strategies and problem-solving techniques.

Generativity. Generativity is defined as the ability to generate novel ideas, often measured using tests of verbal and ideational fluency. Although less directly related to social difficulties than other areas of executive functioning, impairments in generating novel ideas and behaviours spontaneously have been shown to produce inappropriate and repetitive responses, less imaginative responses, and a

failure to adopt self-cueing techniques to improve performance in children with autism (Turner, 1999). For example, generativity impairments might affect an individual's ability to improvise in social situations where people behave in ways that are inconsistent with expectations. In social interaction, this might also affect their ability to use what they know about a person and their previous interactions with that person to produce a novel response or improvise to maintain a conversation.

Relatively few studies have specifically measured generativity in autism. Turner (1999) reported decreased generativity for both word and ideational fluency tasks and more perseverative responses in individuals with ASD. Fluency tasks measure the ability to generate novel ideas and behaviours spontaneously, often in response to a single cue. With respect to social skills, impairments in word and ideational fluency might be considered consistent with a lack of spontaneity and initiative (Bailey, Phillips, & Rutter, 1996). Links between generativity and pretend play with novel toys have also been found (Rutherford & Rogers, 2003). Only one study has linked generativity to communicative abilities in ASD. Bishop and Norbury (2005) showed a significant positive relationship between generativity and communication and a trend for a relationship with social and stereotyped autism symptomatology. Generativity was significantly correlated with the Children's Communication Checklist (Bishop, 1998) pragmatic composite and the Autism Diagnostic Observation Schedule – Generic (ADOS-G; Lord et al., 2000) communication scale, even with structural language and age partialled out. They suggested that this finding was not simply due to an inability

of children with autism to generate ideas, but that these children had difficulty generating ideas that were relevant to context.

Self-monitoring. Self-monitoring refers to the ability to reflect on and monitor one's own thoughts and actions, a critical skill in adjusting to changing social demands. Studies examining the ability to take a third person perspective on one's own goal-directed actions rather than the ability to make judgments and distinguish between self-other (Hill & Russell, 2002) have generally failed to find self-monitoring deficits as a core executive dysfunction in autism. Henderson and colleagues (2006) state that self-monitoring may be a moderator of difficulties rather than a specific deficit. Their findings that children with better response monitoring skills are more likely to have fewer social communication difficulties may explain the success of Bauminger's (2002) cognitive behavioural intervention for children with ASD. The intervention used in her study explicitly focused on training in the ability to consider the anticipated results of various social alternatives. This social problem-solving emphasis provides children with skills to monitor their own responses based on thinking about how their own responses would affect others.

Linking executive functioning skills to social skills. Aspects of planning, cognitive flexibility, inhibition, generativity, and self-monitoring can be directly or indirectly linked theoretically to social skills. Research on planning and problem-solving suggests that social skills intervention could explicitly teach step-by-step strategies for problem-solving, and encourage explicit self-monitoring techniques to evaluate responses from others. Research on cognitive

flexibility as well as self-monitoring supports social skills intervention that teaches the use of specific strategies to link what a conversation partner is saying to a question that one can ask to maintain the dialogue. Directly teaching children with autism to think about what the other person is saying, and then generating possible "follow-up" questions may provide the child with opportunities to create mental schemas for social interaction. Strategies for using what people say to guide children's responses may also be a way to overcome difficulties generating novel ideas that are relevant to context. Specific social skills intervention might focus on using contextual and emotional cues to help children to think about what others might be thinking and feeling.

Further research is needed to demonstrate how deficits in executive functioning might cause difficulties in social functioning (Ozonoff, South, & Provencal, 2005) and vigilance regarding the nature of how executive functioning is measured and how it relates to specific social deficits is needed. Little research has examined direct links between executive functioning and social skills and even less is known about the links between this theory of autism and how intervention for social skills difficulties is provided. Two important theories, one from social information-processing literature and one from cognitive behavioural literature, provide insights as to how social difficulties in autism are understood and how they may be treated.

Social Information-Processing

Crick and Dodge's (1994) social information-processing model provides a framework for considering difficulties that children with ASD have in social interactions. It examines interacting relationships and predictors and provides a framework for understanding and evaluating specific abilities and goals within specific contexts. According to this model, social information-processing consists of six sequential steps (see Figure 1) including the encoding of relevant stimuli, interpretation of these cues, setting social goals, forming a mental representation based on past experiences and contextual cues, selecting possible responses, and enacting a response. The model includes feedback loops which indicate that children may engage in multiple steps of information-processing at the same time, using information to plan and respond. Crick and Dodge suggest that reception and interpretation of social messages (contextually-based verbal and nonverbal social information), clarification of goals, response access or construction, response decision, and behavioural enactment are influenced by a cognitive "data base" which includes memory store, acquired social rules, social schemas, and social knowledge. The model provides a guideline for identifying the social information-processing deficits of children with autism and areas for possible intervention for these children.

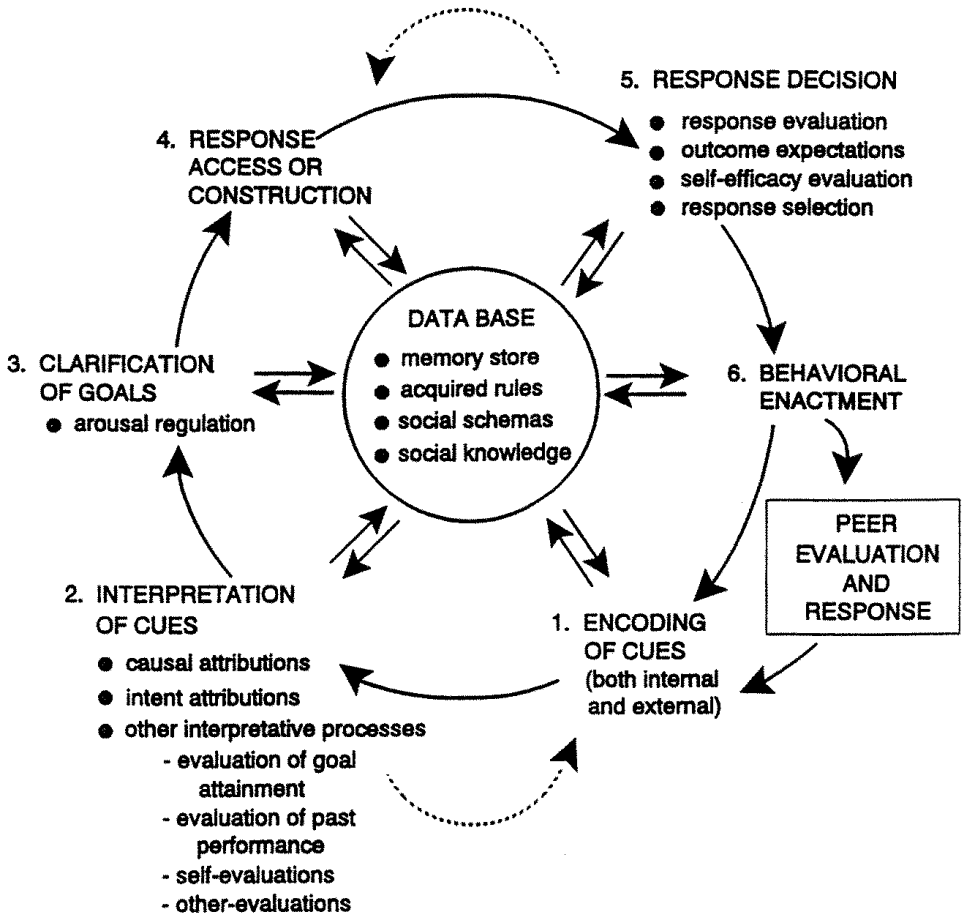

Figure 1. Crick and Dodge's (1994) social information-processing model. Used with permission from the authors.

The model of social information-processing is important in ASD because children who are considered high-functioning by virtue of IQs in the average or above average range have social deficits which are primarily centered around social reciprocity, social cognition, and pragmatic language (e.g., Adams, Green, Gilchrist, & Cox, 2002; Church et al., 2000; Downs & Smith, 2004). Examples of difficulties related to the model of social information-processing include decreased initiation of social interactions with peers (Orsmond, Krauss, & Seltzer, 2004), decreased social responsiveness (Volkmar, 1987), difficulties with inferring others' emotions and responding appropriately (Koning & Magill-Evans,

2001a; Ozonoff, Pennington, & Rogers, 1990), difficulties with perspective-taking (Rehfeldt, Dillen, Ziomek, & Kowalchuk, 2007), and difficulties understanding the social rules and conventions of interaction (Church et al., 2000).

The social information-processing model is particularly useful as a guide for examining social skills difficulties because it considers skills such as cognitive flexibility, planning, generativity, and self-monitoring identified in the executive functioning theory of autism, while also taking into account social context and motivation to interact. Research examining core deficits in social reciprocity has focused at the level of specific components or skills thought to be central to general social impairments. Some areas, such as social perception, friendship, attributing others' mental states, and pragmatic language have been systematically addressed in autism research.

The first and second steps in Crick and Dodge's (1994) model are the perception or encoding and interpretation of both verbal and nonverbal cues of social information-processing. Nonverbal components include the ability to understand emotion from facial expressions, tone of voice, body posture, and gestures. This component of social information-processing considers the ability to process facial expressions, considered a critical skill in social perception (Ekman & Oster, 1979). Lemerise and Arsenio (2000), who have examined the role of emotion processes in social competence in typically developing children, suggest that the process of encoding and interpreting cues requires that one attend to the ongoing nuances of both one's own and another's affective cues.

More than two decades of research in autism has examined whether the ability to attend to and process affective cues from facial expressions is a core deficit in ASD (e.g., Grossman, Klin, Carter, & Volkmar, 2000; Hobson, Ouston, & Lee, 1988; Hobson, Ouston, & Lee, 1989; Klin et al., 1999). In addition, Grossman and colleagues (2000) found qualitative differences between children diagnosed with AS and controls, in how they resolved ambiguity between facial expressions and a mismatched emotion label, despite the finding that there were no differences between the groups at recognizing simple emotions. When their participants viewed facial expressions labeled with a mismatched emotion, they made significantly more errors than controls when choosing the correct emotion, relying on the word rather than the picture even though they correctly identified the emotions when just the picture was presented. Grossman and colleagues suggest that more challenging tasks result in more compensatory, verbally biased strategies and attending more to visual-verbal cues (the mismatched word below the picture) than visual-affective cues (the picture depicting the emotion). However, their results might be explained by cue salience, executive processing, and language comprehension. Given this uncertainty, intervention could teach children to focus attention on facial cues in order to identify how the person they are interacting with is feeling.

Few studies have examined how children with ASD encode and interpret cues in their everyday lives or how they deal with contextually relevant cues presented simultaneously (Klin, Jones, Shultz, & Volkmar, 2003), particularly for children with ASD who have average or above average IQ. In contrast to research

examining static single domain cues such as photographs of facial expressions, studies that have used dynamic video stimuli have shown that children with ASD perform consistently worse than typically developing children. Koning and Magill-Evans (2001a) used a measure of social perception, which presents multiple simultaneous nonverbal cues (facial expressions, tone of voice, gestures, situational cues) in video vignettes. Compared to age, gender and IQ-matched controls, adolescents with ASD had marked impairments in the ability to make inferences about the emotional state of others. A more recent study by Rump and colleagues (Rump, Giovannelli, Minshew, & Strauss, 2009) used a dynamic video presentation of emotions and found similar results with significantly poorer performance of children with ASD, across all age groups. A recurring theme, described by Church and colleagues (2000) in extensive chart reviews and interviews with parents of children with ASD, was that children could identify emotions in a formalized setting or static presentation but, according to their parents, they did not react to expressed emotions in spontaneous, contextually dependent real-life situations.

The ability to infer another's thoughts and feelings is also closely related to encoding and interpreting social cues. Research examining the ability to infer another's thoughts and feelings has also made significant contributions to understanding social perception deficits in ASD. Faux pas recognition studies (e.g., Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997; Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999) have demonstrated that children with HFA may say something hurtful (commit a faux pas) without realizing it. The

ability to recognize a faux pas requires understanding how another might feel and empathizing with this feeling, as well as understanding the social rules governing that particular situation; both critical skills in maintaining close relationships (Eisenberg & Fabes, 1990). In order to provide an appropriate response (and prevent a faux pas), the child with ASD must be able to both generate a response based on recognition of subtle cues and inhibit a potential prepotent response. In order to effectively cope with situations where a faux pas has already been committed, the child must recognize another's discomfort, feel compelled to "right" the faux pas, and generate a response based on social rules specific to that situation. Much of the success of both preventing a faux pas and coping effectively once one has been committed depends on the child's ability to process and interpret nonverbal and verbal cues, while also flexibly considering social rules.

The next steps of Crick and Dodge's (1994) model involve the selection of a goal or outcome for the situation, reviewing possible responses to the situation based on both previous experiences and immediate social cues, evaluating alternative responses, and selecting the most positively evaluated response for enactment. During social interaction, typically developing children quickly make decisions about a response, based on what their goals are. For example, when confronted with a situation where someone "butts in" line, the child has several choices about how to respond, which are goal dependent. Possible goals might be to avoid creating any waves and be friendly to the person or to indicate that this behaviour is unfair and will not be tolerated and getting mad. The ability to

regulate emotion based on social goals is considered a critical social skill (Crick & Dodge, 1994) and predicts social competence (Eisenberg et al., 1997).

Children with ASD have differences both in their ability to regulate emotion (Myles, Adreon, & Stella, 2002) and use metacognitive strategies to guide goal-directed social behaviour (Laurent & Rubin, 2004). This is evident even though their motivation to interact socially may not differ from typically developing children (Bauminger, Shulman & Agam, 2004). No research has directly examined the role of emotion regulation in relation to social skills in autism although Sigman, Kasari, Kwon, and Yirmiya (1992) suggest that a child with ASD may not be aware of the distress of others, which is often communicated in facial expressions. This has implications for the ability of a child with ASD to make a choice about how to respond in a prosocial way, as they may not be able to process the affective information in a way that allows them to make an appropriate response.

Another aspect of socially directed goals less directly connected to the model of social information-processing is making and having friends. Social relational goals require the coordination of both affective and cognitive perspectives (Lemerise & Arsenio, 2000). Planning, self-monitoring, and generativity all play a role in whether a child with autism can effectively use goal-directed social problem-solving to facilitate friendships. Meyer and colleagues (Meyer, Mundy, Van Hecke, & Durocher, 2006) found that children with ASD are able to produce just as many possible solutions to social problem-solving situations as children without ASD but the nature of the solutions is more passive

such as doing nothing or leaving the situation. Despite perceiving themselves as having friends, children with ASD spend far less time interacting with peers (Chamberlain, Kasari, & Rotheram-Fuller, 2007).

Bauminger and Kasari (2000) have also shown that children with HFA have a different understanding of the emotional aspects of friendship and loneliness than age-/gender-/IQ-matched peers. Their study examined whether children with autism understood both the cognitive and affective components of friendship. Bauminger and Kasari suggest that children with HFA lack an understanding of the emotional aspects of loneliness and friendships, even when they are able to cognitively understand the concepts. In contrast to a cognitive understanding of loneliness, which is dependent on children making cognitive comparisons of their social relationships to that of others, understanding the emotional aspects of loneliness requires that the child go beyond the cognitive understanding to an understanding of the emotional experience. Bauminger and Kasari note that the children they studied reported high degrees of loneliness, suggesting that they are, at least to some extent, aware of feeling rejected or aware that they feel the need for someone else. The striking finding by Capps, Sigman, and Yirmiya (1995) that perceived social competence was lower among children with higher IQs and autism compared to children with autism and lower IQs, likely due to greater awareness of their difficulties, suggests that feelings of rejection and isolation may also be a concern. The ability to be aware of differences and to recognize the feelings associated with this is important in considering how intervention might be directed.

Crick and Dodge (1994) proposed that children bring goal orientations or tendencies to social situations and revise and reconstruct new goals based on social stimuli. This type of "on-line planning" requires that children use affective and cognitive perspectives, consider contextual cues, and generate potentially effective interactions. An example of this would be a "real-life" scenario in which a child with ASD encounters three of his peers huddled in the hallway, speaking quietly to one of the group who appears to be crying. In order to make an appropriate social interaction initiation, the child would need to understand what the probable feelings of his peers are (a cognitive "guess" based on simultaneously attending to nonverbal and contextual cues), and then enact a response based on this.

In the final steps of the model, the child uses social knowledge and schemas to choose and enact a response. This aspect of the social information-processing model is most related to the behavioural act of social conversation, with contributions from all of the other steps. The social knowledge and schemas may be considered a cognitive understanding based on previous experience that allows the child to interact appropriately. This area has not been specifically examined in children with ASD, although there is considerable research examining pragmatic language in children with ASD. The model of social information-processing (Crick & Dodge, 1994) addresses many aspects of pragmatic language including the appropriate use of language across a variety of social contexts, allowing a listener to accurately interpret the speaker's intentions

and references (Berko-Gleason & Ratner, 2008), and use language to interact socially.

