

Improving the Social Skills of Children with HFASD: An Intervention Study

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Abstract The present study examines the efficacy of a social skills and Theory of Mind (S.S.ToM) intervention for children with high-functioning ASD. Children were taught to identify and consider their peer's mental states, e.g., knowledge, emotions, desires, beliefs, intentions, likes and dislikes, while learning friendship-making skills and strategies, through the use of visual scaffolds in story format. Compared to two control groups, S.S.ToM participants demonstrated significantly greater gains on measures of Theory of Mind and social responsiveness. At a 3-month follow-up assessment, improvements appeared to have been maintained and continued gains were observed. These results provide support for the utility of a visually supported Theory of Mind and social skills intervention that may be delivered in community settings.

Keywords Theory of mind · Visual supports · Social skills · High-functioning autism · Friendship training · Community intervention

Introduction

Social difficulties characteristically define Autism Spectrum Disorder (ASD) and tend to be most pronounced in unstructured real life situations that require spontaneous processing of, and responding to, social information (Crooke et al. 2008). Individuals with ASD appear to have

major deficiencies in the building blocks of childhood friendship, such as understanding communicative intent, joint attention, social play, social pretend play and prosocial behaviors (Bauminger-Zviely 2012). These challenges, compounded by adherence to inflexible routines and intolerance for change (Loth et al. 2008), have consistently been considered the core features of the disorder (American Psychiatric Association 2000). Indeed, the most recent revision of the Diagnostic and Statistical Manual (DSM-5; American Psychiatric Association 2013) describes ASD as a single spectrum disorder characterized by persistent deficits in social communication and interaction, as well as restricted repetitive patterns of behavior, interests, or activities. Symptoms must be present in early childhood, however for higher functioning individuals, these symptoms may not become fully manifest until social demands exceed limited capacities and therefore impair everyday functioning (American Psychiatric Association 2013).

Although the excellent verbal skills of some children with high-functioning Autism Spectrum Disorder (HFASD) may conceal their challenges during the preschool years, their lack of social awareness and limited play skills and interests inevitably become apparent during the elementary school years and persist into adulthood (Koegel et al. 2013). Children with HFASD typically demonstrate less sharing, less social conversation and more parallel play than their typically developing (TD) peers (Bauminger et al. 2008), and more often engage in stigmatizing behaviors (Klin and Volkmar 2000). They may appear insensitive, self-centered, and overbearing; or conversely aloof and socially disinterested. Their peers may see them as quirky and naïve, and perfect targets for teasing.

Friendship studies consistently reveal that children with HFASD have fewer stable, reciprocated friendships (Kasari

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et al. 2011; Bauminger-Zviely 2013), and lower quality friendships than their peers (Bauminger et al. 2010). While some children with HFASD may be part of the social networks of their classrooms (Calder et al. 2012) they tend to have a lower frequency of socialization with peers outside of school than any other group with or without disabilities (Kuo et al. 2011). Children with HFASD express similar preferences to TD children regarding age and gender of friends, and types of activities enjoyed with friends (Bauminger and Kasari 2000; Bauminger and Shulman 2003), but their friendships are often lower in companionship, security, intimacy, and closeness than those of their peers (Bauminger et al. 2010; Locke et al. 2010). Even though the majority of children with HFASD report having at least one friend (Daniel and Billingsley 2010; Kuo et al. 2011), having a friend does not appear to offset the experience of loneliness (Bauminger and Kasari 2000).

As similar patterns in TD and ASD friendships suggest that individuals with HFASD have capacities for interpersonal awareness and for meaningful and enduring friendships (Bauminger et al. 2008, 2010; Bauminger-Zviely 2012; Kuo et al. 2011), researchers have examined why very few with HFASD appear to attain and maintain quality friendships into adulthood (Carrington et al. 2003; Orsmond et al. 2004). In typical friendships companionship remains constant throughout the lifespan but evolves from a focus solely on common activities and concrete reciprocities to psychological sharing and intimacy during adolescence (Hartup 1993). During the teenage years friendships become more “talk focused” than “play focused” and move outside the confines of the school environment (Buhrmester 1990). The individual must be able to strike up and maintain conversation, make plans to spend time with friends, and be able and willing to provide some level of emotional support. These and other competencies disadvantage the person with ASD since higher cognitive and language skills are known to support friendship development and friendship appears to enhance social interaction skills (Bauminger et al. 2008). Without close friends opportunities to refine important interpersonal skills are missed (Buhrmester 1996), which seems connected to findings that adolescents with HFASD less often reference affection, intimacy, loyalty, and helpfulness than their TD peers in describing their friendships (Newcomb and Bagwell 1995; Petrina et al. 2014; Rose and Asher 2000) and that many find themselves excluded from extracurricular activities (Shattuck et al. 2011). While TD adolescents typically continue to expand their social networks, sadly many adolescents with ASD find their social networks remaining static or even narrowing (Kuo et al. 2011). By adulthood many with ASD report having few, if any friends (Howlin et al. 2004; Howlin and Moss 2012).

Having the motivation to form social relationships, juxtaposed with skill deficits, often leads to continuous failed attempts to interact, which in turn might also result in the development of mental and physical health problems (Sterling et al. 2008). In a vicious cycle, compromised mental health may lead to fewer and/or poor-quality peer social relationships (Koegel et al. 2013) and yet further isolation (Tantum 2000; Sterling et al. 2008). Physical health may also be compromised as the social skill requirements of making appointments by telephone, sitting in crowded waiting rooms, and accurately reporting symptoms prevent the individual from accessing timely and appropriate medical attention (Burke and Stoddart 2014).

Difficulties with friendship are also associated with bullying, and individuals with HFASD are at particular risk (Nowell et al. 2014; Storch et al. 2012). Bullying research has revealed that children and youth with HFASD are significantly more likely to be victimized than their TD peers (Nowell et al. 2014; Van Roekel et al. 2010). Bullying experiences seem to endure for longer periods of time (Cappadocia et al. 2012), and occur with greater frequency when the child with ASD is higher functioning (i.e., higher full scale IQ, and/or higher verbal IQ) (Nowell et al. 2014; Rowley et al. 2012). Bullying of children with HFASD is particularly concerning as children who are bullied are more likely to achieve low grades and demonstrate low self-esteem, psychosomatic symptoms, depression, anxiety, and suicidal ideation (Segers and Rawana 2014; Storch et al. 2012).