In contrast to structural language, which is concerned with the appropriate grammatical form of language, pragmatic language is defined as the ability to use language appropriately in specific contexts and for specific purposes (Prutting & Kirchner, 1987). While structural language is often impaired in children and adults with ASD, it is not always so. There are some individuals with ASD who speak fluently in complete, often complex, sentences. Appropriate social communication, on the other hand, is considered an area of universal impairment in children and adults with ASD (e.g., Landa, 2000; Tager-Flusberg, Paul, & Lord, 2005) and pragmatic language difficulties are well documented. Identified difficulties include overly literal language comprehension, difficulties understanding gestures and body language, and trouble understanding humor (Dewey & Everard, 1974; Emerich, Creaghead, Grether, Murray, & Grasha, 2003; Happé & Frith, 1996; Loveland et al., 1997; Martin & McDonald, 2003; Ozonoff & Miller, 1995; Tager-Flusberg et al., 2005). Other difficulties linked directly to pragmatic ability include limited use of facial expressions and gestures, lack of reciprocity in conversations, difficulties in managing conversations, limited social initiations with others, odd speech prosody, a lack of discourse cohesion, and referential difficulties (Baltaxe, 1977; Dewey & Everard, 1974; Freeman & Dake, 1996; Happé & Frith, 1996; Landa, 2000; Lord, Rutter, & Le Couteur, 1994; Martin & McDonald, 2003; Szatmari, Bartolucci, & Bremner, 1989; Tager-Flusberg et al., 2005). Children with ASD often make uninhibited or inappropriate

comments with decreased consideration for the listener's needs, and have difficulties in varying language register according to listeners' needs, stereotyped utterances and tangential language, difficulties maintaining the topic of conversation, and increased use of idiosyncratic language (Baltaxe & D'Angiola, 1992; Lord et al., 1994; Loveland, McEvoy, Tunali, & Kelley, 1990; Volden, 2002; Volden, Magill-Evans, Goulden, & Clark, 2007; Volden & Lord, 1991). In contrast, a relatively preserved pragmatic skill is the ability to make conversational repairs (Volden, 2004). Collectively, this literature supports Tager-Flusberg et al.'s (2005) conclusion that, despite basic intention to communicate, children with ASD experience social language impairments beyond what might be predicted from their syntactic abilities.

Social Skills Intervention

Social deficits are a defining feature of the diagnosis of ASD so it is not surprising that many interventions have been developed to address the specific social difficulties of children with ASD. There are numerous manuals describing activities aimed at making changes in the social skills of school-aged children with ASD (e.g., Kaufman & Larson, 2005; McAfee, 2002). Most are based on clinical experience and very few are supported by efficacy studies. This section addresses general components of effective social skills programs, outcome research for group-based social skills programs for school-aged children with ASD, and methodological issues of previous research. Finally, a review of literature specifically addressing cognitive behavioural therapy as a treatment

technique for school-aged children with ASD is provided because recent evidence highlights its potential use in social skills intervention for this population.

Components of effective programs for children with ASD. Reviews of effective social skills interventions have identified approaches and components of programs that provide clinically valid results for preschool children with ASD (Krasny, Williams, Provencal, & Ozonoff, 2003; McConnell, 2002; Rodgers, 2000; Simpson & Otten, 2004; Weiss & Harris, 2001). These include structured teaching approaches, peer-mediated intervention, and scripting/modelling/video feedback.

Structured teaching approaches. Structured teaching approaches are based on psychoeducational theories that develop specific programs for children based on strengths and difficulties. Kunce and Mesibov's (1998) Treatment and Education of Autistic and related Communication Handicapped Children (TEACCH) program is a good example of a highly individualized approach which includes components such as routines, schedules, visual supports and adapted instructional strategies as well as adapted environments. The TEACCH program focuses on providing a supportive environment specific to the needs of the individual child with autism. Support for this style of intervention has emerged primarily in research for younger, less able children with autism (McConnell, 2002; Simpson & Otten, 2004).

***Peer mediation/peer tutoring*.** Strain and colleagues (Ragland, Kerr, & Strain, 1978; Strain, 1977; Strain, Kerr, & Ragland, 1979) pioneered research that demonstrated that social interaction of children with ASD improved when

typically developing children were taught to initiate interactions with children with ASD. Peer mediated or peer modelling approaches involve teaching peers to use strategies to increase social interaction in children with autism, rather than less natural adult-mediated approaches, typically used in behavioural approaches. This approach is considered one of the most effective methods for educating children with autism (e.g., Goldstein, Wickstrom, Hoyson, Jamieson, & Odom, 1988; Robertson, Green, Alper, Schloss, & Kohler, 2003) and has also been effectively used in many studies designed to examine the efficacy of social interaction intervention. For a recent comprehensive review of this approach for younger children, see Goldstein, Schneider, and Thiemann (2007). Despite the apparent improvements across numerous studies, this form of intervention is often difficult to implement in clinical practice where recruitment of typically developing peers for ongoing intervention is challenging. It may be more easily implemented in school settings where access to peer mentors is more available.

Scripting/modelling/video feedback. Visual feedback techniques, commonly used in educational practice for children with autism, have also been used to improve social reciprocity. These techniques are based on behavioural theories which focus on learning through practice and immediate feedback. This type of intervention may take the form of videotaping social role-plays that participants engage in with immediate visual and auditory feedback, or cartoon drawings with scripts to illustrate specific social situations (e.g., Charlop & Milstein, 1989). Reviews of social skills intervention suggest that scripting,

modelling and video feedback are significant components of many successful interventions for young children with autism (McConnell, 2002).

Intervention for school-aged children with ASD and IQ in the average range. Literature reviewing social skills intervention aimed specifically at school-aged children whose IQs fall within the normal range contains many of the same principles for effective intervention as literature on younger children with ASD (Gutstein & Whitney, 2002; Huang & Wheeler, 2006; Rao et al., 2008; Paul, 2008; Williams White et al., 2006). However, for older and higher functioning children, intervention strategies are more cognitively-based with a greater reliance on the language competence that these children possess.

Rodgers' (2000) review of interventions facilitating socialization for school-aged children suggested that several methods of intervention have positive outcomes in various areas of social skills. These methods include the social story technique to teach social rules and strategies (Gray, 1994), peer tutor approaches, social skills groups, video modeling, and pivotal response training (Koegel, Koegel, Hurley, & Frea, 1992). There is a growing body of research that systematically evaluates efficacy of these techniques.

A recent review of group-based social skills interventions for school-aged children with ASD by Williams White et al. (2006) identified 14 published studies or dissertations between 1985 and 2006. Using a template developed by the National Institute of Mental Health Working Group to examine psychosocial interventions, the authors systematically reviewed both the outcomes and the study methodology. Common social intervention and social goals include

increasing social motivation (via fostering self-awareness and developing a fun nurturing environment), increasing social initiations (via making social rules clear, teaching social scripts, modeling), improved social responding (via using modeling and role-playing), reducing interfering behaviours (via using structured predictable environments), and promoting skills generalization (via orchestrating peer involvement or practicing in safe, natural environments) (Williams White et al., 2006). Williams White and colleagues also focus attention on the lack of studies that attempt to link intervention to a theory of autism or a more general understanding of the development of social skills and that significant concerns regarding research methodology remain.

Several more recent studies using group-based interventions focused on cognitive and behavioural techniques with curriculum developed specifically for high-functioning children with ASD have reported strong positive results. Laugeson and colleagues (Laugeson, Frankel, Mogil, & Dillon, 2009) used a group-based manualized social skills intervention targeting behaviours such as conversation skills, peer entry and exit skills, developing networks of friendships, and handling bullying and teasing. Compared to their delayed treatment control group, participants in the intervention improved in their knowledge of social skills and how often they attended or hosted peer get-togethers, as well as parent ratings of overall social skills. Similarly, Tse and colleagues (Tse, Strulovitch, Tagalakis, Meng, & Fombonne, 2007) found significant improvements from pre- to post-testing on measures of social skills and problem behaviours using psychoeducational approaches, emphasizing video modeling.

Several studies have used a promising problem-solving approach to social skills intervention using Lego, a popular block-building toy. This type of intervention provides children with opportunities to engage in cooperative social interaction, rather than specifically teaching skills using cognitive or behavioural methods. Supporting two previous studies by LeGoff and colleagues (LeGoff, 2004; LeGoff & Sherman, 2006) that found positive effects on social skills of an individual and group Lego intervention, Owens and colleagues (Owens, Granader, Humphry, & Baron-Cohen, 2008) also found greater improvements in autism-specific social interaction scores using Lego-based therapy. In addition to a no treatment group, they also compared a group receiving a "Social Use of Language Program (SULP)" and found that both the Lego group and the SULP group showed decreases in maladaptive behaviours. LeGoff (2004) suggests that this more "naturalistic" approach may contribute to greater generalization of skills.

Group cooperative computer-based activities have also been used successfully to improve the social interaction of school-aged children with ASD. One study by Piper and colleagues (Piper, O'Brien, Ringel Morris, & Winograd, 2006) used conversation analysis to examine the effectiveness of verbal interactions for the purpose of cooperation during a tabletop computer game (four children playing together). They found that this medium provided a motivating method for effective group work. This modality was taken a step further by Gal and colleagues (2009) who also used a structured observation scale of social interaction to look more specifically at initiation of social interaction with peers, level of shared play, and collaboration and frequency of autistic behaviours.

Positive results were found in all three areas. Beaumont and Sofronoff (2008) used a "multi-component" social skills intervention with a waitlist control group and found significant improvements in social skills (as reported by parents in the treatment group) and in the child's knowledge of emotion management strategies. This intervention used a computer game to teach complex emotion recognition and social problem-solving and then children engaged in small group activities designed to practice these skills in situations approximating real-life scenarios. Computer-based applications for teaching social skills are designed specifically for children with ASD and have only very recently become commercially available.

Cognitive Behavioural Therapy

As outlined above, current outcome research has primarily been based on identifying deficits in social enactment "skills" and applying models of social skills intervention based on behavioural principles. However, focusing just on changing behaviours and not how children think and problem-solve about social situations may not be enough to produce changes that generalize across situations. Cognitive Behaviour Therapy (CBT) is a promising alternative that is emerging as an intervention that moves beyond examining how the person behaves to look at the role of cognition and feelings in producing more effective behaviours.

CBT is broadly defined as brief, structured therapy focused on context-driven problem-solving, linking thoughts, feelings, and behaviours to develop effective coping skills. As outlined by Alford and Beck (1997), Beck developed the classic model of CBT which stresses the importance of context and meaning

assignment, the interplay between cognitive systems and emotional and behavioural responses, and the role of "schemas" (beliefs, rules, assumptions about self and others). This form of intervention addresses generalization issues because, unlike behavioural techniques that rely on external factors for behaviour change, cognitive behavioural techniques have a greater focus on internal factors, such as self-talk (e.g. Kendall & Braswell, 1993). Generalization is also addressed by "homework," which is emphasized in CBT and usually takes the form of a "contract" between the therapist and the participants to try out specific strategies in natural settings outside of the group, with the expectation that success apart from the therapy context is both internally reinforcing and more likely to produce generalization. CBT focuses on the role of affect (feeling) in how individuals perceive the social world and uses a similar dynamic examination of how a person's thoughts, feelings, and behaviours interact to produce a more or less successful social response. In CBT, cognitive problem-solving strategies are developed through intentional, planned intervention that carefully considers how affect influences thoughts and behaviours, thus taking into account both the internal and external contexts. CBT participants are taught to consciously recognize feelings and intensity of feelings and then relate this to thoughts and behaviours.

Several current interventions aimed at children with ASD use aspects of cognitive behavioural principles though the intervention may not be explicitly called CBT. Examples are: social stories, which are individualized descriptions of social situations and relevant social cues (e.g., Hagiwara & Myles, 1999; Norris &

Dattilo, 1999); cartooning with visual support to explain social events (e.g. Gray, 1994; Parsons & Mitchell, 1999); and cognitive scripting where specific scripts for familiar events are explicitly taught and then later faded (e.g., Krantz & McClannahan, 1993; Thiemann & Goldstein, 2001). These interventions have components of cognitive behavioural approaches because they are focused on teaching the child to analyze specific behaviours or thoughts to arrive at a behaviour, although these approaches less explicitly consider the role of affect and its impact on thinking and behaviour.

Explicit CBT-based interventions have been used in several studies of school-aged children with ASD addressing anger management (Sofronoff, Attwood, Hinton, & Levin, 2007), obsessive-compulsive symptoms (Reaven & Hepburn, 2003), anxiety (Reaven et al., 2009; Sofronoff, Attwood, & Hinton, 2005; White et al., 2010; Wood et al., 2009a), social anxiety (Cardaciotto & Herbert, 2004), and depression and self-injurious behaviour (Hare, 1997). These studies adapted CBT for children with ASD by increasing the structure and predictability, inclusion of visual supports, and greater parent involvement. Beebe and Risi (2003) provide an overview of the application of CBT to individuals with ASD, reinforcing use of methods not specific to CBT and already identified in social skills intervention research for ASD (e.g., videofeedback, problem-solving approaches, visually-based strategies such as comic strip conversations, focus on social perception skill building). Like other authors who have made recommendations regarding adaptations for children with ASD, they suggest

greater focus on verbal labeling, rational self-talk, visual supports, and explicitly drawing attention to important social cues.

CBT as a treatment method for social skills has also been examined (Bauminger, 2002, 2006, 2007a, 2007b; Crooke, Hendrix, & Rachman, 2008; Laugeson et al., 2009; Lopata, Thomeer, Volker & Nida, 2006; Wood et al., 2009a). The social skills intervention used in Bauminger's (2002) study was based on theoretical assumptions related to cognitive behavioural therapy theory which suggest that "interpersonal cognitive processes and emotions can mediate interpersonal behaviour; social problem-solving and recognition of emotions can be taught cognitively and can influence behaviour; and social problem-solving and a more comprehensive understanding of emotions can lead to later successful social adjustment" (Bauminger, 2002, p. 286). This focus on social problem-solving and an emphasis on understanding emotions is a consistent theme in subsequent studies using a CBT approach to social skills intervention, and to some degree, in other areas such as intervention for anxiety in children with ASD. Wood et al.'s recent application of CBT to anxiety intervention for children with ASD and an IQ above 70 included modules on friendship skills, and entering and maintaining conversations, in addition to CBT for anxiety. White and colleagues (2010) developed a manual-based cognitive behavioural treatment program to address both anxiety symptoms and social skill deficits, with a strong emphasis on parent involvement, immediate feedback, opportunity for positive social learning experiences, modeling new skills, and structured teaching that includes explicit teaching about how to monitor and evaluate one's own behaviour, how to

recognize cues, and conversation skills. Their program employed a variety of techniques to help the child link thoughts, feelings, and behaviours. Preliminary feasibility data from this well-described program is positive but efficacy data is not yet available.

With the exception of studies describing the development of CBT intervention for ASD, these studies all report significant improvements, usually based on parent- or self-report measures, satisfaction surveys, social knowledge questions, and the assessment of emotion recognition, although few include control group comparisons. Bauminger's (2002, 2007a, 2007b) social skills CBT intervention included typically developing peers as part of the intervention although this is not generally a component of CBT. Sofronoff and colleagues' (2005) research also included positive qualitative information related to the generalization of skills beyond the clinic setting.

CBT seems particularly well suited for treatment of social skills in school-aged children with ASD because:

1. It addresses the issue of generalizability, focusing on opportunities to use specific skills in natural environments (Beebe & Risi, 2003).
2. It has a problem-solving, coping approach designed to allow participants to consider alternatives (Kendall, 2006), that reflects how children in general learn to make social responses as reflected in the Crick and Dodge (1994) social information-processing model.
3. It focuses on the use of cognitive strategies to learn, including the use of verbal labeling, reducing abstract concepts to concrete examples, using

visual supports (cartoons, thought bubbles, feeling scales) and drawing attention to important cues (Kimball, Nelson, & Politano, 1993), assuming that social perception processes are an underlying deficit that can be taught cognitively. This draws on the relative cognitive strength of children with ASD who have IQs in the average or above range.

The proliferation of research examining outcomes based on social skills intervention for children with ASD, with a greater focus on CBT intervention more recently, provides moderate to strong support for social skills intervention despite methodological issues. Most studies report these limitations and reviews of this literature suggest directions for how these issues can be addressed in future studies.

Methodological Issues

As part of a National Institutes of Health sponsored initiative concerning methodological issues in psychosocial intervention in autism, Lord and colleagues (2005) recommended that the following areas need to be carefully considered in designing research in this area: how participants are recruited, outcome measures (targeting specific behaviours and broader measures, measurement sensitivity and specificity, use of multiple instruments), research design (comparison groups, replication), and the need for manualization of intervention.

Koning and Magill-Evans' (2007) systematic review of articles published in peer reviewed journals, on social skills intervention for school-aged children with HFA or AS, found significant issues related to participant description, measurement, methodology, and replicability (particularly as this related to the

actual intervention). Of the 10 studies reviewed, only four reported using a standardized diagnostic tool to confirm the diagnosis. An important methodological issue identified by Lord and colleagues (2006) is that clear pre-treatment characteristics of participants must be defined to begin the process of defining which populations benefit from specific social skills interventions. Substantial gains have been made in making definitive diagnoses of ASD using the widely accepted diagnostic measures, Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999) and the Autism Diagnostic Interview (ADI; Rutter, Le Couteur, & Lord, 2003). Until very recently, few studies of social skills interventions for school-aged children included the ADOS or ADI with the exception of Bauminger (2002, 2006, 2007a, 2007b) and Solomon, Goodlin-Jones, and Anders (2004). Only four studies used a treatment manual and only five had some form of control group. Outcomes were measured by parent report (nine studies), teacher/other report (five studies), and self-report (three studies); coded behavioural observations (five studies); direct measurement of child's skill or knowledge (five studies); and ratings of satisfaction or acceptability (six studies). The most commonly used parent and teacher report measure was the Social Skills Rating System (SSRS; Gresham & Elliot, 1990). Most of the studies using this measure failed to find statistically significant differences pre- and post-group participation while other measures used with the same participants did find significant differences. This suggests that the SSRS may not be sensitive to change or may not measure constructs closely related to the intervention. Although the outcomes of these studies provide promising support for social skills

intervention, there is clearly a need for more rigorous studies to address the questions of which social skills interventions for these children are efficacious and which components of intervention are critical.

Valid and reliable measurement of social skills as an outcome for evaluating intervention programs is difficult because many measures are not sensitive enough to measure change, or lack the specificity required to clearly capture difficulties. There is currently no consensus regarding what measures to use and few studies using standardized measures report effect size or confidence intervals. Koenig and colleagues (2009) emphasize using multiple modes and informants to achieve the most comprehensive picture of a child's social functioning, suggesting the inclusion of parent and clinician rating scales, and behavioural observation. In Williams White and colleagues' (2006) review of social skills intervention, many of the studies relied on two or fewer types of outcome measures.

Consistent with Lord and colleagues (2005), Williams White et al. (2006) make several recommendations for future research including: 1) development and testing of manualized interventions, 2) the use of control groups with random assignment, 3) identification of a primary outcome measure that is sensitive to change, and 4) multi-site treatment trials. Recent research has attempted to determine the effectiveness of social skills intervention in making significant positive changes in social skills for children with ASD. Despite considerable methodological challenges, researchers have clearly begun the process of defining both effective specific intervention techniques and outcome goals.

The present study attempted to address some of the important challenges in current social skills outcome research for children with high-functioning autism or Asperger's syndrome and add to the evidence base. This research was driven by a theoretical understanding of autism, social information-processing, and how intervention might best be provided based on these theories, using a model of intervention that has received evidence-based research support. Care was taken to address some of the methodological issues identified in systematic reviews.

Purpose

This study examined whether encoding and interpretation of social cues, pragmatic language, social responsiveness, general adaptive behaviour in the area of socialization, and social knowledge improved following a social skills intervention protocol based on CBT principles delivered to boys aged 10 to 12 years diagnosed with ASD.

Hypotheses

1. After 15 sessions, participants in a group that received immediate CBT-based social skills group intervention (Immediate Treatment group) would score better than a waitlisted control group (Delayed Treatment group) in the following areas:
    a. Social perception as indicated by higher scores on the Child and Adolescent Social Perception measure (CASP; Magill-Evans, Koning, Cameron-Sadava, & Manyk, 1995).
    b. General adaptive behaviour in the area of socialization as indicated by higher scores on the Vineland Adaptive Behavior Scales –

Second Edition (Vineland-II; Sparrow, Cicchetti, & Balla, 2005) and lower scores on the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005).

c. Pragmatic language/peer interactions as indicated by higher scores on the Children's Communication Checklist – Second Edition, U.S. version (CCC-2; Bishop, 2006) and a researcher-designed measure of peer interaction called the Peer Interaction Measure (PIM; Koning, Magill-Evans, & Volden, 2008)

d. General social knowledge as indicated by higher scores on a researcher-developed questionnaire.

2. Participants who were waitlisted prior to beginning the intervention (Delayed Treatment group) would show significant improvements in the outcome measures listed above only after they received intervention.
3. Participants and their parents would report good levels of satisfaction based on participant and parent satisfaction surveys.

Chapter 3: Methods

Participants

Participants were recruited through an advertisement in the local autism society newsletter and by sending letters to parents of boys aged 10 to 12 in an autism follow-up clinic database. When parents responded they were contacted by telephone to determine if their child met the inclusion criteria of: male, aged 10 to 12 years old, diagnosed with ASD using DSM-IV-TR criteria (American Psychiatric Association, 2000) by either a child psychiatrist or a developmental pediatrician experienced in diagnosing children with autism, and having receptive language and nonverbal IQ within normal limits ($\pm$ 1 standard error of measurement) as measured within the last two years.

According to the parents, some children had received clinical diagnoses of Asperger's syndrome while others were diagnosed with high-functioning autism. Diagnoses of ASD were confirmed using the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999) (see "Inclusion criteria measures" below).

Participation in the study was restricted to boys for several reasons. Based on gender ratios in the ASD population, the population of boys with an ASD diagnosis is substantially greater than that of girls, making recruitment of boys more likely. Also, children display a widely recognized preference to interact in same-gender groupings (Maccoby & Jacklin, 1987). Restricting the sample to boys also simplified selection of appropriate appealing intervention activities.

Average receptive language and IQ (80 or above) were considered necessary prerequisites for the CBT-based intervention (Reynolds, Girling, Coker, Eastwood, 2006). Given that there is error associated with all scores, the standard error of measurement (SEM) was applied to both IQ and receptive language scores in order to ensure that any children whose true scores were within the desired range would be identified. Thus, two children whose IQ or receptive language standard scores were between 76 and 80 were included. Descriptions of IQ and receptive language measures are in "Inclusion criteria measures" below. Children were excluded if their parents reported significant behavioural difficulties that would disrupt the group or if their parents had difficulty with English that would interfere with their ability to complete questionnaires and weekly homework assignments with their sons. If English was a second language, parents were asked if English was the language spoken at home and if they felt comfortable reading the information presented in the information letter and consent forms.

Eligible boys and their parents attended an initial meeting to review the study objectives, complete the consent process, and undergo assessment using the ADOS (Lord et al., 1999). Boys who scored above the ASD cut-off (ADOS total score greater than 7) were then scheduled for IQ and language assessments. Full scale IQ scores were obtained using the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999), except in the case of one boy who had recently had an IQ assessment using the Test of Nonverbal Intelligence-3 (Brown, Sherbenou, & Johnsen, 1997). These measures are described below.

Parents and participants provided consent and assent, in accordance with local ethics review committee regulations. Ethical approval was obtained from the University of Alberta Health Research Ethics Board and operational approval was obtained from Alberta Health Services.

Inclusion Criteria Measures

IQ: Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). The WASI was developed to provide a short and reliable measure of IQ for individuals aged 6 to 89 years. It is administered individually and yields verbal, performance and full scale IQ scores based on four subtests: vocabulary, block design, similarities, and matrix reasoning. Only the Full Scale IQ score was used in this study. The mean score is 100 with a standard deviation of 15. The WASI was administered by a research assistant who had formal training in assessment, supervised by an experienced psychologist.

The WASI has been used in many studies of persons with autism (e.g., Hadjikhani et al., 2004; Howlin, 2003; Solomon, Ozonoff, Carter, & Caplan, 2008). A study examining its predictive accuracy for children and adults with HFA indicated that this short form has good predictive accuracy even when there is an atypical subtest profile (Minshew, Turner, & Goldstein, 2005). The WASI manual (Wechsler, 1999) reports all reliability coefficients as greater than .90.

Receptive language: Clinical Evaluation of Language Fundamentals – Fourth Edition (CELF-4; Semel, Wiig, & Secord, 2003). This norm-referenced assessment measures language and communication development for individuals aged 5 to 21 years and provides a core language score, a receptive language index

score, an expressive language index score, as well as a language content index and a language memory index. The full measure was administered but only the receptive language score is reported. The mean score is 100 with a standard deviation of 15. The CELF-4 was administered by a speech language pathologist (SLP) experienced in using the measure.

The CELF-4 is used to describe language abilities in many different types of autism research (e.g., Cannon et al., 2009; Diehl, Bennetto, Watson, Gunlogson, & McDonough, 2008; Lewis et al., 2007). The CELF-4 manual reports test-retest reliability (.71-.86 for subtests; .88-.92 for composite scores), internal consistency (alphas from .69-.91 for subtests; 87-.95 for composite scores), inter-rater reliability (.88-.99), as well as stability coefficients, standard errors of measurement, and confidence intervals.

Diagnosis: Autism Diagnostic Observation Schedule (ADOS, Lord et al., 1999). The ADOS is a semi-structured standardized assessment in which the test administrator observes the individual's communication, social interaction, and play using one of four modules, each designed to be administered to individuals based on their expressive language level. It is considered one of the gold standard measures of ASD, which when used with an experienced clinician diagnosis, provides an accurate diagnosis (Ozonoff, Goodlin-Jones, & Solomon, 2005). The ADOS was administered by a research trained ADOS assessor who was involved only in testing and not intervention.

The ADOS is used extensively in the literature to classify participants as having ASD (Carter et al., 1998; Klin et al., 2007; Volkmar, Sparrow, &

Goudreau, 1987) and extensive training for research administration of the ADOS ensures reliability of test administration and scoring. Scores of 7 or higher indicate an Autism Spectrum Disorder and scores of 10 or greater indicate Autism.

Procedures

The first 14 boys who met criteria were stratified into two groups: boys scoring above a standard score of 100 on the Clinical Evaluation of Language Fundamentals-4, and those scoring below 100. This facilitated a greater likelihood that the two groups would be equivalent on receptive language scores. Boys in each of these two groups were then randomly assigned to either a Delayed Treatment control group or the Immediate Treatment intervention group using a random numbers table. Six boys began intervention immediately and eight were waitlisted for a later group. Just prior to the beginning of the first intervention group, one boy refused to attend and one boy dropped out after five sessions, leaving four participants in the first intervention group. See Figure 2 for a diagram of the flow of recruitment of participants. Three additional boys were added when the Delayed Treatment control group began intervention, for a total of 15 participants across the two groups.

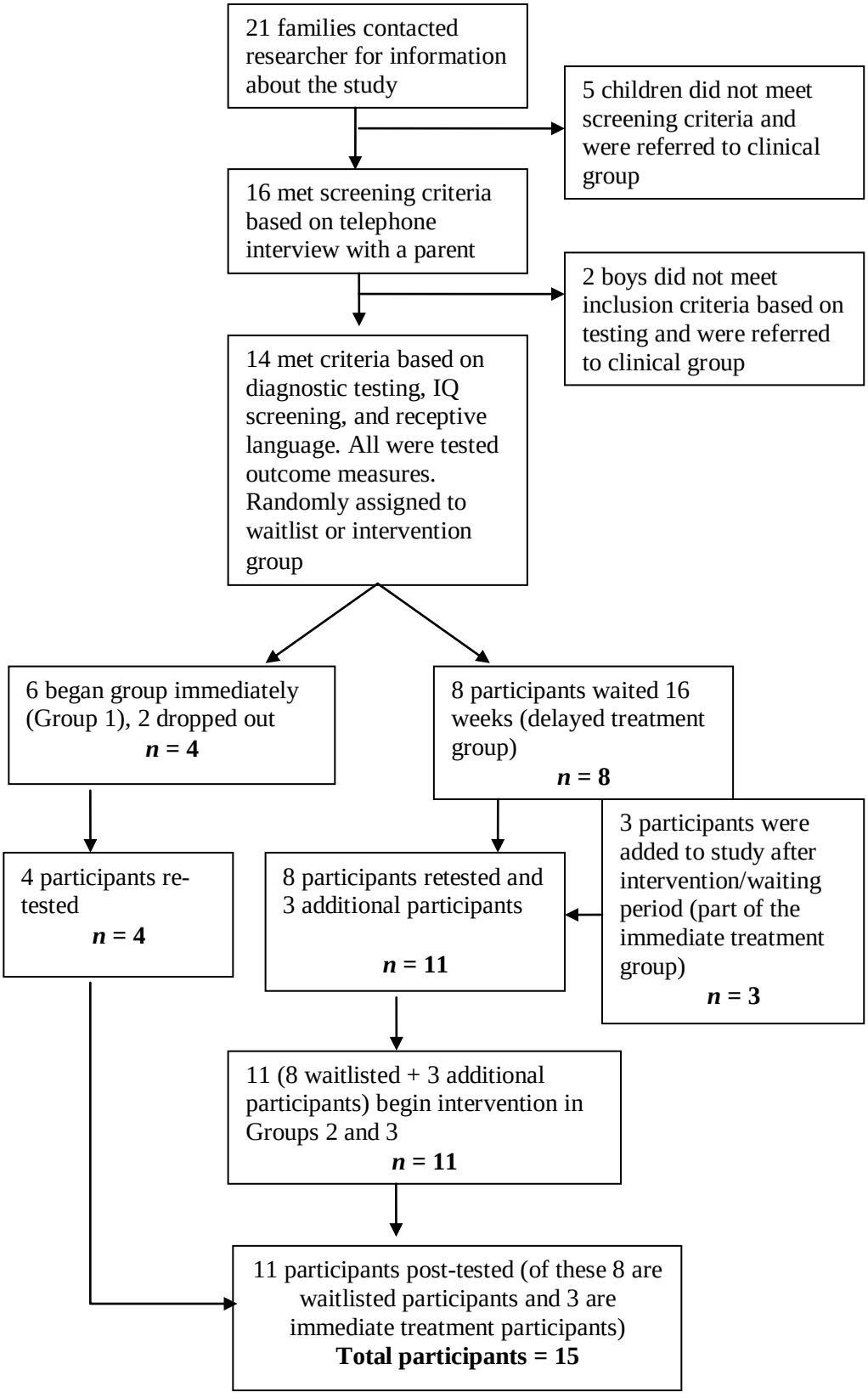

Figure 2. Diagram of the flow of participant recruitment.

Four to six participants attended 2-hour weekly group intervention sessions for 15 sessions. The two group leaders were either occupational therapists or speech language pathologists. One leader was consistent across all groups to ensure equivalence of intervention content. The group leaders all had extensive experience providing social skills intervention using the same intervention manuals (described below) for similar groups of children. Intervention took place after school in a large outpatient room. All participants attended at least 13 of the 15 sessions with only two of the 15 participants (one from the Immediate Treatment group and one from the Delayed Treatment group) missing two sessions. Material for missed groups was reviewed with the parents and participant in the week following the missed group. Intervention is described in more depth in a separate section after a description of the outcome measures.

The eight waitlisted boys in the Delayed Treatment group were tested on all measures at the beginning of the waitlist period, at the beginning of the 15-week group intervention, and after the intervention was completed. The Immediate Treatment group was tested just before beginning the intervention and after completing it. All participants were given an honorarium of $25.00 after the first seven weeks of intervention and another $25.00 after the final week. Participants and parents completed the satisfaction survey on the last day of the intervention.

The outcome measures were administered in one 1.5-hour session. They were administered to the participant in the following order: the Peer Interaction Measure (waiting room scenario so this made sense to the child, and then the

Child Adolescent Social Perception (CASP) measure. The knowledge questionnaire was completed by participants in the Delayed Treatment group after the CASP for the first assessment time point. All other knowledge questionnaires were completed during the first and last treatment group. Parents were presented with a package of three assessments with the Vineland Adaptive Behavior Scales – Second Edition (Vineland-II) first followed by the Social Responsiveness Scale (SRS) and then the Children's Communication Checklist – Second Edition (CCC-2) but were not directed to complete them in that order. These forms were generally completed while their child was being assessed, except in three cases where the parent who had brought the child wanted their spouse to complete the measure. In 11 cases, it was the mother who completed the parent report measures. The parent-report measures required about one and a half hours to complete in total. All testing was completed by independent experienced test administrators who were blind to whether the child was in the Delayed Treatment or immediate intervention group, and did not know the hypotheses being tested. Test administrators did not have access to scores from prior assessments. An experienced SLP manually scored the items for all language measures and performed a consistency check to verify that the subtotal raw scores were within the possible range. The CASP and the Peer Interaction Measure were administered and scored by a clinician who had achieved inter-rater reliability of greater than 90% on these measures. Checks on reliability were not done for the CASP.

For parent report forms, primary caregiver(s) were given careful instructions about how to complete the form and where to start each section, and asked to contact the research assistant with any questions. Telephone follow-up was completed for questions that were missing answers. Both the Vineland-II and the SRS were scored by a research assistant experienced in administering and scoring these measures. Parent survey forms for the Vineland-II were scored with the ASSIST software available from the Vineland-II publishers. Scores were entered twice to ensure accuracy. SRS forms were manually scored by a trained research assistant and the total SRS score was rechecked using Excel.

Outcome Measures

Outcome measures used multiple informants and both observational and standardized measures as recommended by Williams White et al. (2006) and Koenig et al. (2009).

Peer Interaction Measure (Koning et al., 2008). A measure of initiating and maintaining conversations, the Peer Interaction Measure (PIM), was developed for this study. Scores are obtained by videotaping the participant's response to a structured, contrived social situation, in which a confederate greets the participant and encourages initiation and maintenance of a conversation and shifts in the conversation topics. The confederate, in this case an 11-year-old boy with acting experience who was recruited from a local performing arts school, was hired to reliably enact a waiting room scenario. The scenario was based on a waiting room interaction between two boys who are unfamiliar with each other. The confederate was seated in the waiting room, playing a hand-held video game.

The boy with ASD was brought into the room and asked to wait there for a short while. The boys were then left alone. A prescribed script of verbalizations and behaviours were provided to the confederate (see Appendix A for examples of script and scoring criteria). Hidden ceiling cameras captured the 10-minute interaction. After approximately 10 minutes, one of the examiners would open the door and tell the boy with ASD that she was ready to see him.

Verbal and nonverbal behaviours were scored based on a coding system, derived from sources including the ADOS (Lord et al., 1999), and behavioural scoring criteria developed by Magill (1987), and Barry et al. (2003). The scoring system had two parts. Part I provided a total of the number of times the boy with ASD made eye contact, and responded appropriately to a prompt with an appropriate target behaviour. Part II had eight behaviours which were rated on a scale that varied from 1 to 3 up to 1 to 5. These eight items were: orienting to peer, gestures related to activity, facial expressions directed to peer for the purpose of communicating affect, flow of the interaction, overall appropriateness of the interaction, ability to adjust speech to the speaker, sense of shared enjoyment in the interaction, and showing an interest in peer's responses (sense of awareness of peer's interests). Higher scores indicate greater skill in interaction with the peer. The total possible score for this section is 36 points.

Two coders tested the coding system with typically developing boys, refined the coding process through consensus scoring, and then used the system to independently score three videotaped interactions, achieving an inter-rater reliability of 80% or greater prior to data collection. Inter-rater reliability during

the study was assessed for every six measurements using the PIM and was 76%. This measure was intended to provide a socially valid measure of how the participant responded in a "natural" setting which addressed generalization of skills beyond the treatment milieu. The total score from Part II was used in the analyses. Cronbach's alpha, examining internal consistency of the measure for Part II was .89.