One of the most powerful predictors of mental health, behavior, and overall well-being in adulthood, for both typical and special populations, is peer acceptance throughout elementary school (Parker and Asher 1987; Sherman et al. 2000). The risks of peer rejection—and benefits of friendship—extend from adolescence well into middle age (Marion et al. 2013). Since children with HFASD report higher levels of both victimization and loneliness, experience as much anxiety as children with anxiety disorders (Jennett et al. 2013; Mazurek and Kanne 2010), and significantly more depression than their TD peers (Mayes et al. 2010), the need to teach skills that might enhance peer acceptance, and potentially result in friendship formation, is particularly urgent. This is the broad objective of the current study, which draws upon research demonstrating that children with ASD appear to have deficits in theory of mind and strengths in visual processing, both of which will be described below.

Social Cognition and Theory of Mind

Social cognition is the complicated process whereby an individual acquires, understands, and uses social knowledge to quickly and accurately respond to social

information (Crooke et al. 2008). Among individuals with HFASD, social cognition may lag three or more standard deviations behind expectations based on cognitive potential (Klin et al. 2007). Individuals with HFASD characteristically exhibit reduced attention to cues while in social situations (Klin et al. 2002), and appear to use atypical (and perhaps compensatory) strategies to recognize faces and expressions of emotion (Joseph and Tanaka 2003). This markedly poor ability to process the social world is often accompanied by an impressive ability to process the physical world (Frith 2012).

In accounting for poor social cognition in ASD, what is known as the “weak” social motivation theory posits that diminished social interest and orienting, and less desire to maintain social interactions, leaves the developing child with fewer social learning opportunities (Chevallier et al. 2012). While this might explain a lack of social development among the apparently disinterested, it does not account for those who desire friendships yet remain on the periphery of social networks (Calder et al. 2012). What seems more likely is that the variability in social motivation in ASD results from the inability to effectively identify, explain, and predict human behavior. Perhaps children with ASD find social interactions to be so complex and demanding that recurring failures lead to loss of interest in social interactions. Thus the child may wish for social interaction at an implicit level but express the desire for social involvement only with familiar people in specific situations when success is likely (Deckers et al. 2014), giving the impression of disinterest in social activities and approval.

A more plausible explanation of these delays in social cognition, is that autism involves specific deficits in ToM (Baron-Cohen 2000), and that social and communicative differences are closely linked to these deficits. ToM, also referred to as mentalizing (Frith 2003), or perspective-taking (Jameel et al. 2014) is a developmental phenomenon in which the cognitive ability to predict and explain human behavior in terms of mental states such as intentions, desires and beliefs (Baron-Cohen 2000) progresses in a reliable sequence of steps (Peterson et al. 2012). While empirical support for the ToM hypothesis as a unified explanation for ASD has not been found (Hale and Tager-Flusberg 2005), there is evidence that ToM ability contributes in important ways to the ability of children with autism to engage in reciprocal and effective conversation with others.

Although difficulties in anticipating and appreciating thoughts, feelings, and desires appears to reduce the ASD child’s ability to detect subtle social cues and demonstrate empathic prosocial behaviors, researchers have failed to find a direct relationship between mentalizing and real-life behaviors in studies involving participants with ASD

(Calder et al. 2012; Pellicano et al. 2006). This lack of one-to-one mapping of ToM ability and social proficiency does not necessarily mean the two are unrelated, but it does underscore that processing social information in real life requires more than understanding mental states (Bauminger-Zviely 2013) and that the relationship between various developing systems is interrelated and complex. For instance, evidence suggests that in ASD verbal ability plays an important role in the relationship between ToM and executive functioning (EF) and in facilitating ToM; however, EF is crucial for the development of ToM irrespective of verbal ability (Kimhi et al. 2014). Similarly, Bauminger et al. (2010) found that among children with ASD, a combination of high ToM and high attachment security resulted in an enhanced sense of closeness with a friend. Their finding that ToM skills contributed more strongly to social responsiveness in children with low verbal IQ than it did for those with high verbal IQ led them to conclude that children with ASD, like their peers, have relationship capabilities supported by developmental accomplishments (Bauminger et al. 2010). Since growth in the social domain has important consequences for the child’s ability to function in everyday environments and ultimately to achieve optimal life outcomes, the need to more fully understand the relationship between ToM, EF, verbal ability, and friendship, and to develop corresponding interventions is imperative.

Visual Scaffolds

Perhaps sparked by the achievements and insights of successful adults with ASD, such as well-known autism advocate Temple Grandin who attributes her engineering success to an ability to “think in pictures” (Grandin 1995, 2009), varied research approaches have produced evidence of an intact, and perhaps enhanced, visuospatial system in at least a subset of individuals with ASD (Kunda and Goel 2011). Grandin (2009) describes her own thinking as predominantly bottom-up and non-sequential and her ability to visualize concepts as a substitute for true abstract thinking. Through her own interview-informed research, Grandin has proposed that there are three predominant types of specialized learning among individuals on the autism spectrum. Unlike her own photo-realistic visual thinking, word-fact thinkers have excellent memories for verbal facts, and pattern thinkers, who are more capable of abstract thought, see patterns and relationships between numbers and tend to excel in music and mathematics (Grandin 2009).

Empirical evidence of visual thinking has been inferred through the relatively high scores achieved on the Embedded Figures Task (Goldstein et al. 2001), Raven’s Standard Progressive Matrices (Dawson et al. 2007; Raven

et al. 2003), and the Digit Span and Block Design subtests of the Wechsler Intelligence Scale (Bölte et al. 2009). Neuroimaging research, investigating variations in brain activation through fMRI studies, has also produced evidence of enhanced visual processing in ASD (Kunda and Goel 2011). For example, Koshino et al. (2005, 2008) found less brain activation in brain regions associated with verbal reasoning, and greater activation in regions associated with visual processing. Kana et al. (2006), who found unexpected activity in brain regions associated with imagery during engagement in low-imagery sentence comprehension tasks, suggested that among individuals with ASD there may be reliance upon visualization to support language comprehension. Soulières et al. (2009) found evidence suggesting a prominent role of visual processing mechanisms while examining participants engaged in the Raven's Standard Progressive Matrices (Raven et al. 2003). These and other studies collectively suggest that information may be processed differently in ASD and that a corresponding bias may exist that favors visual information over verbal mental representations.

Not surprisingly then, a range of visual approaches have been shown to be effective in a variety of educational and treatment settings among young children with ASD (Arthur-Kelly et al. 2009). Efficacious interventions that incorporate visual information include: the Picture Exchange Communication System (Bondy and Frost 2001) which employs symbols as the currency of transaction; individualized activity schedules which use pictorial or graphic sequences to describe the specific steps within a learning activity or between activities (Betz et al. 2008; Knight et al. 2014); work systems (Hume and Reynolds 2010) in which the sequence of real objects or symbols are arranged to provide cues for the completion of each step in a sequence; and contingency maps that illustrate for the child the consequences of the fulfillment or lack of compliance with expectations. Occupational therapists use visual supports and visual imagery to enhance the sequencing of work tasks and promote independence (Precin 2010) and thought-bubbles, as used in comic strips, have been shown to support mental state understanding and teach social skills to children with ASD (Gray 1998; Wellman et al. 2002). Even very young children, with and without autism, who have failed standard false belief tasks, have been shown to understand that thought-bubbles represent thoughts and can be used to infer an unknown reality (Kerr and Durkin 2004).

Social Skills Intervention Research

Despite the pervasive and persistent nature of social deficits in ASD across the lifespan and evidence that “well-functioning relationships have a bearing on mental and

physical health, mortality, and well-being” (Hartup 2009, p. 8), there is still quite limited empirical evidence for most of the social skills interventions widely used with children with ASD (Cappadocia and Weiss 2011). Until recently, descriptions of evidence-based practices were described through narrative reviews and therefore did not follow a standard process (Wong et al. 2015). These studies had many limitations including diverse participant characteristics as well as different teaching techniques, study designs, and measurement tools, which made comparisons across studies difficult (Rao et al. 2008). However, through qualitative reviews and meta-analyses of intervention studies, important recommendations have been made providing valuable direction for the development of social skills interventions and further research (Bellini et al. 2007; Hwang and Hughes 2000; Krasny et al. 2003; McConnell 2002; Rogers 2000; White et al. 2007; Wong et al. 2015).

In designing an intervention program, literature reviews are invaluable for informed selection of treatments that are likely to result in positive outcomes for children with ASD and their families. In a comprehensive review of the intervention literature identifying evidence-based, focused intervention practices, Wong et al. (2015) selected studies that generated behavioral, developmental or academic outcomes and that had employed experimental group design, quasi-experimental design, or single case designs. Focused interventions are operationally defined, address specific learner outcomes, occur for a relatively short period of time, and serve as the building blocks of comprehensive educational programs for children with ASD (Wong et al. 2015). Wong et al. (2015) identified 27 focused ASD intervention practices published between 1990 and 2011 that they deemed evidence-based practices, noting that increasingly, combinations of these practices are being integrated into interventions to address specific behaviors or goals through multidimensional approaches. The following five evidence-based practices have particular merit for addressing the social needs of children with HFASD: cognitive behavioral intervention (CBI); parent-implemented intervention; social skills training; social skills narratives; and visual supports.

Among the most efficacious social skills interventions, those that have used social cognitive strategies to teach social understanding, along with skills (Cappadocia and Weiss 2011; Rao et al. 2008; Wang and Spillane 2009), have been associated with maintenance of treatment outcomes and generalization of skills to other settings (Wong et al. 2015). The first efforts to increase social cognition focused on enhancing social understanding (Gray 1998) and promoting social cognitive capabilities such as ToM and basic emotion recognition (Ozonoff and Miller 1995), however, in general, improvements noted in the targeted domain did not generalize to other domains of social

competency. More recently, CBIs have produced promising outcomes in reducing a range of symptoms such as anxiety (Sofronoff et al. 2007), anger (Attwood 2004), and obsessive–compulsive symptoms (Reaven and Hepburn 2003). In a CBI targeting emotion recognition, ToM, and EF, Solomon et al. (2004) found increases in problem solving and facial expression recognition although substantial gains in ToM skills were not realized. Following an intervention targeting group interaction skills, Bauminger (2007) found that children improved in EF and in the ability to justify the motivations of story characters even though EF and ToM skills had not been directly targeted.

Parent-implemented interventions train parents to support their child's skill development at home and/or in the community (Wong et al. 2015). Interventions including parent training have reported significant outcomes related to social skills acquisition (Cappadocia and Weiss 2011), especially for young children with ASD. For example, children's facial expression recognition, problem solving skills (Beaumont and Sofronoff 2008; Solomon et al. 2004), and play date skills (Frankel et al. 2010) have improved with parent training. Interestingly, interventions that have included a parent-support component as opposed to parent training have not resulted in children's improved social skills despite high levels of reported parent satisfaction (Cappadocia and Weiss 2011) suggesting that it is the training of parents, as distinct from simply being supportive of parents, that is the critical factor when involving parents in an intervention that aims to improve children's social proficiency.

The Present Study

Considering the evidence to date of efficacious elements of social skills interventions, we sought to develop a curriculum called Social Skills and Theory of Mind Training (S.S.ToM) in which the internal cognitive processes of ToM and the external behaviors required to make and keep friends would be integrated. In order to capitalize upon the strengths of ASD and reduce cognitive load, the curriculum involved visually scaffolded information throughout the intervention, as well as a parent training component to maximize the potential for generalization. We compared the intervention group to two control groups: one control group received the well-known, evidence-based Children's Friendship Training (CFT; Frankel and Myatt 2003) and a second control group received treatment only after completion of the study (delayed treatment control group, or DTC). In order to measure durability of gains as well as immediate outcomes as a result of participation in the intervention, a follow-up assessment was conducted 3 months post-intervention for participants in both the S.S.ToM and CFT groups.

Children's Friendship Training is a 12-week parent-assisted social skills intervention that targets ecologically valid friendship skills through parent-structured and supervised play dates with children from outside the treatment group. Effectiveness of the program has been demonstrated for children with attention-deficit hyperactivity disorder (Frankel et al. 1997), fetal alcohol spectrum disorders (O'Connor et al. 2006) and ASD (Frankel et al. 2010; Mandelberg et al. 2013). Key intervention elements of S.S.ToM that were similar to CFT included: a manualized curriculum focused on friendship-making skills; the use of role play and games to practice pivotal skills; a parent training component; and homework assignments intended to provide children with additional practice. Skills targeted by Frankel and Myatt (2003) in CFT that were also selected for this study included conversational skills, peer entry, handling teasing, practicing good sportsmanship and good host behavior during play dates (Frankel et al. 2010).

Although there were many similarities between the S.S.ToM intervention and CFT, such as the lesson format and parent involvement, there were important differences. Critical and unique to the S.S.ToM intervention was the inclusion of ToM concepts, for instance, emotions, false belief, persuasion, sarcasm, and malicious intentions. In addition, unlike CFT in which lessons are presented aurally using a didactic approach, the S.S.ToM intervention implemented a visually scaffolded instructional approach delivered by means of comic-style illustrated stories. Finally, groups were not conducted in clinics by psychologists, as reported in studies of the CFT program (Frankel et al. 2010; Mandelberg et al. 2013), but rather situated in community settings and delivered by individuals with training and experience in autism supports and services through community-based organizations.