The Child and Adolescent Social Perception measure (CASP; Magill-Evans et al., 1995) was used to assess the ability to infer the emotional state of others based on nonverbal cues such as facial expression, tone of voice, gestures, and contextual cues. The Emotion score (ES) measures the accuracy of emotion recognition based on facial, gestural, tone of voice, and situational cues and the Nonverbal Cues score (NCS) measures the number of different cues used to infer emotions. Using short, videotaped scenarios depicting social situations that children and adolescents often encounter, this measure attempts to approximate natural social situations as cues are presented simultaneously, within specific environmental contexts. Speech content is altered by the removal of certain sound frequencies so that tone but not content is preserved. The child is asked two primary questions after each scenario: "What were each of the people feeling? How could you tell that the girl/boy/adult was feeling___," inserting the words chosen by the child. The child's answers are compared to an answer key and scored from 0 to 2. Lower scores reflect greater impairment. Raw scores for the Emotion score and the Nonverbal Cues score were used in the analyses as these scores represent the actual number of cues recognized or the number of emotions

partially or completely named. The total possible for the Emotion raw Score is 86 and 135 for the Nonverbal Cues raw score.

Koning and Magill-Evans' (2001b) validation study compared 32 boys with ASD and 29 typically developing boys matched on age. Children with ASD scored significantly worse than matched controls, and correlations between CASP scores and the Social Skills Rating System (Gresham & Elliot, 1990) were moderate and positive. Additional validity was recently demonstrated in a study comparing children with Asperger's syndrome, Nonverbal Learning Disability, Attention Deficit Hyperactivity Disorder-Predominantly Inattentive, and controls (Semrud-Clikeman, Walkowiak, Wilkinson, & Minne, 2010). These researchers found that children with AS or nonverbal learning disability experienced the greatest difficulty understanding emotional and nonverbal cues with the number of AS symptoms most strongly related to CASP scores. Based on the standardization sample of 212 children, authors report internal consistency as .88, test-retest reliability as .83, and inter-rater reliability as ranging from .94 to .99 for the ES. Cronbach's alpha for the current study for the ES was .77.

Social Knowledge: A test of knowledge with 14 multiple choice and short answer questions was developed for this study and administered both at the beginning and the end of the group to identify changes in social skills knowledge. Questions were based on skills that the group addressed. The total possible score on this investigator-developed measure was 34 points. See Appendix B for questions, and scoring key. This measure addressed the participant's understanding of social norms and rules, as well as their current knowledge about

starting and maintaining conversations, awareness of affective cues, and strategies for dealing with difficult social situations. The measure used very brief scenarios (one sentence), which provided several possible answers or were open-ended. In order to have enough questions to allow the measure to be sensitive to change but also be completed in a short time, 14 questions were used. The measure was pilot tested with typically developing children in the target age group to ensure that questions were clear and unambiguous. Six typically developing children provided answers from which an answer key was developed, with 1 or 2 possible points awarded. Only one question on the quiz, "How are thoughts, feelings, and behaviours connected?" was directly related to material covered in the group.

Socialization: Measures of socialization included the socialization scale of the Vineland Adaptive Behavior Scales – Second Edition (Vineland-II; Sparrow et al., 2005), and the Social Responsiveness Scale (SRS; Constantino & Gruber, 2005).

The Vineland-II is a measure of the adaptive behaviour skills needed for functioning in everyday life and includes measures of communication, daily living skills, socialization, and motor skills. The socialization domain of the parent/caregiver rating form was used in the analysis. This section of the Vineland-II asks parents questions about their child's coping skills (e.g., "says he or she is sorry after hurting another's feeling," "accepts helpful suggestions or solutions from others"), interpersonal relationships (e.g., "is careful when talking about personal things," "meets with friends regularly") and play and leisure time (e.g., "refrains from entering the group when nonverbal cues indicate that he or

she is not welcome," "plays simple games that require keeping score"). Parents rate their child on a scale of 0 (never) to 2 (usually). Higher scores on the Vineland-II represent better adaptive function. Socialization standard scores were used in the analysis. The mean is 100 and the standard deviation is 15.

The Vineland-II Socialization score has been used to measure intervention outcome for children with ASD (Laugeson et al., 2009; LeGoff & Sherman, 2006; Salt et al., 2002). According to the Vineland-II manual, internal consistency for the survey form socialization domain (ages 10 to 12) ranged from .89 to .92 and test-retest reliability for the socialization domain was .93.

Social Responsiveness Scale (SRS; Constantino & Gruber, 2005): Another broad parent report measure of socialization, the SRS, examines interpersonal behaviour and communication including social awareness, social cognition, social communication, social motivation, and social mannerisms. Ratings are on a 4-point Likert scale, resulting in a total score and subscale scores in each of the dimensions, including social awareness, social cognition, social communication, social motivation, and autistic mannerisms, with higher scores reflecting greater impairment. Only the total score, which reflects the severity of social deficits, was used in this study. It is expressed as a T-Score with a mean of 50 and a standard deviation of 10.

The authors suggest that the SRS may be used as an outcome measure for social skills intervention. The SRS appears to be sensitive to behavioural change within short time periods, as demonstrated by Tse et al. (2007) who reported significant differences with moderate effect sizes after a 12-week social skills

intervention. The manual reports internal consistency (alpha) for the total SRS scores (boys) as .93, total score test-retest reliability as .85 with a 17-month period between testing, and inter-rater reliability from .75 between father and teacher to .91 between mother and father.

Pragmatic language: Measures addressing pragmatic language included a standardized assessment, the Children's Communication Checklist – Second Edition, United States Edition (CCC-2; Bishop, 2006), and the observational assessment, the Peer Interaction Measure (PIM), described earlier.

Children's Communication Checklist – Second Edition (CCC-2; Bishop, 2006): The CCC-2 is a parent report checklist addressing pragmatic and communication skills in children aged 4 to 16 years, 11 months who are able to speak in complete sentences. It consists of 50 sentences about difficulties children may that affect their ability to communicate. Another 20 sentences focus on strengths children may have that affect communication. Parents rate how often they have observed these behaviours in their child from 0 (less that once a week or never) to 4 (several times a week). Subscales include speech, syntax, semantics, coherence, initiation, scripted language, context, nonverbal communication, social relations, and interests. Two composites are derived: the General Communication Composite (GCC) identifies children likely to have clinically significant communication problems of any sort, and the Social Interaction Difference Index (SIDI) assists in identifying children with disproportionate problems in pragmatic language and provides qualitative information about impairment patterns. The GCC is a standard score with a mean

of 100 and a standard deviation of 15 derived from the total of all the subscale standard scores. The SIDI is an index derived by subtracting the total of the scaled scores for the speech, syntax, semantics, and coherence subscales from the total of the scaled scores for the initiation, scripted language, context, and nonverbal communication subscales. Negative scores on the SIDI suggest a greater number of pragmatic problems relative to general communication skills. The manual suggests that SIDI scores of -11 or greater are characteristic of a child with ASD. Both the GCC and the SIDI were used in the analyses.

The CCC-2 is one of only a few standardized measures of pragmatic language for children with ASD. A validation study by Norbury and colleagues (Norbury, Nash, Baird, & Bishop, 2004) using the CCC-2 UK version (Bishop, 2003) demonstrated its ability to differentiate children with ASD from typical children. A recent study by Volden and Phillips (2010) comparing the CCC-2 with the Test of Pragmatic Language (TOPL; Phelps-Terasaki & Phelps-Gunn, 1992) found that the CCC-2 identified pragmatic language difficulties in a greater proportion of children with ASD than the TOPL. Although the CCC-2 is not identified as an outcome measure in the manual, there is some evidence supporting its use in measuring change following intervention (e.g., Kouijzer, de Moor, Gerrits, Congedo, & van Schie, 2009). Kouijzer et al. used a Dutch version of the CCC-2 (Geurts, 2007) as an outcome measure examining neurofeedback to improve executive functioning in children with ASD and found a time by group interaction for one of the CCC-2 domains, nonverbal communication. It is not clear whether this is exactly the same measure as the English or American version

in terms of the scores provided. Validity data available for the American version suggests that it may be sensitive to change, although this has not been examined in any research.

The manual indicates internal consistency values ranging from .69 to .85 for all of the subscales (only the interests subscale fell below .75), and test-retest reliability coefficients ranging from .86 to .96. Inter-rater reliability is not given for the United States Edition.

Parent and Participant Satisfaction Survey

In addition to outcome measures, a brief satisfaction survey (see Appendix C) was completed by participants and their parents at the end of their participation in the group. Two open-ended questions were asked: "The three best things about the group are:" and "Some things I would change about the group are:" Responses to the remaining six questions were rated on a 10-point Likert scale ranging from 1 (strongly disagree) to 10 (strongly agree).

Curriculum for Intervention: Conceptual Basis and Content

Goals and activities for the group followed a standard protocol employing CBT principles relating how thoughts, feelings, and behaviours are connected. A psychologist with extensive CBT experience evaluated two to three sessions per group to ensure that the intervention adhered to CBT principles. The first hour of intervention focused on increasing social motivation and initiation, improving social perception and appropriate social responding, promoting skill generalization, and teaching social problem-solving. The manual "Social Skills Training for Children and Adolescents with Asperger Syndrome and Social-

Communication Problems" by Baker (2003) and worksheets taken from Garcia-Winner's manuals (2002, 2007) provided weekly group goals and activities. Leaders coached, prompted, praised, and highlighted conversation and problem-solving skills and provided loosely structured natural situations for social behaviours to occur during the 45 minutes of fun activities (e.g. games and building activities) that followed the one-hour teaching portion of the intervention. In addition, three extra sessions (every 4th week) focused entirely on having fun together as a group and the use of skills were interspersed throughout. Activities were decided by participants and included going swimming, playing Nintendo Wii on an auditorium screen, and a games day. These extra sessions were held on Saturdays. Parents were given handouts each week summarizing the goals and activities and a simple activity to try at home to facilitate generalization. At the beginning of the following group, parents completed a short questionnaire to rate how well they thought the child was doing with regard to the previous week's topics and whether they had tried the "homework activity." See Table 1 for an outline of the 12 weeks of group activities.

Table 1

Outline of Group Activities

Week	Activity
1	• Getting to know each other • Deciding group rules • Naming the group • Learning about "Show That I Can" • Knowledge questionnaire completion
2	• Introduction to the concept of self-monitoring • Becoming more aware of our own behaviour • Recognizing expected and unexpected behaviour in group • Introduction to concept of personal space • Introduction to links between feelings, thoughts, and behaviours
3	• Showing others that you are listening • Eye contact • Starting a conversation: what kinds of questions to ask another person • Monitoring your thinking about others • Introduction to maintaining a conversation: asking follow-up questions, staying on topic
4	• Thinking with our eyes • Interpreting nonverbal communication
5	• Hidden rules of communication • Importance of being flexible when playing games with others • Compromising • Dealing with winning and losing • How to quit when you don't want to play anymore
6	• Figuring out what others are thinking and feeling just by watching them • Importance of emotions in understanding others' social communication • Using mood monitors
7	• Conversation skills • Using "brain videos" to remember what we know about the other person • Using question prompts to organize your thoughts
8	• Timing (how long to talk) • Sensitive topics (what to say, what not to say)
9	• Staying calm during stressful social situations • Problem-solving and conflict management • Dealing with teasing

10	• Friendship management • Review of social problem-solving • Dealing with difficult friendship situations • Expectations of friends • Calling a friend on the phone • Instant messaging and e-mailing a friend
11	• Planning a social activity with a friend • How to get your parents to help you make it happen
12	• Reviewing links between feelings, thoughts, and behaviours • "Graduation" • Knowledge questionnaire and satisfaction survey completion

Intervention techniques included problem-solving activities such as an assigned Lego building activity, videotape feedback of specific role-playing, use of Polaroid cameras for facial expressions, "eye spy" games to track someone else's gaze, guessing group leaders nonverbal communication, and a "who wants to be a social skills millionaire?" game. At the end of each group, participants engaged in an activity called "Show That I Can," an adaptation of an activity used by Kendall and Barmish (2007) to have participants evaluate their ability to complete homework related to CBT. Each week participants eagerly rated their own accomplishments in meeting three group goals. This information was used only as individual feedback and not evaluated for intervention outcome.

Treatment Fidelity

Treatment fidelity was maintained by using manualized intervention and documenting variations both on an individual and group basis to any of the protocols and activities, using a checklist completed on a weekly basis by participants and parents about homework they completed, and consistency of at least one of the group leaders across all groups. Fidelity to the model of intervention was monitored by having an independent expert in CBT observe two

to three of the 15 intervention sessions to ensure their equivalence for all groups, based on elements from the weekly lesson plan, focusing on content, use of CBT principles, and activities in the second hour. Observations were random and were used to provide feedback to group leaders on treatment fidelity. Participants' attendance was monitored. As noted, all the boys attended every session except for two boys who attended 13 of the 15 sessions. One of the boys who attended 13 of the 15 sessions had missed one Saturday session and one regular session.

Data Analysis

The primary objective of this study was to examine the efficacy of a 15-week CBT-based social skills group intervention for boys aged 10-12 years diagnosed with an Autism Spectrum Disorder. To do this, two primary analyses were carried out. The first compared the changes in outcome measure scores for the group of boys who were waitlisted for 15 sessions (Delayed Treatment: DT) with the changes in scores for the boys who received immediate intervention (Immediate Treatment: IT) using a repeated measures ANOVA examining the interaction of group and time. Thus the design for this analysis is a 2 X 2 (Group X Time) design with group being Delayed versus Immediate Treatment and the two time points being the first measurement of outcome and the second measurement of outcome.

The second objective examined only the boys in the Delayed Treatment group, using a repeated measures ANOVA. The within subjects variable was time over three time points: before beginning the waitlist time period of 15 sessions, after the waitlist period and after the 15 sessions of intervention.

Significance was set at $p < .05$ and corrections (e.g. Bonferroni corrections, adjusting alpha level) were not made for multiple comparisons because the study presents pilot, exploratory data. Effect sizes were calculated using partial eta squared as this is the most appropriate effect size calculation for a repeated measures ANOVA (non-independent cells) (Brown, 2007). Partial eta squared is defined as the ratio of variance accounted for by an effect plus its associated error variance within an ANOVA study (Brown, 2007). Guidelines for the magnitude of partial eta squared effects sizes differ from the more commonly reported Cohen's d. Partial eta squared values are considered small at .01, medium at .09 and large at .25 (Bakeman, 2005; Wuensch, 2009).

Chapter 4: Results

A total of fifteen boys participated in the group based intervention with eight waitlisted and seven beginning intervention immediately. There were no significant differences between groups on age, full scale IQ, ADOS total scores, and receptive language scores as measured using a multivariate analysis of variance, $F(4, 10) = .58$, $p = .68$. Table 2 presents the mean descriptive variables for each group along with results for post-hoc test comparisons for each variable in the analysis. All participants except one in the Delayed Treatment group attended regular educational settings and none were involved in any other behavioural intervention during their participation in this study.

Table 2

Descriptive Information for all Participants in Delayed Treatment (DT) and Immediate Treatment (IT) Groups

	Mean (SD)	Range	Group	*n*	Mean (SD)	Difference Between Groups	
						F	*p*
Age in months	132.87 (6.51)	124-146	IT	7	131.85 (6.28)	.30	.59
			DT	8	133.75 (7.00)		
WASI Full Scale Score SS	109.53 (17.50)	78-136	IT	7	113.14 (18.51)	.54	.48
			DT	8	106.37 (17.17)		
CELF-4 Receptive Language SS	92.93 (10.68)	79-113	IT	7	92.29 (10.59)	.05	.83
			DT	8	93.50 (11.46)		
ADOS Communication + Social Interaction = Total Score	11.60 (3.52)	7-17	IT	7	13.14 (3.44)	2.85	.16
			DT	8	10.25 (3.20)		

Note. WASI = Wechsler Abbreviated Scale of Intelligence (M = 100, SD = 15); ADOS = Autism Diagnostic Observation Schedule, scores of 7 or greater indicate Autism Spectrum Disorder, 10 or greater indicate Autism; CELF-4 = Clinical Evaluation of Language Fundamentals – Fourth Edition (M = 100, SD = 15); SS = Standard Score.

Objective 1: Comparing the Immediate Treatment Group to the Delayed Treatment Group

Results of a repeated measures ANOVA revealed a significant Group (Immediate Treatment versus Delayed Treatment) by Time (before and after the 15 sessions) interaction effect for the two Child and Adolescent Social Perception composite scores, $F(1, 13) = 9.84$, $p = .003$. Two post-hoc univariate ANOVAs, using the Emotion score and the Nonverbal Cues score of the CASP as the

dependent variable, revealed significant interaction effects for each CASP score: CASP Emotion score, $F(2, 12) = 20.50$, $p = .001$; CASP Nonverbal Cues score, $F(2, 12) = 10.71$, $p = .006$. See Table 3 for means, power, and effect sizes.

As seen in Table 3, the Immediate Treatment group showed a marked improvement in their ability to correctly recognize and label emotions, measured using with the Emotion score of the CASP, while the ability of the Delayed Treatment group on average remained virtually identical after the 15-week period of no intervention. It should be noted that the variability in the scores for the Immediate Treatment group increased from pre- to post-intervention testing times, suggesting that not all boys made similar gains. The Delayed Treatment group's variability remained the same. The average gain of 10.2 points by the Immediate Treatment group is statistically significant as well as clinically significant as the boys were able to correctly identify or partially identify more of the emotions. Effect size for the CASP Emotion score is large and observed power (computed using alpha = .05) is .99.

For the CASP Nonverbal Cues score, the Immediate Treatment group's average score increased by 16.4 points, doubling over the 15 sessions. In contrast, the Delayed Treatment group increased by 1.3 points and variance remained almost the same. Effect size for the Nonverbal Cues score was strong and observed power greater than .80. The Immediate Treatment group showed more variability at Time 2, suggesting that not all of the boys showed similar increases in their ability to correctly use a variety of nonverbal cues to identify emotions.

Using a repeated measures ANOVA, a Group (Immediate Treatment versus Delayed Treatment) by Time (before and after the 15 sessions) significant interaction effect was also found for the knowledge questionnaire, $F(1, 13) = 27.87$, $p < .001$. The Immediate Treatment group's average score more than doubled, increasing by 10.4 points. Although the two groups had different scores at the time of initial assessment, the Delayed Treatment group's average score increased only minimally without intervention. Neither group was close to the ceiling of 34 points at either assessment time. See Table 3 for means. Effect size for the knowledge questionnaire was large and power was above .80.

A repeated measures ANOVA also revealed a significant Group (Immediate Treatment versus Delayed Treatment) by Time (before and after the 15 sessions) interaction effect for the investigator developed Peer Interaction Measure total score (PIM, $F(1, 13) = 4.87$, $p = .046$). See Table 3 for means. This measure represented an opportunity for the boys to use their social skills in an engineered but naturalistic social situation with a peer and allowed a limited evaluation of generalization of social skills learned in the intervention to a more typical situation. The average score for the Immediate Treatment group increased by 6.29 points while the Delayed Treatment group increased only 0.8 points. The average score for the Delayed Treatment group started out notably higher than that of the Immediate Treatment group. Neither group was close to the ceiling of 36 points at either assessment time. All changes in the Immediate Treatment group were in the expected direction, that is, participants' scores improved. On this measure, effect size and power were smaller.

Interestingly, the Child and Adolescent Social Perception measure scores, the Peer Interaction Measure scores and the social knowledge scores are all measures that provide more direct measures of the child's skills or knowledge, in contrast to parent report measures. The other measures, which are all parent report instruments (Vineland Adaptive Behavior Scale – Second Edition, Social Responsiveness Scale, and Children's Communication Checklist – Second Edition), showed no significant Group by Time interactions indicating that the Immediate Treatment group did not improve significantly more than the Delayed Treatment group over time. In addition, it is important to note that in this analysis, standardized measures were less likely to show improvements than non-standardized measures, with the exception of the CASP, which has limited standardization data.

The amount of variability on each of the measures is considerable (as shown in Table 3, with the Immediate Treatment group often showing greater variability in scores, particularly after intervention. Extreme outliers on several measures likely had a significant effect on the means of the small samples for each of the groups.

Table 3

Means, Standard Deviations and Differences Between the Delayed Treatment (DT) Group and the Immediate Treatment (IT) Group on Outcome Measures

Measure		IT Group Mean (SD) Range		DT Group Mean (SD) Range	$F(1,13)$[a]	p	Effect size	Power
PIM Total Score	T1	17.14 (5.46) 9-27	WL	24.62 (6.16) 14-33	4.87	.05	.29	.52
	T2	23.43 (7.04) 13-32	T1	25.38 (6.21) 17-36				
CASP ES	T1	14.14 (9.46) 0-28	WL	18.63 (6.57) 10-29	20.49	.00	.61	.99
	T2	24.86 (13.35) 2-29	T1	18.25 (6.27) 6-27				
CASP NCS	T1	16.57 (14.14) 0-41	WL	19.88 (9.17) 9-33	10.71	.01	.45	.86
	T2	33.00 (21.44) 0-62	T1	21.38 (9.64) 4-36				
Knowledge Total	T1	8.57 (5.02) 0-16	WL	16.75 (3.65) 10-22	27.90	.00	.68	.99
	T2	19.00 (3.65) 13-23	T1	17.88 (3.90) 12-25				
Vineland-II Socialization SS	T1	72.57 (5.53) 68-82	WL	74.00 (8.32) 62-85	.15	.70	.01	.07
	T2	78.29 (11.53) 62-96	T1	77.50 (11.36) 62-96				
SRS Total *t*-score[b]	T1	80.71 (5.22) 75-90	WL	85.00 (6.39) 78-98	.01	.92	.00	.05
	T2	74.85 (11.61) 60-92	T1	79.62 (9.53) 59-90				
CCC-2 GCC	T1	76.50 (3.73) 72-81	WL	81.25 (10.15) 60-92	1.23	.29[a]	.10	.18
	T2	80.83 (12.17) 69-104	T1	79.57 (11.54) 60-94				
CCC-2 SIDI	T1	-8.00 (4.05) (-13)-(-2)	WL	-14.25 (8.22) (-28)-(-4)	.25	.63[a]	.02	.08
	T2	-5.83 (5.60) (-11)-3	T1	-15.14 (4.60) (-21)-(-6)				

Note. WL= testing prior to beginning waitlist, T1= testing before intervention, T2 = testing after intervention; CASP = Child and Adolescent Social Perception Measure (ES = Emotion score, NCS = Nonverbal Cues score); PIM = Peer Interaction Measure; Knowledge = Social Knowledge Questionnaire; SRS = Social Responsiveness Scale (M = 50, SD = 10); CCC-2 = Children's Communication Checklist – Second Edition (GCC = General Communication Composite, M = 100, SD = 15; SIDI = Social Interaction Difference Index, scores of -10 to 10 are typical, scores of -11 or less are similar to scores of children with ASD); SS = Standard Score.

[a]Degrees of freedom for the CASP are 2, 12 because the CASP scores were entered together into the repeated measure calculation; degrees of freedom for the CCC-2 scores are 2, 10.

[b]Decreased scores on the SRS reflect improvement.

Objective 2: Comparing the Three Measurement Points for the Delayed Treatment Group

The Delayed Treatment group (n = 8) also served as their own controls (hypothesis 2). A repeated measures ANOVA using all three time points (at the beginning of waitlist, Time 1, and Time 2) revealed significant differences on all measures except the Nonverbal Cues score of the CASP, and the CCC-2 scores. Means, standard deviations, F-values and effect sizes are presented in Table 4 for all outcome measures across the three time points; waitlist or initial assessment (WL), immediately prior to intervention (T1), and post intervention (T2). Mauchley's test of sphericity was not significant for all measures, therefore sphericity was assumed. See Table 5 for within subject contrasts comparing WL and T1, and T1 and T2 for all outcome measures.

Table 4

Means and Standard Deviations, Repeated Measures ANOVA, and Effect Size for all Outcome Measures for the Delayed Treatment Group

Measure	Mean (SD)			*F*(2,6)	*p*	Effect size[a]	Power
	WL	T1	T2				
PIM Total Score	24.63	25.37	29.50	7.39	.01	.51	.88
	(6.16)	(6.21)	(6.05)				
CASP ES	18.62	18.25	24.62	4.90	.02	.41	.71
	(6.57)	(6.27)	(9.62)				
CASP NCS	19.87	21.38	23.88	.91	.43	.12	.18
	(9.17)	(9.64)	(14.44)				
Knowledge Total	16.75	17.87	21.88	16.28	.00	.70	1.00
	(3.65)	(3.91)	(3.80)				
Vineland-II Socialization SS	74.00	77.50	86.25	11.56	.00	.63	.98
	(8.32)	(11.63)	(11.02)				
SRS Total *t*-score[b]	85.00	79.62	74.75	5.30	.02	.43	.75
	(6.39)	(9.53)	(10.91)				
CCC-2 GCC[c]	80.71	79.57	84.00	1.84	.20	.47	.27
	(10.84)	(11.54)	(12.26)				
CCC-2 SIDI[c]	-15.57	-15.14	-16.57	0.20	.82	.03	.07
	(8.22)	(4.60)	(6.73)				

Note. CASP = Child and Adolescent Social Perception Measure (ES = Emotion score; NCS = Nonverbal Cues score); PIM = Peer Interaction Measure; Knowledge = Social Knowledge Questionnaire; SRS = Social Responsiveness Scale (M = 50, SD = 10); CCC-2 = Children's Communication Checklist – Second Edition (GCC = General Communication Composite, M = 100, SD = 15; SIDI = Social Interaction Difference Index, scores of -10 to 10 are typical, scores of -11 or less are similar to scores of children with ASD); SS = Standard Score.

[a]Partial eta squared.

[b]Decreases in scores on the SRS reflect improvements.

[c]Degrees of freedom for the CCC-2 scores are 2, 5.

Table 5

Within Subject Contrasts for Outcome Measures

Measure	WL to T1		T1 to T2	
	F	*p*	*F*	*p*
PIM Total Score	.23	.64	9.64	.02
CASP ES	.06	.81	4.99	.06
CASP NCS	.37	.58	.67	.44
Knowledge Total	5.50	.05	12.8	.01
Vineland-II Socialization SS	3.33	.11	8.80	.02
SRS Total *t*-score	2.72	.14	3.05	.12
CCC-2 GCC	.25	.64	5.29	.06
CCC-2 SIDI	.02	.89	.83	.40

Note. CASP = Child and Adolescent Social Perception Measure (ES = Emotion score, NCS = Nonverbal Cues score); PIM = Peer Interaction Measure; Knowledge = Social Knowledge Questionnaire; SRS = Social Responsiveness Scale (M = 50, SD = 10); CCC-2 = Children's Communication Checklist – Second Edition (GCC = General Communication Composite, M = 100, SD = 15; SIDI = Social Interaction Difference Index, scores of -10 to 10 are typical, scores of -11 or less are similar to scores of children with ASD); SS = Standard Score.

There were improvements approaching significance on the CASP Emotion score and the Children's Communication Checklist – General Communication Composite, and significant differences on the Peer Interaction Measure total score, and the Vineland-II Socialization score only after intervention. On the Knowledge questionnaire there were significant differences after the waitlist period ($p = .05$) and after the intervention ($p = .009$). Effect sizes for all measures, except the Nonverbal Cues score of the CASP and the CCC-2 Social Interaction Difference Index were large. Plots of the eight participants across three time points for each of the outcome measure scores are presented in Figures 3 through 10.

Unlike the Immediate Treatment group, there was no significant improvement on the CASP Nonverbal Cues score. Variability in the two CASP scores increased post intervention suggesting that some boys may have improved on their ability to identify salient nonverbal cues while others did not. There were five boys who showed little or no improvement in the Nonverbal Cues score while three boys did improve with intervention. This is unlike the CASP Emotion scores where all but one boy made improvements in his score from T1 to T2.

On the knowledge questionnaire participants went from an average of 25% correct to an average of 55% correct. The range of increases in scores on this measure from WL to T1 was 0 to 3 points, with an average of 1.25 points. From T1 to T2, the range of increases was 0 to 9 points with an average increase of 4 points at T2. Again, it is evident from individual data that there was considerable variability in the gains made on this measure after intervention, with three boys showing little or no improvement and four showing improvements that equaled or exceeded the average increase of 4 points, which represents about a 10% increase in scores.

Variability in individual scores was also seen on the Vineland-II Socialization standard score, where the range of changes in participants' scores from WL to T1 was -6 to 11 with an average of 3.5. From T1 to T2 changes in participants' scores ranged from 0 to 19 with a mean of 8.75. On this measure, four boys well exceeded the mean increase of 8.75 with increases of more than 13 points after intervention with the remaining four boys showing improvements of less than 3 points, well below the mean increase.

On the Children's Communication Checklist – General Communication Composite, the change in scores from WL to T1 ranged from -12 to 12 with a mean of -.75. From T1 to T2 changes in scores ranged from -4 to 11 with a mean of 3.88. On this measure only three boys showed improvements greater than 7 points on the standard score.

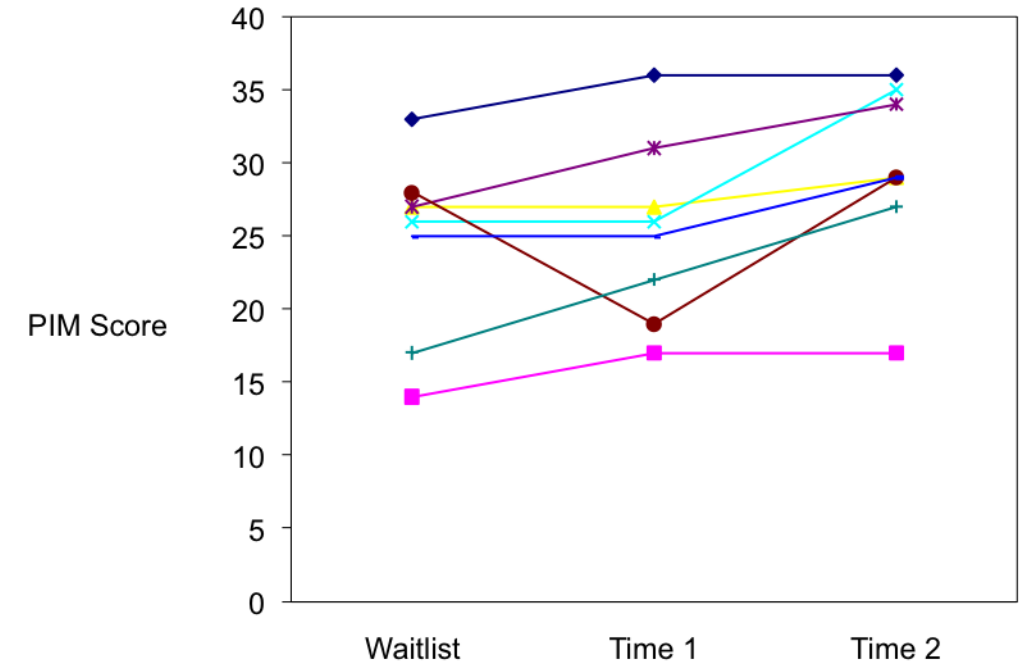

Figure 3. Plot of eight waitlisted participants' performance across three time points on the Peer Interaction Measure.

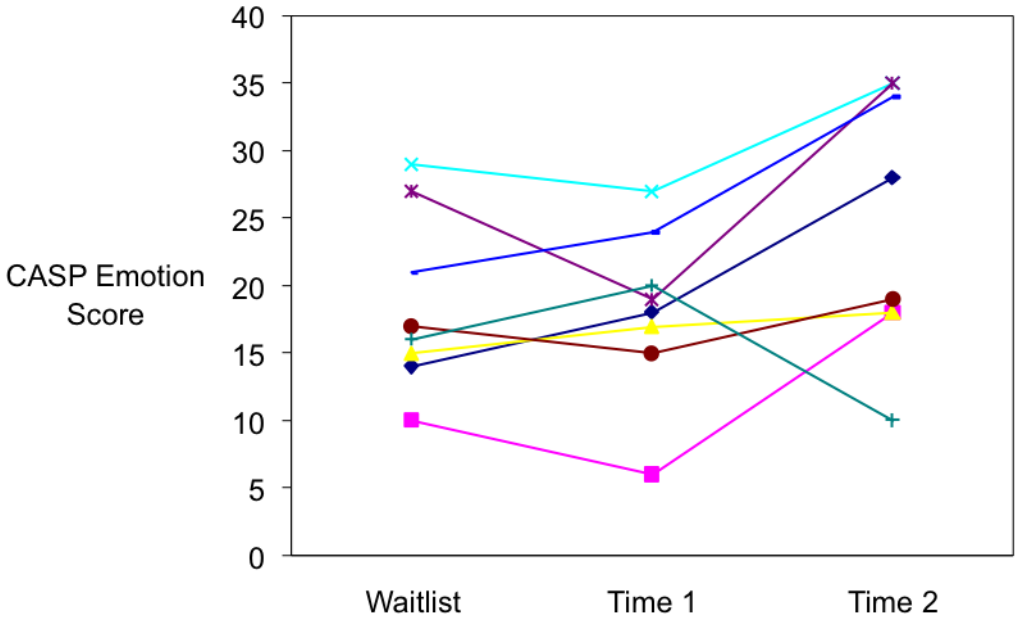

Figure 4. Plot of eight waitlisted participants' CASP Emotion scores across three time points.

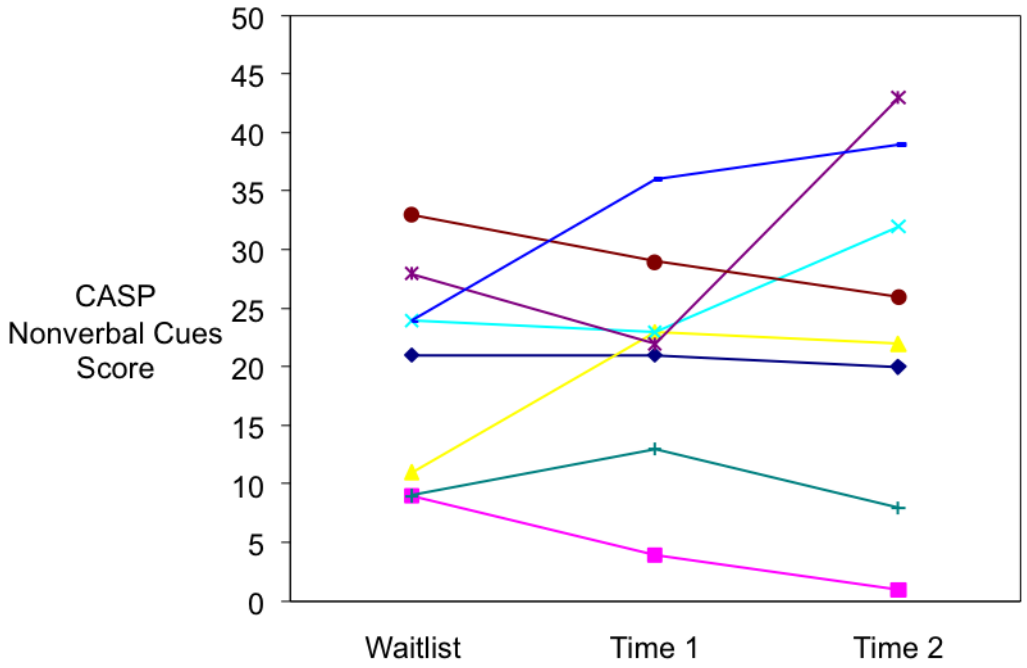

Figure 5. Plot of eight waitlisted participants' CASP Nonverbal Cues score across three time points.