The overarching aim of the S.S.ToM intervention was to teach children with HFASD *how* to think about other people, how *other* people think, and to *predict* others' behaviors. We speculated that by integrating mental state knowledge with social skills strategies, the children's social awkwardness and ineptitude might be mitigated because they might have increased understanding as to when and why to apply strategies. In teaching them to *think* about what might make an activity enjoyable for a peer and how to implement strategies to 'help the other kid have fun' the intervention might assist them in evoking positive social responses from peers and therefore increase the likelihood of engendering friendship. Increased social understanding in combination with successful and enjoyable experiences with peers, and feedback from group leaders and parents, might in turn lead to the maintenance of gains made during the intervention. We hypothesized that children in both the CFT and S.S.ToM groups would make gains in social responsiveness as compared to children not participating in

an intervention. Secondly we hypothesized that children in the S.S.ToM group, having been explicitly presented with visually scaffolded ToM information while being taught high yield behavioral strategies, would demonstrate greater gains in ToM and possibly social responsiveness, than either control group. Thirdly, we hypothesized that gains made by the S.S.ToM group during the intervention would be maintained at a 3-month follow-up.

Methods

Participants

Forty-nine children with HFASD, ranging in age from 6 to 13 years ($M = 9:0$) completed this study along with their caregivers. Parents provided their child's diagnostic assessment report and all of the 42 male and 7 female participants had received a previous diagnosis within the autism spectrum (HFASD, Asperger Syndrome, PDD-NOS), determined by a clinical psychologist, psychiatrist or developmental pediatrician. Although only 63 % of the children ($n = 31$) had been diagnosed within 3 years of the study, (mean age of diagnosis was 6:4), current autistic symptoms were confirmed by three further measures: the Social Responsiveness Scale—Second Edition (SRS-2); the Autism Quotient (AQ); and the subscales of the Vineland Adaptive Behavior Scales—Second Edition (VABS-II). Communicative abilities were measured using the communication subscale of the VABS-II.

In addition to the 49 participants, two children were originally tested but were not included in this study. These two children began the S.S.ToM intervention and withdrew after only two sessions; in each case the child became increasingly resistant to parental encouragement to attend sessions. Two other children participated in intervention groups however their data was not included in the study due to low scores on either the Autism Quotient (AQ-Child) or the Social Responsiveness Scale (SRS-2).

Based on an initial assessment, children were included in the study if they had the following: an interest in playing with peers of a similar age as reported by the parent and then confirmed during an initial interview; the ability to engage in age-appropriate levels of verbal communication; and a parent or guardian who was fluent in English and willing to participate in the study. Exclusionary criteria were: an intellectual disability, significant adaptive communication challenges (VABS-II communication score < 60), the child's need for a teacher's aide for the entire school day to ensure safety and manage behavior; an obvious lack of interest in developing friendships with

peers; the inability to participate in a two-way conversation, and hearing or visual impairments that were serious enough to preclude participation in group instruction and game play.

All participants were recruited through community-based organizations that offer services for populations with autism, as well as through publicly-funded schools. Study participants joined during one of two phases. During the first phase, which was part of an ongoing service of CFT social skills training for the ASD community, families were recruited for CFT training. Families who expressed interest in this training were randomly placed in either a CFT group ($n = 15$) which functioned as a control group for the present study, or placed on a waitlist for S.S.ToM training. Four families who had been invited to participate in a CFT group withdrew just prior to baseline testing due to scheduling conflicts leaving a total of 11 participants in this control group. In the second phase of recruitment, families were invited to participate in an intervention, to begin immediately following phase 1, which was designed to improve children's social thinking while developing friendship-making skills. A group of newly recruited families was assigned to the S.S.ToM intervention group ($n = 19$ including those on the waitlist from recruitment-phase 1) or placed on a waitlist to function as the delayed treatment control (DTC) group ($n = 19$).

Social Responsiveness Measure

Social Responsiveness Scale-Second Edition (SRS-2; Constantino and Gruber 2012)

The SRS-2 is a 65-item measure of ASD symptoms intended to support clinical interpretations of diagnoses and assist with educational and psychological intervention planning. This parent-informed measure is scored on a 4 point Likert scale and has demonstrated sensitivity to changes in social functioning among ASD children (Constantino and Gruber 2012; Laugeson et al. 2012). The SRS-2 has five treatment subscales: social awareness, social cognition, social communication, social motivation, and restricted interests and repetitive behaviors; and two subscales corresponding to the DSM-5 criteria: social communication and interaction index and restricted interests and repetitive behaviors. The SRS-2 Total score is expressed in raw and T -scores with higher scores indicating greater social impairment. Authors of the SRS-2 report very strong evidence of internal consistency reliability with all alpha values falling in the range of .92 to .95 (Constantino and Gruber 2012). The SRS-2 was used both to confirm the ASD diagnoses of all participants and as an outcome measure.

Theory of Mind Measures

Revised Version of the Strange Stories Test (O'Hare et al. 2009)

The Strange Stories test evaluates ToM capabilities in individuals who generally pass simpler measures. The short version used in this study consists of 12 scenarios and includes advanced concepts such as white lies, persuasion, and double bluff (O'Hare et al. 2009). The Strange Stories test has strong interrater reliability (87 %) (Happé 1994). It has been successfully used in intervention studies to evaluate progress in ToM (Bauminger-Zviely et al. 2013), and has consistently identified poorer performance of ASD participants compared to TD controls (Ahmed and Miller 2011; Kaland et al. 2007). Administration of the Strange Stories test for this study adhered to the standard protocol consisting of reading the vignettes aloud to participants while they read along, and writing their answers verbatim. The test was scored by someone blind to the child's group assignment and was used pre- and post-intervention as an outcome measure.

Theory of Mind Inventory (ToMI; Hutchins et al. 2010)

The ToMI, is a parent-informant measure of ToM, consisting of 42 statements designed to tap a wide range of social-cognitive understanding and skill sets that are believed to be related to the construct of ToM. Parents indicate the degree to which they agree with statements by making a vertical hash mark at the appropriate point along a 20-unit continuum anchored by 'definitely not', 'probably not', 'undecided', 'probably', and 'definitely.' A rater measures each item with a ruler and enters scores into an on-line tool which calculates total scores and percentiles. Higher values reflect greater degrees of capability for each construct (Hutchins et al. 2010). The ToMI was used as an outcome measure.

Diagnostic-Only Measures

Autism Spectrum Quotient: Adolescent Version (AQ-Adolescent; Baron-Cohen et al. 2006)

The AQ-Adolescent is a 50-item parent-report questionnaire that aims to quantify autistic symptoms in adolescents 12–15 years old. The measure uses a 4-point Likert scale to assess five areas associated with the broader phenotype of autism including: social skills, attention switching, attention to detail, communication, and imagination. Higher scores correspond to more 'autistic-like' symptoms. The authors report a high sensitivity (95 %) and specificity (95 %) determined through receiver-operating characteristic analyses

using cut-off scores of 76. The AQ-Adolescent was used to confirm the ASD diagnoses of participants in the study aged 12 and over ($n = 6$).

Autism Spectrum Quotient: Child Version (AQ-Child; Auyeung et al. 2008)

The AQ-Child was adapted from adult and adolescent versions of the test for use with children 4–11 years old. The authors revised items that were not phrased with age-appropriate wording and examples in the adolescent version. For example, the adolescent version reads "When s/he is *reading* a story, s/he can easily imagine what the characters might look like" whereas the child version reads "When s/he is *read* a story, s/he can easily imagine what the characters might look like". In all other respects, the AQ-Child is exactly the same as the AQ-Adolescent. The AQ-Child was used to confirm diagnoses of those participants in the study who were aged 6–11 years ($n = 43$).

Vineland Adaptive Behavior Scales—Second Edition, Survey Form (VABS-II; Sparrow et al. 2005)

The VABS-II is a measure of adaptive behavior skills needed for everyday living within the domains of communication, daily living skills and socialization; it also provides a scale for measuring maladaptive behaviors. For this study, parents were asked to complete the communication, socialization and maladaptive behaviors subtests by rating the degree to which their children had exhibited various behaviors over the previous 6 months. Domain scores for the VABS-II are presented as standard scores with a mean of 100 and a standard deviation of 15. Higher scores represent better adaptive functioning, and for individuals with HFASD ($IQ > 70$), higher levels of communication are predictive of general cognitive ability (Bölte and Poustka 2002; Kanne et al. 2011; Klin et al. 2007). Content validity has been established for each domain of the VABS-II (Sparrow et al. 2005). Positive relationships have been found between IQ and Vineland Communication (Klin et al. 2007). The VABS-II was used as a descriptive and inclusionary measure.

Design and Procedures

The Social Skills and Theory of Mind (S.S.ToM), Children's Friendship Training (CFT) and Delayed Treatment Control (DTC) groups were matched according to chronological age, adaptive communication and socialization skills, and autism symptom severity. Groups of between 4 and 7 children, with no more than a 4 year age span between children, were held on different days, in different locations once a week for 10 weeks. Children's

age, family availability and ability to travel were taken into consideration when placing participants in groups. To ensure that families were not required to drive any more than an hour to participate, 2 CFT participants and 5 S.S.ToM participants were deliberately placed in groups relatively close to their residence. The characteristics of the children who completed the study are described in Table 1.

A three-group, pre- and post-test design was used to compare S.S.ToM vs. CFT vs. DTC groups. Following an initial telephone screening interview all potential participants were mailed a packet including demographic information, the AQ and VABS-II. An in-person testing session was scheduled at which time social responsiveness and ToM measures were completed. For participants in the S.S.ToM and CFT groups, testing sessions took place 2 weeks prior to receiving the intervention (pre-test); during the last session of the intervention (post-test); and 12 weeks after the conclusion of the intervention (follow-up). The DTC children and their parents completed outcome measures upon entering the study (pre-test) and 12 weeks after pre-test. During testing sessions conducted at pre-test and at 12 week follow-up, children completed the Strange Stories test with the first author while parents completed the SRS-2 and ToMI. On the final evening of the intervention children participating in the S.S.ToM and CFT groups were individually tested by research assistants at the same time, each with a lap top computer, while parents completed the SRS-2 and ToMI.

Intervention and Control Groups

Social Skills and Theory of Mind (S.S.ToM) Intervention Group Program

Each S.S.ToM lesson followed a consistent format beginning with 30 min of instruction followed by game play for practicing skills (see Table 2 for lesson content). Instruction was visually supported by means of comic-style illustrated stories presented via Microsoft® PowerPoint® which were projected onto a screen, and read aloud by the group leader. Each lesson was explicitly scripted for child group leaders to ensure adherence to the curriculum. Between 60 and 90 PowerPoint® slides were used for each lesson and included the session schedule, illustrated stories, a description of homework for the upcoming week, and a summary of strategies to remember.

Throughout the stories, fictitious characters engaged in activities that participants would likely recognize as occurring in school classrooms and on playgrounds. Three main characters (a scientist, an apprentice and a dog) who assumed the roles of onlookers, would muse together as they reviewed the scenarios. The dialogue between characters, as well as the thoughts and self-talk of the fictitious

children and onlookers, were elucidated through speech- and thought-bubbles (see Fig. 1) as they attempted to understand and predict behavior, and plan their own actions. Intermittently the onlookers asked questions, at which time the S.S.ToM group leader, paused in reading to allow participants to supply a response. These questions and pauses were inserted to allow group leaders to monitor children's comprehension of the stories and concepts. Following participant response opportunities, the correct answer was supplied by the story characters thus providing emphasis, correcting potential misconceptions and reducing the need for group leaders to spontaneously respond to child errors.

Each lesson incorporated concepts from preceding lessons, altered slightly to foster generalization. The curriculum specifically highlighted for participants not only how to perform a skill or apply a strategy, but *why* the skill or strategy is important, and *how* the thoughts and feelings of others are altered or reinforced as a result of applying, misapplying, or neglecting to use a skill or strategy. The context for story characters' behavior, including their beliefs, expectations and situational factors, were highlighted to facilitate more accurate predictions with regard to how people might think, feel, or respond. Participants were continuously prompted throughout each lesson to consider the situation as well as the beliefs and expectations that story characters might have.

While children received instruction, parents participated in a concurrent session in which they learned about the concepts and skills that their children were learning, what might be expected in terms of their child's current social development, and how to encourage improved social skills and growth in social thinking. They discussed how to support their children in homework assignments in order to facilitate skill acquisition in other environments; they shared successes and challenges and set goals for the upcoming week. Parents received weekly handouts outlining skills taught to the children along with explanations of homework assignments as well as weekly information sheets for their children's school teachers.