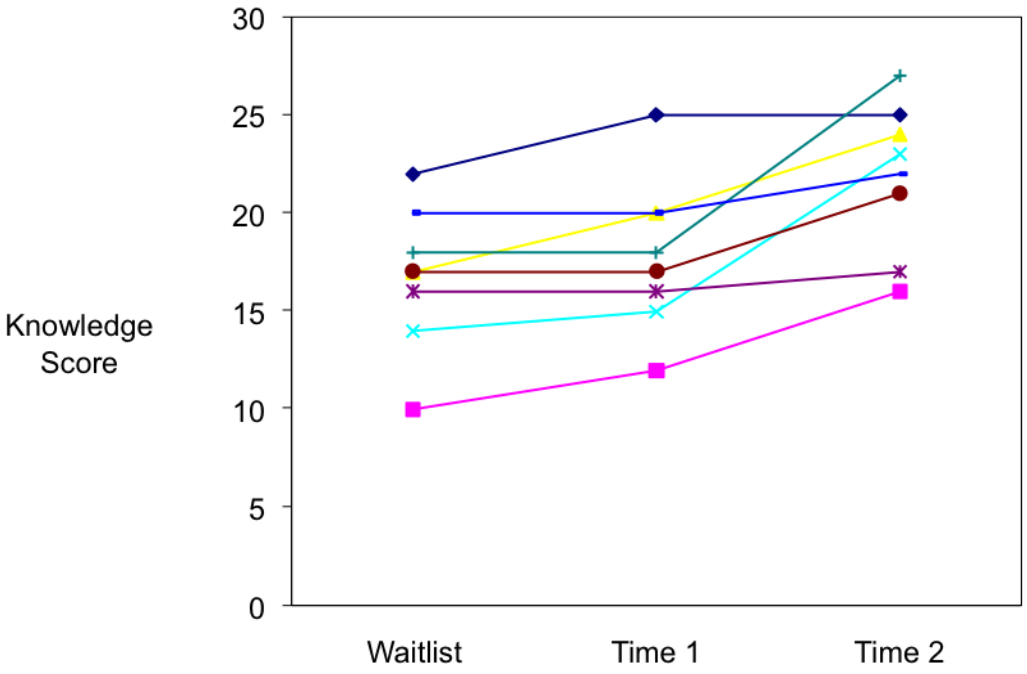

Figure 6. Plot of eight waitlisted participants' performance across three time points on the Knowledge questionnaire.

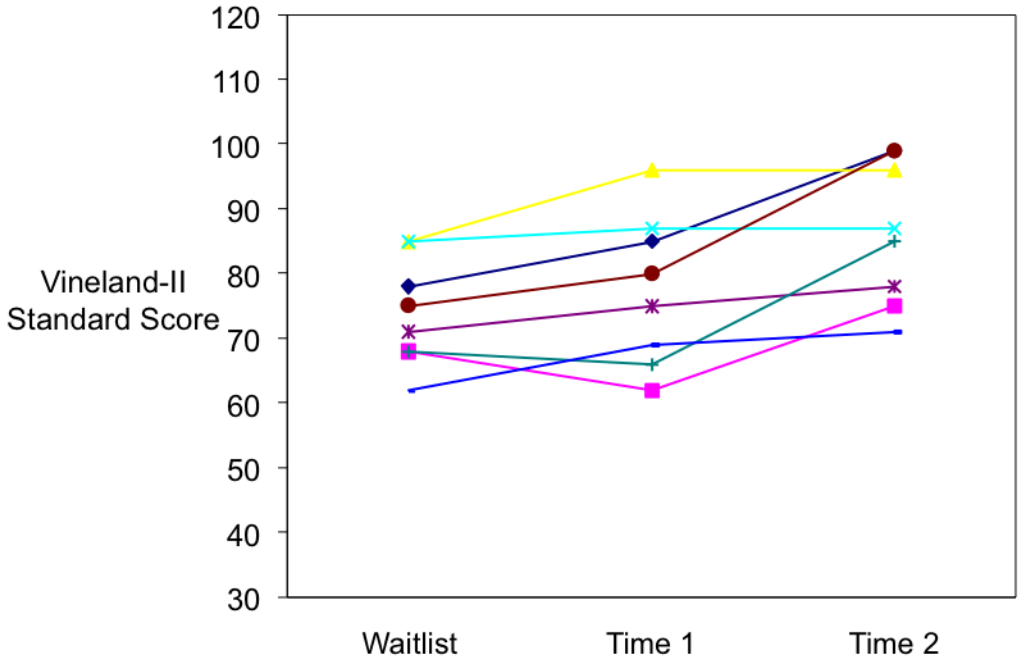

Figure 7. Plot of eight waitlisted participants' performance across three time points on the Vineland-II Socialization scale.

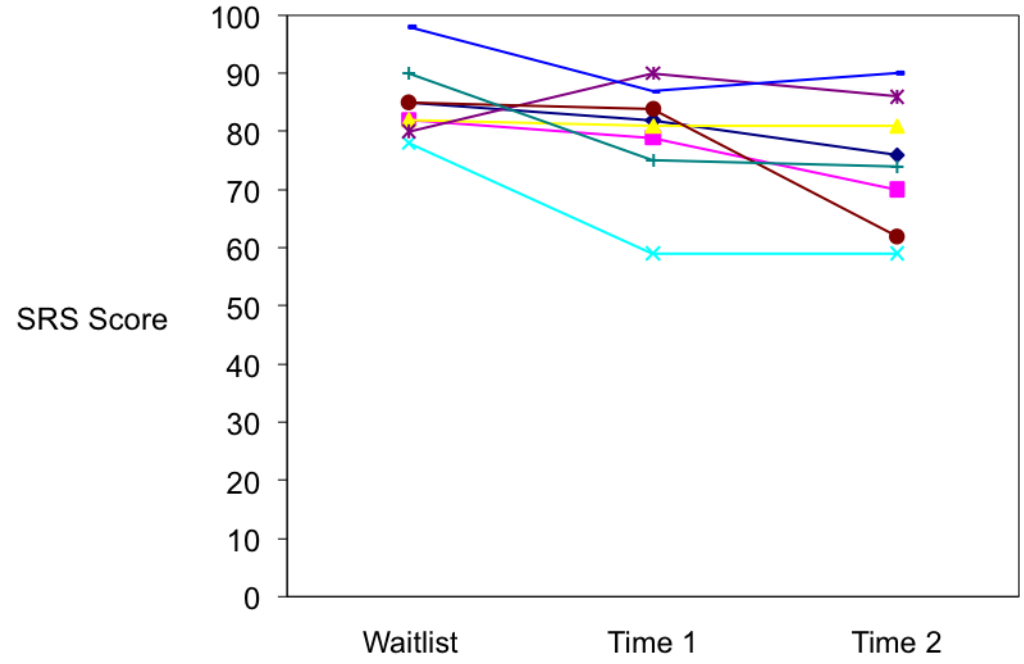

Figure 8. Plot of eight waitlisted participants' performance across three time points on the Social Responsiveness Scale.

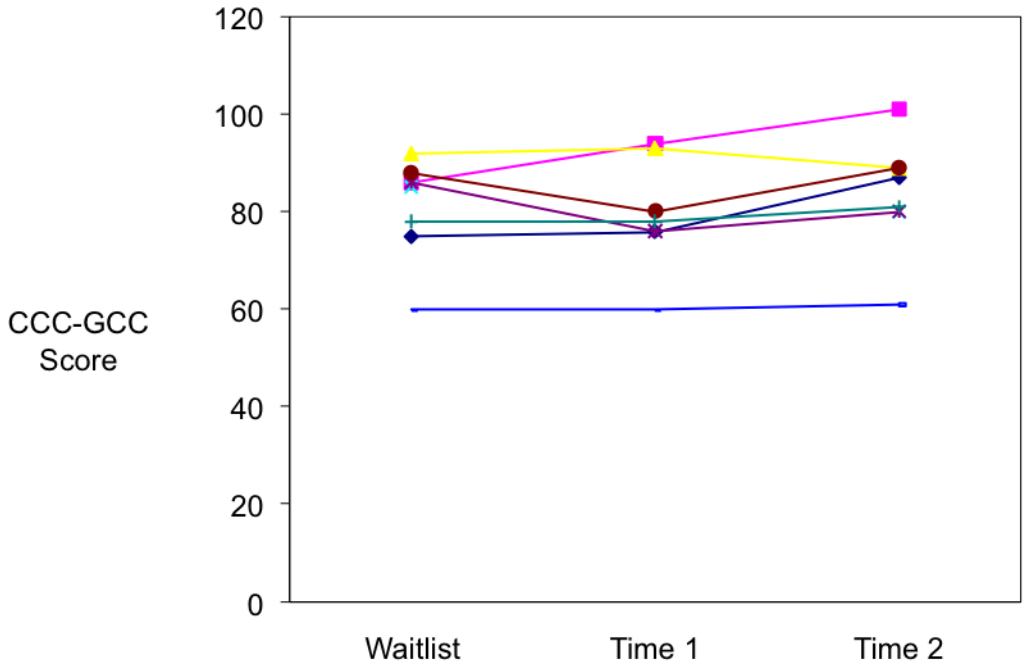

Figure 9. Plot of eight waitlisted participants' performance across three time points on the CCC-2 General Communication Composite.

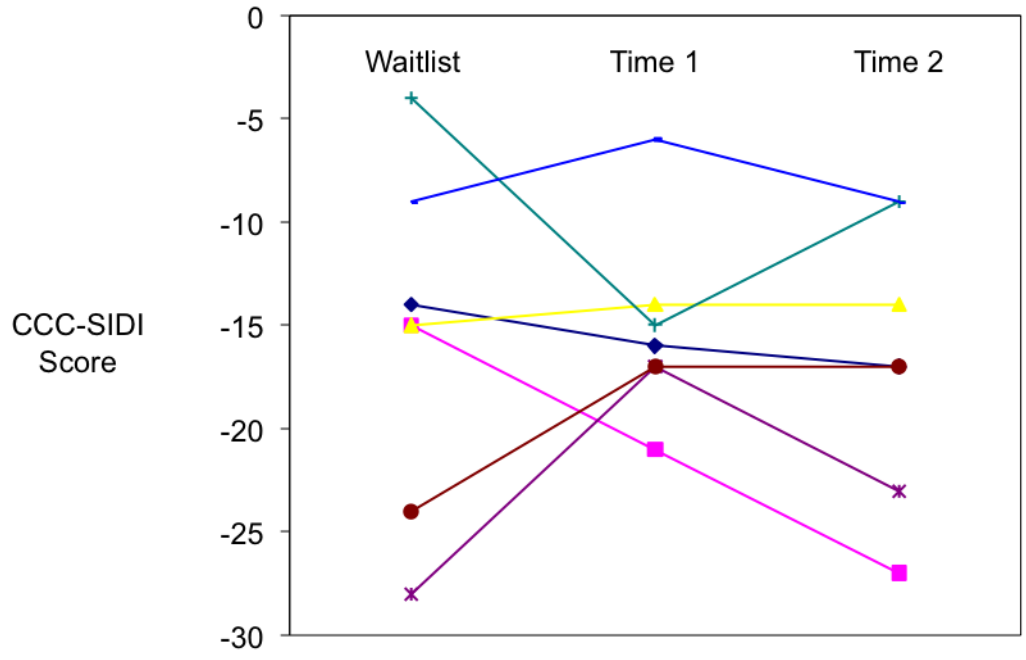

Figure 10. Plot of eight waitlisted participants' performance across three time points on the CCC-2 Social Interaction Difference Index.

There were also improvements after intervention on one of the parent report measures. The effect size for the increase on the Vineland-II Socialization score was larger for the Delayed Treatment group than for the Immediate Treatment group. For boys 10:0 to 10:11, a mean standard score of 86.25 falls within one standard deviation of the standard score mean of 100 and would be described as adequate, using Adaptive Level Descriptions from the manual (Sparrow et al., 2005, p. 65).

The lack of significant change on the CCC-2 scores is consistent with the results for the Immediate Treatment group. While changes on the CCC-2 General Communication Composite score were in the anticipated direction they were not large enough to reach significance. Scores on the CCC-2 Social Interaction Difference Index remained virtually the same across all three time-points. The sample size was reduced because one of the eight DT group participants could not be included as he did not meet the measure's consistency check, similar to the Immediate Treatment results where one boy's scores were not consistent. Individual variation was again evident with changes in the standard score from T1 to T2 in the General Communication Composite scores ranging from -4 to +26 and changes on the Social Interaction Difference Index ranging from -6 to +9.

Results from the parent and participant satisfaction questionnaire were also examined. On the satisfaction questionnaire which was completed by 13 of the 15 parents, parents rated how strongly they agreed or disagreed (1 = strongly disagree, 10 = strongly agree) with six statements about the group. Table 6 provides the range, and mean (SD) for parents' responses. Parents were most

positive about the communication with the group leaders and least positive about whether participation in the group would help their child make a friend at school. Sample comments made by parents include:

- My son is more aware of his actions
- My son enjoyed being around other boys like him
- My son can tell me about social clues and how he can react to them when he is in a calm stage
- My child got to meet and interact with other children with high functioning ASD
- The group activities prompted us to discuss social topics more at home
- My child was encouraged to think more about how his actions affect others
- Giving parents tools so that we can practice skills with our children
- Opportunity to receive feedback in areas that are challenges for our kids
- Networking with other parents/resources for families

When asked to comment on negative things about the group parents said:

- The drive :)
- Not much – possibly a smaller snack
- Location

Table 6

Parent Responses on Satisfaction Questionnaire

	Range	Mean (SD)
Helped my child pick up on social cues	5-10	7.46 (1.61)
Helped my child to react appropriately to social cues	5-9	6.92 (1.26)
Initiate conversation with peers	5-9	6.77 (1.48)
More likely to make a friend at school	5-9	6.38 (1.45)
Recommend this group to other families	6-10	8.85 (1.40)
Good communication with group leaders	4-10	8.38 (2.06)

Participants also rated the group using a satisfaction questionnaire with the same scale as the parent questionnaire (n =14). Several participants crossed out the number 10 and put in a number like 10,000 or a million, reflecting their enthusiasm for the group. Table 7 presents the range, means and standard deviations for the participants' responses. These scores reflect greater variability than those of the parents. Participants were most positive about suggesting this group to a friend and least positive about whether participation in this group would help them make a new friend at school. Their scores on the first two questions, which were the same as the questions their parent rated were similar to their parents. Sample positive comments made by participants included:

- Games
- Best snacks
- Getting paid
- The Saturday classes
- Got to play Wii on the Saturday group

- The parents got to do homework
- Making new friends
- Learning new things
- Activity time

Negative comments included three participants who wrote:

- Nothing is bad about it
- Making the hours longer
- Having/playing more games
- Making the room wider
- That it could last forever
- That my mom forgot the Wii group.

Table 7

Participant Responses on Satisfaction Questionnaire

	Range	Mean (SD)
Pick up on social cues	4-10	7.07 (1.94)
React better to social cues	3-10	7.07 (2.40)
Start talking with kids my age	1-10	5.00 (2.86)
Make a new friend at school	1-10	4.57 (3.16)
Get along better with other kids	1-10	6.07 (2.76)
Suggest this group to other kids	1-10	7.29 (3.20)

Chapter 5: Discussion

Deficits in social interaction skills are one of the core features of ASD and are a major barrier to a good quality of life and meaningful participation in school, work and leisure activities for persons with ASD. Relatively few research studies have studied the efficacy of social skills intervention for school-aged children with ASD. It is also important to evaluate programs which are in common usage, especially given the ever increasing number of published manuals aimed at providing clinicians with group-based formats for treatment in this area.

This pilot study addressed the use of a CBT-based social skills intervention group for boys aged 10 to 12 years. Curriculum was based on programs and materials available in the literature. One group of participants began intervention immediately while another were assessed but placed on a waitlist. Following the 15-week intervention, both groups were re-assessed and the participants on the waitlist then began intervention. The study revealed marked positive effects on children's measures for children in the immediate intervention group compared to children who had been waitlisted when both groups were assessed at the 15-week time-point. In addition, the study added another element of experimental control as participants in the Delayed Treatment group were assessed at three time points, before the waitlist period, just prior to intervention, and after intervention. On the Peer Interaction Measure, the Child and Adolescent Social Perception Measure Emotion Score, the knowledge questionnaire and the Vineland II Socialization Standard Score, the scores of the eight boys did not change significantly until they too had participated in the intervention. These

results contribute to the social skills intervention literature for school-aged children with ASD.

The results represent preliminary findings based on a small sample. They are, nonetheless, encouraging. In comparison to the Delayed Treatment group who received no intervention for 15 sessions, the Immediate Treatment group significantly improved in their ability to infer emotions, use nonverbal cues effectively, interact successfully with peers, and correctly answer questions about how to respond to social situations with intervention. Significant improvements were not found on parent report measures of pragmatic language, social responsiveness or general socialization skills. Findings examining only the Delayed Treatment scores at three time points found significant improvements for their ability to infer emotions and their general communication skills, and significant improvements in their ability to interact appropriately and effectively with a peer in a waiting room situation. In addition, results for this group also found improvements on a parent rated measure of socialization.

Improvements in the ability to understand and interpret social cues suggest that some children with ASD can be explicitly taught to recognize nonverbal social cues. Emotion recognition was taught in the context of typically occurring social scenarios and reinforced during play-based activities. Although much work needs to done to examine the mechanisms for improvements in this area, the intervention's focus on verbally describing the cognitive processes linked to observing and interpreting others' nonverbal social cues may be a contributing factor to improvements. For example, participants in the group were encouraged

to say out loud what they were noticing about another person's cues and what this might mean in games that gave points for noticing cues. Making explicit the more subtle, implicit ways that typically developing children infer emotions may have taken advantage of participants' average to above average cognitive skills. This approach supports previous research that suggests that children with ASD can be taught to use cognitive skills to better understand emotions (e.g., Bauminger, 2007a, 2007b; Kasari, Chamberlain, & Bauminger, 2001; Sofronoff et al., 2005; Solomon et al., 2004). Izard et al. (2001) suggest that understanding emotions may generalize to greater social competence in the long term. While there were marked improvements for some children, scores also indicated that there was still room for skill development. Scores did not come close to the ceiling on the measure.