Children's Friendship Training (CFT) Control Group Program

To control for time-on-task in this intervention study, the CFT (Frankel and Myatt 2003) program was reduced to 10 weeks from the original 12. The curriculum and program structure were otherwise strictly adhered to. The two excluded lessons for the children included 'rules for being a good winner', and 'how to stay out of fights' as the concepts of these lessons were variations of the foundational concepts and strategies introduced in earlier lessons (i.e. on being a good sport, praising and encouraging

Table 1 Characteristics and pre-test scores of treatment and control groups

	S.S.ToM (n = 19)	CFT (n = 11)	DTC (n = 19)	Statistic		
				χ^2 (df)	F (df)	p
Mean age (years)	8.6	9.4	9.1		.62 (2,46)	.54
Range	6.9–13.01	7.9–12.11	6.6–13.6			
Gender				2.11 (2)		.35
Male	15	9	18			
Female	4	2	1			
Diagnosis				4.43 (4)		.35
Autism spectrum disorder	7	4	11			
Asperger syndrome	11	7	6			
PDD-NOS	1	0	2			
Grade	3.4	4.4	4.1		1.14 (2,46)	.33
Range	1–7	2–7	2–9			
School placement				.38 (2)		.83
Regular classroom	16	10	17			
Special education	3	1	2			
Autism quotient	98.0 (16.9)	92.27 (8.3)	93.47 (18.6)		.57 (2,46)	.57
Vineland adaptive behavior scales						
Communication	80.26 (19.2)	82.64 (18.2)	87.05 (18.1)		.65 (2,46)	.53
Socialization	75.16 (16.3)	74.55 (9.9)	73.95 (12.5)		.04 (2,46)	.96
Social responsiveness scale–total	79.79 (8.0)	75.36 (10.5)	72.11 (9.4)		3.37 (2,46)	.04
SRS–social awareness	76.53 (8.4)	70.82 (12.5)	67.47 (9.5)		4.09 (2,46)	.02
SRS–social cognition	77.58 (7.02)	71.27(10.7)	69.47 (10.1)		3.95 (2,46)	.03
SRS–social communication	77.89 (7.9)	74.91 (10.6)	70.74 (9.0)		1.92 (2,46)	.16
SRS–social motivation	69.47 (12.2)	68.0 (8.4)	63.42 (12.0)		1.42 (2,46)	.25
SRS–restricted interests and repetitive behaviours	80.42 (8.6)	75.18 (9.9)	72.0 (11.2)		3.44 (2,46)	.04
Strange stories test	10.89 (4.9)	10.91 (5.9)	9.63 (5.4)		.33 (2,46)	.72
Theory of mind inventory	11.94 (2.9) ^a	14.34 (1.5)	12.44 (2.9) ^b		2.47 (2,46)	.10

^a N = 17

^b N = 16

others, not provoking teasers by retaliating, teasing back or ‘refereeing’ other children). The CFT manual provides directions for delivering child and parent treatment sessions, as well as suggestions for how group leaders should respond to common problematic situations either in the child or parent groups and these directions were followed in the implementation. Child sessions followed the prescribed format of four segments: a 10 min discussion of the homework assignment; 20 min for a didactic presentation that included a brief, coached behavioral rehearsal between children; a 25-minute practice of newly learned skills; and a 5 min joint session with children and their caregivers to finalize homework assignments. In preparation for this study, the first author further operationalized the manual by creating explicitly scripted lessons for child group leaders to ensure adherence to the curriculum.

Delayed Treatment Control Group

Children recruited for participation in the DTC group were initially tested to establish pre-test scores and then tested 12 weeks later which was equivalent to the timespan between the pre- and post- testing for the S.S.ToM and CFT groups. In between these two testing sessions, the DTC group did not receive a social skills intervention. Following the second testing session, DTC participants were given the opportunity to participate in an S.S.ToM intervention group for ethical reasons.

Treatment Integrity

Treatment fidelity is challenged when an intervention is repeated across various groups. Because group leaders may

Table 2 Overview of the S.S.ToM curriculum used for the intervention group

Session	Mental state concepts	Social skills
1	Seeing or hearing leads to knowing Predicting actions on the basis of a one's knowledge	Two-way conversations (trading information)
2	Situation-based emotions	Two-way conversations Phone calls: beginnings and endings
3	Desire-based emotions (happiness)	Rules for being a good sport
4	Desire-based emotions (sadness/disappointment)	Rules for being a good sport Accepting "no" for an answer
5	Belief-based emotions True belief/fulfilled and unfulfilled desire	Rules for being a good host
6	Deception	Honesty: Determining how much of the truth to tell
7	Belief-based emotions False beliefs (fulfilled and unfulfilled desires)	Group Entry—slipping in
8	Malicious Intentions	Dealing with Teasing and Malicious Intentions
9	Persuasion and Influence	Making a good impression on others Demonstrating respect towards adults
10	Child Session: final testing session and graduation	Parent Session: Where do we go from here?

be prone to subtly modify treatment, treatment fidelity was maintained in this study in the following ways: (1) for standardization the manual written by the authors was used for each CFT group; the group leaders began each session by reading directly from the manual; (2) a PowerPoint® presentation was used to present illustrated stories for each S.S.ToM child group lesson and the group leader read each story and corresponding lesson from the screen. The parent group leader used parent handouts to provide session structure and guide conversation; and (3) all child group sessions were videotaped and reviewed to ensure that content of the program was adhered to.

Data Analyses

For a priori power, mixed ANOVA with 3 study groups as a between factor, and 3 repeated measures (pre-, post- and 3-month follow-up) as a within factor, was selected to address the main research question. A power analysis using GPower 31.7, focusing on the interaction effect, was conducted to determine the minimum sample size needed, and to detect a significant interaction effect. We estimated an effect of .25, alpha .05 and desired power of .80. The total sample size required for this study, given the above parameters is 36 therefore the sample size $n = 49$ is sufficiently large to detect the effect of the magnitude listed above.

The SRS-2 and Strange Stories test were selected as the primary outcome measures for this study. All analyses were performed using SPSS version 22 software. Chi square tests were used to determine that the intervention

and control groups were equivalent in gender, diagnosis and school placement. Analyses of variance (ANOVA) were conducted to ascertain differences in pre-test scores and to compare how groups, on average, differed in gains. Between-group comparisons of measures taken at three time periods (pre-, post-, and 3-month follow-up tests) were conducted for the S.S.ToM and CFT groups. The DTC group was assessed at two time periods prior to their participation in an intervention. Outcomes of the treatment were examined by converting immediate outcome measures to a mean difference score (DS) where positive DSs indicated improvement. DSs were calculated by subtracting post-test scores from pre-test scores for the SRS-2 (total and subscales) and by subtracting pre-test from post-test scores for the Strange Stories test and the ToMI. ANOVAs were then performed at the group level to compare DSs on these measures.

The Strange Stories test was scored by two raters: an interrater reliability analysis using the Kappa statistic was performed to determine consistency among raters. The degree of agreement between raters on the 12 items of the Strange Stories test was assessed using Cohen's kappa and the percentage of agreement on each item ranged from 84 to 94 %.

Results

Preliminary Analyses

No significant group differences were found at pre-test for chronological age, gender, grade, school placement, and

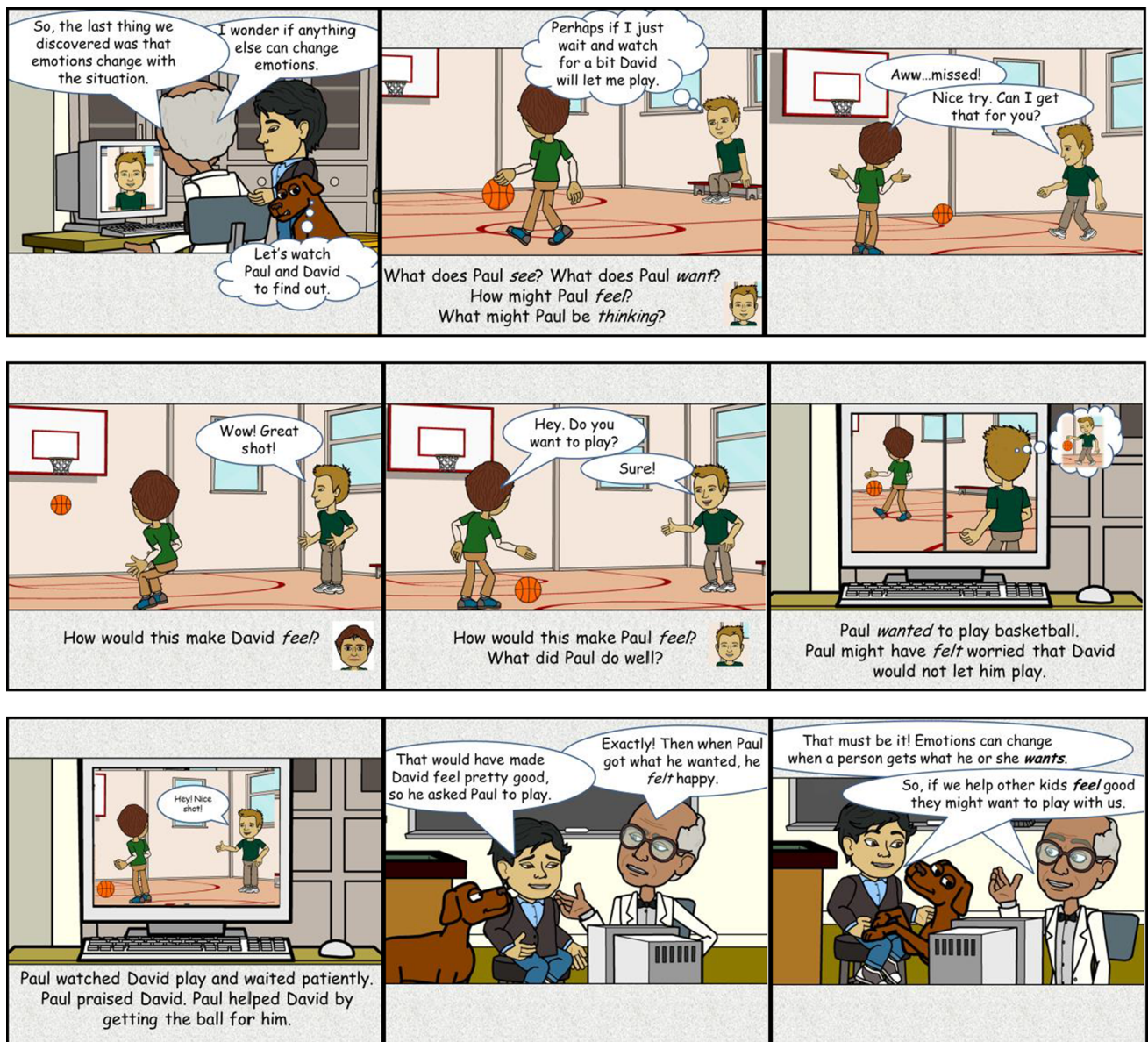


Fig. 1 Sample comic

diagnoses or on scores of the AQ, VABS-II subscales, Strange Stories, and ToMI. There were no differences found on two of the five subscales of the SRS-2 however differences were found for the SRS-2 total score as well as on three subscales of the SRS-2 (see Table 1). *T*-tests were subsequently conducted on the SRS-2 total and remaining three subscales; there were no significant differences found between the CFT and DTC groups or between the CFT and S.S.ToM groups. Three of the DTC group participants had low scores on some of the SRS-2 subscales (reflecting milder autistic tendencies) which contributed to the statistically significant differences at pre-test between the S.S.ToM and DTC groups on social awareness, $t = 3.11$, $p < .01$; social cognition, $t = 2.87$, $p < .01$; restricted

interests and repetitive behaviors, $t = 2.6$, $p = .01$; and the SRS-2 total, $t = 2.71$, $p = .01$.

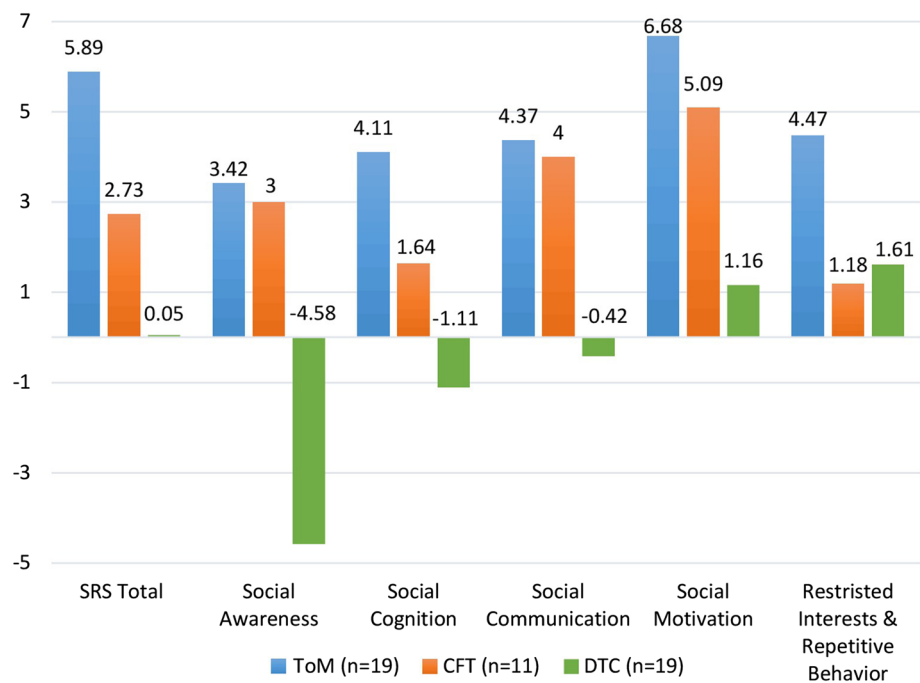
Between Group Outcome Comparisons

Group Comparisons of Social Responsiveness

Table 3 and Fig. 2 show the differences in SRS-2 scores from pre-test to post-test for all groups. The ANOVAs were significant for social awareness $F(2,46) = 3.94$, $p = .03$, $\eta^2 = .03$; social communication, $F(2,46) = 3.49$, $p = .04$, $\eta^2 = .13$; restricted interests and repetitive behaviors $F(2,46) = 4.44$, $p = .02$, $\eta^2 = .16$; and the SRS-2 Total $F(2,46) = 5.63$, $p < .01$, $\eta^2 = .2$. Upon further