Changes in the ability to correctly answer problem-solving social knowledge questions (see Appendix B for questions) suggest that the intervention was effective in teaching participants to both generate potentially appropriate responses to specific social scenarios and to choose the best possible alternative. In order to do this, participants needed to anticipate, at least in part, how another person might respond. Teaching a child with autism to take another's perspective using cognitive behavioural techniques appears to be particularly promising given that perspective-taking ability is often considered a social deficit in children with ASD (David et al., 2010). Results from the social knowledge data in this study support the idea that both of these cognitive behavioural techniques can be used to teach children with ASD skills such as perspective-taking (Charlop-Christy &

Daneshvar, 2003). Dawson and Fernald (1987) suggest that this ability may contribute to greater social competence.

Another area addressed by the social knowledge questionnaire was related to knowing what to say in particular social situations. For example, participants were asked what they might say when they want to keep a conversation going with a peer. During the group, participants were reminded to add information about their peers to a "brain video" where they could store things they knew about another person. They were then taught to use brain video information to ask appropriate questions, sometimes emphasizing that they might need to ask a question that was not particularly interesting to them. Rehearsals of this skill during unstructured time such as snack time provided "out loud self talk" opportunities allowing participants to use cognitive rehearsal skills in homework assignments and across natural occurring opportunities during the group. Application of this self-talk technique adds to previous research where it has been used with children with ASD to teach memory strategies (Bebko & Ricciuti, 2000), and self-control (Groden & LeVasseur, 1995).

The results for the Delayed Treatment group must be interpreted cautiously as their scores indicated a significant improvement even prior to intervention, for the Knowledge questionnaire. Although the reasons for this may be related to maturation, it seems more likely that this group's improvement without intervention is related to the characteristics of the group. Participants in this group demonstrated greater social knowledge to begin with and had lower ADOS scores.

Comparisons of the Delayed Treatment group and the Immediate Treatment group as well as the Delayed Treatment group across three time points both showed that changes occurred only after intervention on most of the measures. Neither maturation nor prior experience with the measure could account for improvement because, in the first analysis, the two groups were tested after equal amounts of time with only the group receiving intervention demonstrating significant improvements. In the second analysis, improvements occurred only after intervention with the exception of the social knowledge questionnaire, as discussed above.

Definitive changes were observed on the Peer Interaction Measure (PIM), developed by the investigators for this study, while changes on the parent-rated Children's Communication Checklist – Second Edition (CCC-2; Bishop, 2006) were not significant. Both of these were viewed as measures of pragmatic language. Behaviours scored on the PIM included orienting to peer, gestures, facial expressions, flow of interaction, ability to adjust to the speaker and show an interest, and a sense of shared enjoyment (see Appendix A) during an opportunity to engage in a conversation with a peer he did not know. Interestingly, some of the boys observed that they had seen the confederate in the waiting room before but none seemed to think this was strange, so it seems unlikely that this affected the actual interaction. Previous encounters with the confederate peer may have made second or third encounters more comfortable (and thus higher scoring). This is not borne out by the data from the Delayed Treatment group where minimal gains were made during the waitlist period and more substantial gains were made

after intervention. Observation of improvements in these behaviours provide some evidence supporting the generalization of skills learned during intervention beyond the group, as participants were unaware of why they were in the "waiting room" or that their behaviours were being taped. Motivation to engage in the interaction was provided by the fact that the child confederate was playing a handheld video game, an attractive activity for many of the boys. The level of motivation may not be the same in day-to-day interactions with peers or siblings and hence parents may not have seen the same kinds of improvements on the CCC-2, although some improvements in the General Communication Composite were observed after intervention for the Delayed Treatment group.

There are some additional reasons why improvements might not be observed by parents on the CCC-2. One is that the CCC-2 focuses on behaviours that are unusual for typically developing children but have been clinically reported in kids with a pragmatic language impairment, so they might not occur in a semi-structured observation, like that of the Peer Interaction Measure. In addition, these behaviours are not necessarily frequent, but when they do occur they are salient – and parents are able to clearly identify them, while they may not be observed in the 10 minute interaction used in the Peer Interaction Measure.

The finding that pragmatic language skills on the CCC-2 (Bishop, 2006) did not significantly improve over the course of the 15-week intervention, despite a focus on many aspects of pragmatic language, may also be related to how comprehensive pragmatic language is by nature and how it was measured in this study. Bishop (2003) does not identify outcome measurement as one of the

potential uses of the CCC-2, and this study suggests that the CCC-2 may not be an appropriate outcome measure when the intervention is being evaluated in the short term.

Changes in pragmatic language ability might be more effectively addressed by measuring component parts of pragmatic language that could be expected to change in 15 sessions rather than a global measure, which is more likely to remain stable over this period of time. Adams and Lloyd (2005) discuss the challenges of measuring changes in pragmatic language and suggest that checklists identifying pragmatic language difficulties are more useful for identifying goals for intervention than for measuring change and the CCC-2 is a checklist.

The only additional measure to show improvements was based only on the results for the Delayed Treatment group on the Vineland (Sparrow et al., 2005) Socialization standard score. With participants acting as their own controls, parents identified improvements in behaviours related to the three subdomains of interpersonal relations, play and leisure time, and coping skills, which together make up the domain of Socialization.

The sensitivity of the Vineland-II Socialization score to change after 15 sessions of intervention should be considered. Owens and colleagues (2008) used the Socialization standard score as an outcome measure comparing a problem-solving social skills group to an alternative intervention and a no-intervention group. This intervention was offered for one hour per week over 18 weeks so it

represents a similar dosage. They reported a "trend" for the intervention groups to improve faster than the control group who received no intervention.

Using parent reports to measure intervention outcome in school-aged children has shown mixed results, with some research showing significant improvements (Beaumont & Sofronoff, 2008; Tse et al., 2007), some failing to reach significance (Sim, Whiteside, Dittner, & Mellon, 2006; Webb, Miller, Pierce, Strawser, & Jones, 2004), and some showing more mixed results (Laugeson et al., 2009). LeGoff and Sherman's (2006) three-year intervention used the Socialization standard score of the Vineland-II and were able to demonstrate significant improvements over this relatively long period of intervention. Thus results from this study are particularly encouraging, especially given the short treatment time frame and small sample size.

Parent and participant satisfaction results provided some interesting insight into the impact that this intervention might have. When participants and their parents were asked if they thought this group might help the boy make a friend at school, they were least likely to agree with the statement. Both the boys and their parents recognized that making new friends outside of the group may still be difficult. On the other hand, both parents and participants felt strongly that they would recommend the group to someone with similar problems indicating that they viewed the group as beneficial.

Relationship of Results to Social Information-Processing

Crick and Dodge's social information-processing model was chosen as a general basis for understanding areas for intervention for children with ASD

because it is a well-established model which has proved useful with children with other disabilities (Bauminger, Schorr-Edelsztein, & Morash, 2005; Quiggle, Garber, Panak, & Dodge, 1992; Walz, Yeates, Wade, & Mark, 2010). The mental processes of encoding and interpreting social cues (social perception), deciding on a relevant social goal, generating possible behaviours, and choosing and evaluating a specific response for enactment were primary foci for the CBT-based intervention of this research. Social perception was a particular focus and there were significant gains seen in this area. While the Crick and Dodge's (1994) model does not specify intervention activities, concepts such as "thinking with your eyes," detective games to teach attention to facial expressions, gestures, and situational cues, were explored in several of the 15 sessions and were reinforced throughout the 15 sesions.

Embregts and van Nieuwenhuijzen's (2009) paper suggests that understanding the underlying process of social interaction may be critical in appreciating differences in how children with ASD process social information, which would in turn facilitate the design and adaptation of social skills intervention. Using video vignettes, with a structured interview, children with ASD were asked to describe what had happened in the vignette, why it had happened and what they would do. Responses were then coded according to encoding of emotional cues, response generation, evaluation of submissive/ assertive responses, and whether the child perceived that the person in the vignette had made a good choice. They found that there were significant differences for boys with ASD compared to a control group on these areas of the social

information-processing model. Therefore, the model was useful in providing a focus for intervention efforts.

Some areas of the social information-processing model were not addressed in this research and may be important in understanding why some boys did better than others after intervention. Emotion and cognition are forms of information-processing (Lemerise & Arsenio, 2000) that interact to affect the child's motivation to interact socially. Motivation to interact may be affected by, for example, previous experiences, social knowledge, mood, how nonverbal cues are interpreted, how others respond or show interest, the child's own ability to regulate emotion, and whether interacting with another person meets their needs or goals. Motivation to interact and having the skills/knowledge to engage successfully with peers are both important (Bye & Jussim, 1993). Children with ASD may be motivated to interact but lack the ability to interpret their peers' subtle cues. Alternatively, they may acquire skills in interpreting and responding to social cues but still not be motivated to engage, for a variety of reasons, sometimes related to specific preoccupations not shared by their peers. Although this was not addressed by this research, observation of participants in group suggests that motivation needs to be carefully considered in measuring responses to intervention for these children across activities and contexts.

Crick and Dodge's (1994) social information-processing model provided a useful framework for both measurement and intervention. The autism literature identified specific deficits related to aspects of this model. The current study adds to the recent research done by Embregts and van Nieuwenhuijzen (2009) who

began the process of mapping social deficits seen in ASD onto the Crick and Dodge model of social information-processing. Perhaps the social information-processing model should be specifically adapted to understand differences in children with ASD. Bauminger et al. (2005) adapted Tur-Kaspa and Bryan's (1994) social information-processing measure to examine various aspects of the Crick and Dodge (1994) model for children with learning disabilities and nonverbal learning disabilities. Their adapted measure, which includes questions addressing the encoding of social cues, representing and interpreting social cues, clarifying goals, searching for possible social responses and making a response decision might provide valuable additional information in intervention studies for children with ASD. In summary, Crick and Dodge's model holds promise for understanding social information-processing difficulties, providing intervention, and measuring changes in social skills for children with ASD.

Relationship of Results to Cognitive Behavioural Therapy

Results from this research provide support for CBT as an intervention technique for children with ASD whose cognitive skills fall in the typical range. Building on research by Bauminger (2002, 2006, 2007a) and more recent research led by Laugeson et al. (2009) and White et al. (2010), this research focused on using CBT techniques to teach social cognitive abilities using techniques such as video modeling; "homework assignments;" explicitly linking thoughts, behaviours, and feelings; and behavioural rehearsal in naturalistic, play based settings. CBT-based social skills intervention is hypothesized to be effective

because it moves beyond behavioural rehearsal to a greater focus on changing thinking processes.

In typically developing children, early work by Meichenbaum and Goodman (1971) demonstrated that children could be taught to use a form of self-talk as a way of problem-solving and changing behavioural responses. This application of self-talk as a way to make social perception judgments is gaining greater support in studies examining CBT for children with ASD (e.g., Reaven et al., 2009). Interventions that have used CBT-based techniques often apply social cognition or social thinking curriculums. A good example of this type of intervention is a recently published study by Crooke and colleagues (2008) which used one of the same manuals as this study (Michelle Garcia Winner's Social Thinking program) for boys with ASD aged 9 to 11. Using a multiple baseline, single subject research design, they found substantial gains on "expected" social behaviours. They suggest that one of the reasons that previous social skills interventions have failed to show "large scale improvements" or generalization is that these studies have not addressed the cognitive aspect of social interaction. A shift towards an emphasis on using social cognitive abilities to interpret social cues and respond effectively seems to demonstrate greater gains in social skills (e.g., Bauminger, 2002, 2007a, 2007b; Crooke et al., 2008; Solomon et al., 2004). The findings of our research (which occurred during Crooke's publication period) support the idea of teaching children to use metacognitive techniques rather than only teaching discrete skills (Crooke et al., 2008). Further refinement of the

adaptation of CBT for children with autism should continue to be a focus of future research as evidence for its support continues to emerge.

Relationship of Results to Executive Functioning Theory of Autism

The question of whether results from this study can be directly linked to the executive functioning theory of autism requires an understanding of how CBT-focused intervention might have an impact on executive functioning in real-life situations. The focus in CBT on explicitly teaching metacognitive skills may be critical in helping children with ASD to plan using mental rehearsal strategies, to adapt more flexibly to the demands of social interaction using "stored" social knowledge about specific individuals and situations, and to generate a greater range of potentially appropriate responses using definitive problem-solving methods (with a strong focus on contextual or environmental cues). Self-monitoring was a primary focus of the intervention offered in this study; participants were taught to monitor and make self-judgments about expected and unexpected behaviour. This particular skill may be a crucial moderator (Henderson et al., 2006) in how well children did on the Peer Interaction Measure where the demands of the situation required that the participant make behavioural and interaction choices without any adult or peer coaching.

To date, few studies have attempted to draw links between executive functioning and why CBT may be a critical component of intervention for children with ASD. Crooke et al. (2008) suggest that the social cognitive approach may be more effective for this population because its focus on understanding the "why" of interaction capitalizes on these children's relative

language and cognitive strengths. Further research examining whether social skill remediation using CBT techniques actually changes executive functioning would be helpful in understanding whether the reason for CBT's relative success is related to its use of metacognitive strategies to teach social skills. The 'active ingredient' may be CBT's focus on linking thoughts, feelings, and behaviours so that children with ASD are not just learning rote skills but processing social information to produce more successful, appropriate interactions. At present, only Bauminger's 2007 study demonstrates an indirect effect of CBT-based group social skills intervention on executive functioning.

Measurement Issues

To begin the process of examining which children benefit most from this type of intervention, this research used inclusion criteria which defined participants diagnosed using both DSM-IV-TR criteria and the Autism Diagnostic Observation Schedule as well as specifying age, gender, IQ, and receptive language. The inclusion criteria provide important information about potential participants for researchers interested in replicating the research as well as for clinicians interested in implementing this type of intervention in clinical practice. Outcome measurement intentionally included both direct measures, i.e., observation of social behaviours, as well as indirect measures, based on parent report. Koenig and colleagues' paper (2009) on the unique circumstances of providing and measuring efficacy in group-delivered social skills identified the need for multidimensional, multi-method approaches to measurement of outcome. The complexity of social interaction as a construct demands methods of

conceptualizing change that include and go beyond standardized, global measures. This research attempted to address both intervention-specific components of social interaction and more general measures of these components. The finding that changes were not significant on the broader standardized measures of socialization constructs is consistent with several other research studies (e.g., Barry et al., 2003; Ozonoff & Miller, 1995; Webb et al., 2004) and suggests that 15 sessions may not be long enough to see changes in more comprehensive measures of social skills.

Few intervention outcome studies for children with ASD have included an observational measure focused on individual peer interaction after a group intervention. Bauminger's (2007b), Legoff's (2004), and Owens and colleagues' (2008) research did include behavioral observation during free playtime. These research studies support this labor-intensive method of recording observations of social interaction, which often provides the most sensitive measure of change and generalization beyond intervention. It was possible to observe changes in social behaviour using a more structured observation, lending support to the potential of this novel and less time-consuming method of observing interaction. However, it is not clear how well this measure relates to actual peer interactions that a child has in everyday life.

Potential rater bias was addressed by having all inclusion criteria and outcome measurements completed by assistants not involved in the intervention. They were also blinded to whether the participant was in the Delayed or Immediate Treatment group and to the research hypotheses.

Systematic Application and Manualization of Intervention

The intervention used in this study adapted material from two readily available treatment manuals and was based on an understanding of social information-processing, principles of CBT, and an understanding of the role of executive functioning in social competence. Smith and colleagues (2007) suggest that there are four phases of research on psychosocial interventions in autism including "(a) formulation and systematic application of a new intervention technique, (b) developing a manual and research plan for evaluation of the intervention across sites, (c) randomized clinical trials, and (d) community clinical effectiveness studies." (p. 356). This research attempted to address the first phase and parts of the second phase. There is merit in the concepts and strategies of CBT-based intervention using manuals that are commercially available and already accepted by clinicians. Balancing the need for individual flexibility in approaches and the need for uniformity of intervention was challenging, especially given the nature of interactions of individuals within the group, which varied considerably based on the individuals in a particular group. For example, one group had a fairly outspoken boy whose behaviours were annoying to another boy who really wanted everyone to follow all the rules about taking turns. In each of the groups, the salient features of one or more group members certainly did affect the group's interactions. Nonetheless it was possible to base enough of the intervention goals, and the activities used to implement the goals, on clearly documented plans that the intervention could be delivered to three different groups of boys with only minor modifications. Clinicians who have recently used

the program developed for this study in a clinical setting with a more heterogeneous group of children have had little difficulty following the intervention goals and activities for a 12-week intervention program (Keya Clegg, personal communication, September, 2009)

Limitations

Methodological. An obvious limitation of this research is the sample size (n = 15). Despite significant differences, there remains a concern that the differences occurred by chance. Chance is not a likely explanation because two comparisons were made: one examining differences between a group not receiving intervention and a group receiving Immediate Treatment, and the second examining differences within subjects who received the delayed treatment. As well, a crucial limitation, based on sample size, is that a lack of significant findings on some of the measures may actually be related to decreased power from insufficient sample size. The small sample size also means that the effects may be specific to the children whose parents volunteered them to be part of the intervention or to these specific children. Despite the small sample size of the pilot study, it does support a growing body of social skills intervention research that systematically addresses research quality by including a Delayed Treatment control group.

Other aspects of the sample also limit the generalization of these results. Inclusion criteria limited participation to boys, and to participants with average or above average IQ and receptive language. In addition, the involvement requirements meant that parent participation and commitment played an integral

role in factors such as attendance and completion of homework assignments, which are all factors that are often less controlled in clinical settings.

Several other important methodological limitations may have had significant impacts on the results of this study and their generalization to clinical populations. Data on adherence to "homework assignments" was not systematically collected (except to ask the parents to rate their perceptions of whether they had completed the homework assignment). Parental involvement in general was not captured in the results of this study and may play an important role in social skill improvements (Laugeson et al., 2009). Evaluation of dosage of intervention would be difficult to carry out, at least partly because of the variability in the motivation to engage in activities at home to reinforce skills learned in the group.

There is also concern about the credibility of the results on measures that were not standardized where there were greater improvements than those seen on more standardized measures. This may have been related to sample size, sensitivity of the measures to change, and whether the measure addressed areas that would be expected to change after the intervention provided in this study. The amount of change in scores seen on the Social Responsiveness Scale (SRS) corresponds to that seen in the Tse and colleague's study (2007) (approximately 10 points), although their study's participants had poorer scores to begin with. They did find significant differences with a larger sample (n = 34), but measured only pre- and post-intervention, without measuring a control group. Another study using the SRS to measure parent rated autism symptoms after a cognitive

behavior intervention program did find significant differences using raw scores on the SRS (Wood et al., 2009b).

Whether improvements were sustained was also not addressed in this study. Fifteen sessions of weekly intervention provides a relatively small dosage, especially compared to early intervention programs that are offered daily for much longer periods of time. In clinical practice, many children with ASD have returned to attend additional social skills intervention programs. This research would have been strengthened by measurement of social skills after a few months had passed. Clinical experience would support the need for "booster" sessions, common to the CBT process, to maintain gains made in intervention. In addition, research will need to address developmental changes in areas of social information-processing for children with ASD. This intervention focused only on children aged 10-12 and participants were encouraged to engage in social interaction appropriate to that age. Children who are younger or older will need interventions geared specifically to how children of their age interact socially.

Intervention. Two important evidence-based components of intervention were not included in this study: the inclusion of peer tutors in the group, and an emphasis on parent involvement. This research intended to look primarily at CBT-based intervention without confounding results by including peers. Although the initial plan was to include peer tutors, advice from reviewers prior to beginning this research suggested that this component should be added to an efficacy study after CBT-based strategies had been tested and supported. Practical limitations related to available group leaders prevented additional parent

education and participation. These two components will certainly need to be addressed in future studies.

Future Directions

Several recent systematic reviews of social skills interventions for children with ASD (Cappadocia & Weiss, 2010; Rao et al., 2008; Reichow & Volkmar, 2010; Wang & Spillane, 2009) have called attention to important gaps in current research in this area. All of these reviews have called for greater research rigor with a focus on many of the methodological concerns raised by Lord and colleagues (2005). They suggest that future research include more rigorous research designs (with larger samples), a better understanding of the essential elements of a social skills intervention program, measurement which includes both global standardized measures and specific observational measures, inclusion of criteria that examine clinical significance, measures of generalizability and maintenance, and uniformity across curricula (manualization of intervention). This will likely require multi-site studies, which can systematically address these issues. Most reviews of intervention research also call for a focus on understanding which strategies and techniques work best for which age group or developmental level (using clearly described inclusion criteria) and comparison of intervention techniques. While this research has attempted to address some of these directions, much remains to be done to address these concerns. Few systematic reviews have called for a clear theoretical understanding of critical concepts underlying social skills intervention. Koenig and colleagues (2009) thoughtful paper is one of very few that examines the complexity of the social

reciprocity and impairments in social functioning. They suggest efficacy of social skills intervention needs to be considered within the context of a multi-dimensional, multi-method approach to measurement and intervention.

Measurement issues raised by Koenig and colleagues (2009) emphasize the need for social validity in measurement. Results from the Peer Interaction measure suggest that further development of this measure may be valuable. This would include further examination of its reliability and validity both in application to children with ASD and typical children. If the validity of this measure is corroborated by observation of the child in natural settings, it may prove to be a more standardized way of collecting data on how children interact with peers than methods which require extensive observation.

Several important areas have yet to be systematically addressed in a way that takes into consideration the multi-dimensional, multi-method approach to measurement and intervention of social skills. Theoretically, a greater understanding of the links between executive functioning and social interaction would provide a clearer picture of how outcome might be measured and where intervention might be focused. Application of specific intervention techniques will need to be driven by both an understanding of the causes of difficulties and an understanding of the intervention mechanisms. This may even be critical in understanding how to achieve greater generalization of skills beyond the intervention and over time.

Few studies have examined the generalization of skills across settings and the maintenance of gains over time. There is some indication that greater parent

participation is an important factor (e.g., Laugeson et al., 2009) in both immediate improvements and generalization. Certainly research examining parent responsiveness to their children with autism has proven to be an important predictor for language development (Siller & Sigman, 2008). There is a growing body of research supporting parent delivered intervention with younger children (e.g., Birkin, Anderson, Moore, & Seymour, 2004; Coolican, 2009). Application of parent-mediated approaches is already used extensively in other applications of CBT for children and will be an important area to address in future social skills intervention.

Another evidence-based practice that has been incorporated into few CBT-based social skills interventions, but many other social skills intervention programs, is the inclusion of peers. Peer mediation and tutoring has been well developed and applied in research of younger children or less cognitively able children with autism, but little is known about its application to older, more cognitively able children. Some research has examined how children with HFA interact with their typically developing peers (Lord & Magill-Evans, 1995) and several reviews of social competence intervention for children with high-functioning autism have stressed the importance of including peers who have been taught specific tutoring strategies (Huang & Wheeler, 2006; Paul, 2008. Both Bauminger's individual and group interventions (Bauminger, 2002, 2007a, 2007b) included peer tutors, in contrast to a study by Lopata et al. (2006) who also applied CBT strategies to social skills intervention and did not use peer tutors but also found significant gains. The issue of whether or not peer tutor participation is

a critical factor for intervention efficacy has not been addressed. This will be an important addition to future CBT-based social skills interventions for school-aged children. Future research will need to apply the intervention to a larger sample so that researchers can examine for whom the intervention works best. This sample would need to include girls and children with a variety of cognitive and receptive language skills.

Although this research has attempted to address some of these concerns much remains to be done to move research on social skills intervention from efficacy studies to effectiveness studies. The proliferation of research in the past few years on social skills intervention for school-aged children with ASD has provided considerable support for its efficacy in research-based intervention, under optimal conditions. Effectiveness studies, designed to examine how well an intervention works in a clinical setting, will provide important information for families, clinicians, teachers, and policy makers.

There is much that remains to be done in knowing whether social skills intervention can make a substantial change in the lives of children with ASD. This intervention focused on changing aspects of how the child with ASD interacts, without attempting to change the child's environment. Increasing opportunities for successful interactions and working towards a more tolerant social environment in schools may be more critical in allowing children with ASD to live meaningful social lives. Mediating factors in the response of a child with ASD to intervention will require careful examination as the body of research on social skills intervention grows. Consideration will need to be given to the

heterogeneity of social skills seen in children with ASD, how intervention may best be delivered, and whether and how much intervention is needed on an ongoing basis.

Conclusion

The present study extends the literature on Cognitive Behaviour Therapy based social skills intervention for school-aged children. First, it attempted to explicitly link theories of social information-processing, executive functioning and cognitive behavior therapy to assessment and intervention of social skills. Secondly, it contributed support to a growing body of research that employs CBT as a short-term intervention for improving social-emotional understanding and social interaction in school-aged children. Further research employing larger samples, including other evidence-based aspects of intervention, and measures of generalization will help to further delineate much need information about efficacy of social skills intervention for children with ASD.

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Appendix A

Example from the Peer Interaction Measure Script and Scoring Criteria

Purpose: This brief (10 minute) semi-scripted interaction between a peer confederate (PC) and a child whose social interaction skills are being observed, is intended to provide an opportunity to observe interaction in a structured way. The peer interaction is a videotaped structured, contrived social situation. The targeted behaviours include:

- **acknowledging greeting**
- **initiating** a specific interaction based on verbal and nonverbal cues
- **maintaining the interaction**, e.g., elaborating on something related to the interaction or asking a question in context (2 opportunities)
- **responding to attempt to terminate** game
- initiating or responding to a shift to **a new topic** of the interaction
- **responding to leave taking**

Scenario: The peer confederate (PC) is seated playing a hand-held electronic game (e.g., DS) or MP3 player (iPod) when the participant enters the room.

PC = peer confederate

Examples of coded behaviours are included below:

Behaviour of PC	Nonverbal/ Verbal prompt from PC	Comment on PC's behaviour	Target/ Expected behaviour	Coding	Record participant's verbalizations/ behaviour
1. Seated playing electronic game	Looks up, nods, smiles "Hi"		1. Participant **acknowledges greeting**	Yes ___ No ___ Eye contact Yes ___ No ___	
2. Participant may initiate interaction here (continue to 3c)			2. Participant **initiates interaction** (go to 3c)	Yes ___ No ___ Eye contact Yes ___ No ___	
4. PC attempts to change topic, puts device in his backpack	"I better shut it off. I bet I'll run out of batteries and my brother will be mad."		4. Participant **responds appropriately to attempt to terminate** e.g., release device if he is holding it	Yes ___ No ___	
5. Waits 20-30 seconds for participant to initiate an	Look expectantly at participant		5. Participant **initiates** interaction with a comment or	Yes ___ No ___ Content of speech is	

interaction			question about **a new topic**	appropriate Yes ___ No ___	
6. PC initiates interaction with something new (e.g., sports, holidays, TV show)	"Hey, I just saw that new movie (insert current popular movie) with what's his name." (or reference something about the movie)		6. Participant is able to shift to **a new topic** away from computer/ video games	Yes ___ No ___ Responds appropriately to shift in topic Yes ___ No ___	
7. PC continues conversation	Looks interested and alternates conversation with comments and questions		7. Participant responds verbally, **maintaining interaction** by elaborating or asking relevant questions **(note if participant returns to previous topic)**	Yes ___ No ___ # of questions, comments _____ Content is appropriate Yes ___ No ___	

PART TWO: Examples of coded behaviours

Orienting to peer
1 = rarely looks at peer's face
2 = looks at peer's face very briefly or on few occasions
3 = looks at peer when speaking but otherwise avoids looking
4 = looks at peer when speaking and when the peer is speaking
5 = looks at peer about the same amount as the peer looks at him

Facial expressions directed to peer for the purpose of communicating affect
1 = participant directs no facial expressions to peer
2 = directs only one facial expression to peer or the majority of facial expressions are unusual or odd
3 = some direction of appropriate facial expressions to peer
4 = facial expressions to peers are usually appropriate in number and type
5 = facial expressions are always appropriate in number and type

***Overall appropriateness of the interaction*:**
1 = participant shows limited interest in peer; uncomfortable interaction

2 = conversation is very one-sided (e.g., all initiations come from the peer; responses are brief)
3 = conversation is somewhat one-sided (e.g., participant responds to peer initiations and makes at least one initiation)
4 = participant responds to and initiates interaction; interaction is somewhat stilted and some aspects are inappropriate
5 = interaction is comfortable, reciprocal, & age appropriate for the context

Sense of shared enjoyment in the interaction (relative to what would be expected in interaction with a strange peer)
1 = no sense of shared enjoyment and coordinated relatedness
2 = one example of shared enjoyment in the interaction
3 = moderate amount of shared enjoyment in the interaction
4 = appropriate shared enjoyment in most of the interaction

Appendix B

Social Knowledge Master Key

1. **You see two people you know talking quietly together in the hall at school. You would like to talk to one of them. What should you do?**

   2 points = Wait for an opportune time, and then politely join in.

   Examples:

   - Wait until they're done, then talk to the one I want to talk to
   - Wait for a good time to join, and then join in

   1 point = Talk later; politely interrupt

   Examples:

   - "Excuse me, can I talk to X?"
   - Wait for them to finish
   - Go up and say "can I talk to you for a second?"
   - Walk up and say "Hey guys, what's going on?"

   0 points = Don't know; inappropriately interrupt

   Examples:

   - "What are you talking about?"

2. **A friends of yours gets his test back before lunch break and you hear him say, "oh no!" and he throws the test on the desk and puts his fist up to his forehead. How is he feeling?**

   2 points = disappointed, frustrated, sad, upset, mad at himself

   1 point = angry, not happy, bad, depressed, mad

   0 points = Don't know

3. **What could you say to that friend who just got his test back?**

   2 points = Support/condolences; acknowledge disappointment

   Examples:

   - "It's okay, you did your best"
   - "A mark is just a mark"

   1 point = Express some concern; "pep-talk"

   Examples:

- "I feel sorry for you"
- "Do you want to study with me next test?"
- "Cheer up, you'll do better"
- "Nice try"

0 points = Nothing, inappropriate remark

Examples:

- "I hope you did well on the test!"
- "Did you get a good mark?"
- "How well did you do?"

4. You want to keep a conversation going with someone. What is the best way to do this?

2 points = ask him or her a question about something you know interests them even if it isn't interesting to you.

1 point = ask him or her a question about something that might interest them, but only if it is interesting to you too

0 points = ask him or her a question about the weather

0 points = tell them something that is really interesting to you

5. You want to end a conversation and go back to your computer game. What is the best way to do this?

2 points = Wait until an appropriate time, then politely end the conversation

Examples:

- "Excuse me, I'm kind of busy, can we finish this later?"

1 point = Politely interrupt

Examples:

- "It's been nice talking to you"
- "Can we talk later?"

0 points = Inappropriately interrupt; abruptly stop the conversation

Examples:

- "Goodbye, it is time to leave"
- Just quit

- Start talking about something you know he is not interested in

6. **You invite a friend over to your house. You want to play Sony Play Station and your friend wants to try out your new pool table. What should you do? Explain your answer.**

   2 points = Play pool first, then play SPS

   Examples:

   - First you play pool, and then SPS
   - Compromise

   1 point = Play pool

   Example:

   - Play pool because you still like pool

   0 points = Play SPS; inappropriate suggestion

   Examples:

   - Just play the SPS

7. **You feel worried about making a phone call and start to think it is probably better not to make the phone call. What is something you can say to yourself to help you feel better about the phone call?**

   2 points = "I can do this. After all, what's the worst that could happen?"

   1 point = "I should wait a little while until I feel more sure about doing this."

   0 points = "I really don't need to make that phone call."

   0 points = "I wonder if my mom will make the call for me…"

8. **You see the principal of your school at the mall. How should you greet him or her?**

   2 points = Say hello, Mr(s). X, some sort of greeting/casual conversation starter

   Examples:

   - "Hello, Mr(s). X, how are you?"
   - Say "Hi Mr(s). X" and get a quick conversation started

   1 point = Say hello

   Examples:

- "Hi, Mr(s). X"

0 points = Nothing; Don't know; inappropriate

9. You see some of your friends from group at the mall. How should you greet them?

2 points = Say hello, their name, some sort of greeting/casual conversation starter

Examples:

- "Hi guys, how are you doing?"
- Say "Hi" and gesture a wave
- Say hi, then get a quick conversation started

1 point = Say hello; abrupt/somewhat inappropriate comment

Examples:

- "Hey, what are you doing here?"

0 points = Nothing; Don't know; inappropriate

10. You see someone drawing in their notebook when the teacher told everyone to read their book. What should you do?

2 points = Nothing, it probably isn't your job to make sure they are reading.

1 point = Tell the person who is drawing that he really should be reading or he will get in trouble.

0 points = Walk over to the teacher and quietly point out the person who is drawing instead of reading.

0 points = Raise your hand and tell the teacher about the person who is drawing instead of reading. People should follow the rules.

11. Some of the ways you can tell if someone is sad:

Correct: crying/tears/sniffling, body language/head down, specific facial expression, quiet, eye contact, sighing/whimpering, shaky voice

Incorrect: droopy, don't eat, he said it, he said he wasn't and he's sarcastic, talking slowly, face is red, the sound, sad motion

12. Sometimes you body tells you that you are starting to get angry. Some of the clues are:

Correct: heart rate, body temperature, tensed muscles, shaking, head hurts, red face, hard to focus, inappropriate gestures, yelling, heavy breathing, want to hurt someone, growling

Incorrect:, frowning, grumbling, baring teeth,

13. What are some ways that you can show that you are listening to another person?

Correct: eye contact, physical acknowledgement, verbal acknowledgement, body language/face the person, don't interrupt, don't leave

Incorrect: not fidgeting/stay still, you hear everything, be silent, try to keep the conversation going, talk about same subject, don't have a bored face, give them "five," say "I can't hear you talking from over here"

14. Explain how feelings, thoughts, and behaviours are related.

2 points = Thoughts → feelings → behaviour

1 point = portion of the 2 point answer

Examples:

- They all control your actions
- Your thoughts affect your behaviour and feelings

0 points = Don't know; incorrect relation

Examples:

- They all come to your brain – sometimes you say them quietly to yourself or sometimes out loud
- They all affect your life

Appendix C

Parent and Participant Satisfaction Surveys

Participant Satisfaction Questionnaire Date:_____

1. I think that being in this group helped me to pick up on social cues.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

2. I think that being in this group helped me to react better to social cues.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

3. I think that being in this group helped me to start talking with peers.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

4. I think I am more likely to make a new friend at school now.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

5. I think being in this group helped me to get along better with other kids my age.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

6. I would suggest this group to another kid like me.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

7. I think this group was pretty fun.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

8. The three best things about the group are:

9. Some things I would change about the group are:

Thank-you for filling this out!

Parent Satisfaction Questionnaire Date:_____

1. I think that participation in this group helped my child to pick up on social cues.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

2. I think that participation in this group helped my child to react appropriately to social cues.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

3. I think that participation in this group helped my child to initiate conversations appropriately with peers.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

4. I think my child is more likely to make a friend at school now.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

5. I think the communication with the group leaders was good.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

6. I would recommend this group to another family who has a child similar to mine.

Strongly disagree Strongly agree

1 2 3 4 5 6 7 8 9 10

7. The three best things about the group are:

8. Some things I would change about the group are:

Thank-you for filling this out!