Table 3 Between group comparisons of mean difference scores (pre-test to post-test)

Variable	T1–T2			<i>p</i>	<i>p</i>
	S.S.ToM <i>M</i> (<i>SD</i>) <i>n</i> = 19	CFT <i>M</i> (<i>SD</i>) <i>n</i> = 11	DTC <i>M</i> (<i>SD</i>) <i>n</i> = 19		
Social responsiveness scale-2 total	5.89 (5.7)	2.73 (6.2)	.05 (4.4)	<.01	<.01
SRS–social awareness	3.42 (9.4)	3.00 (11.5)	−4.6 (8.4)	<.05	<.01
SRS–social cognition	4.11 (8.7)	1.64 (5.7)	−1.11 (5.8)	ns	<.05
SRS–social communication	4.37 (5.7)	4.00 (4.9)	−.42 (7.1)	<.05	<.05
SRS–social motivation	6.68 (9.4)	5.09 (4.6)	1.16 (5.9)	ns	<.05
SRS–restricted interests and repetitive behaviours	4.47 (5.6)	1.18 (7.1)	1.61 (6.1)	<.05	<.01
Strange Stories test	2.74 (4.4)	2.55 (4.8)	1.5 (4.0)	ns	ns
Theory of mind inventory	.72 (1.2) ^a	.68 (1.9)	.84 (1.6) ^b	ns	ns

^a *N* = 17^b *N* = 16**Fig. 2** Mean difference scores for S.S.ToM, CFT and DTC groups on the SRS-2 pre-test to post-test

investigation, differences were not found to be significant between the S.S.ToM and CFT groups or between the CFT and DTC groups. However, differences were significant for all indices of the SRS-2 comparing the S.S.ToM and DTC groups: social awareness $F(1,36) = 7.66$, $p < .01$, $\eta^2 = .18$; social communication, $F(1,36) = 5.25$, $p = .03$, $\eta^2 = .13$; social cognition, $F(1,36) = 4.73$, $p = .04$, $\eta^2 = .12$; social motivation, $F(1,36) = 4.67$, $p = .04$, $\eta^2 = .12$; restricted interests and repetitive behaviors $F(1,36) = 10.38$, $p < .01$, $\eta^2 = .22$; and the SRS-2 Total $F(1,36) = 12.3$, $p < .01$, $\eta^2 = .26$.

To account for differences between the S.S.ToM and DTC groups on the SRS-2 Total score at pre-test, a one-way analysis of covariance (ANCOVA) was planned. Prior to conducting the ANCOVA a preliminary analysis evaluating the homogeneity-of-slopes assumption indicated that the relationship between SRS-2 scores at time 1 and SRS-2 scores at time 2 did not differ significantly as a function of group assignment, $F(3,45) = 32.09$, $MSE = 25.63$, $p < .01$, partial $\eta^2 = .68$. The ANCOVA was not significant $F(2,45) = 2.91$, $MSE = 25.86$, $p = .07$, partial $\eta^2 = .11$. However, mean scores on the SRS-2 at time 2,

adjusted for initial differences were ordered as expected: the DTC group had the largest adjusted mean ($M = 75.0$), the CFT group had a smaller adjusted mean ($M = 73.0$), and the S.S.ToM group had the smallest adjusted mean ($M = 70.7$). Follow-up tests, conducted to evaluate pairwise differences among the adjusted means, indicated significant differences between the S.S.ToM and DTC groups, $p = .02$, but not between the DTC and CFT groups, $p = .31$, nor between the CFT and S.S.ToM groups, $p = .26$.

Group Comparisons of Theory of Mind

ANOVAs conducted to evaluate change in theory of mind as measured by the Strange Stories test did not result in significant differences between groups. However, only the S.S.ToM group made significant improvements from pre-test to post-test as revealed through two-tailed pairwise t -tests of the group's change scores on the Strange Stories test, $t(18) = 2.71$, $p = .01$. Furthermore, this improvement appeared to have been maintained as reflected in changes made from pre-test to follow-up on the Strange Stories test, $t(17) = 6.68$, $p < .01$. While neither control group made notable gains from pre-test to post-test on this measure, the CFT group did make notable gains from pre-test to follow-up, $t(10) = 3.01$, $p = .01$. Change scores for the DTC group as measured by the Strange Stories test did not reach significance.

Within-Group Outcome Comparisons

S.S.ToM Treatment Effects at Post-Test and Follow-Up

The effects of treatment on outcome variables for the S.S.ToM group were evaluated with two-tailed pairwise t -tests (pre-test to post-test). This group demonstrated significant results on most variables, with the exception of social awareness and social cognition (see Table 4). Compared to their own pre-test scores, the S.S.ToM group showed improvement in social communication $t(18) = 3.34$, $p < .01$, social motivation $t(18) = 3.09$, $p < .01$, restricted interests and repetitive behaviors $t(18) = 3.49$, $p < .01$, and the total SRS-2 $t(18) = 4.47$, $p < .01$.

The effect of treatment on outcome variables at 3-month follow up was evaluated with two-tailed t -tests on the scores of children in the S.S.ToM condition. The dependent variables were DSs across two time periods: post treatment to 3-month follow-up (post-test to follow-up) and pre-test to follow up. Results of both the post-test to follow-up and the pre-test to follow-up analyses indicated that the S.S.ToM group made significant gains not only from the time of pre-test to immediate post-test, but continued to

improve in social awareness $t(17) = 3.1$, $p < .01$, social cognition $t(17) = 3.28$, $p < .01$, social communication $t(17) = 4.62$, $p = .01$, social motivation $t(17) = 4.13$, $p = .01$, restricted interests and repetitive behaviors $t(17) = 4.31$, $p < .01$, and the total SRS-2 $t(17) = 6.13$, $p < .01$.

CFT Treatment Effects at Post-Test and Follow-up

The effect of treatment on outcome variables for the CFT group was also evaluated with two-tailed pairwise t -tests (pre-test to post-test). The CFT group showed significant improvements in social communication, $t(10) = 2.70$, $p = .02$, and social motivation $t(10) = 3.69$, $p < .01$ (see Table 4). The effect of treatment on outcome variables at 3-month follow up was evaluated with two-tailed t -tests on the scores of the CFT condition. The CFT group maintained gains at follow-up on social communication $t(10) = 2.46$, $p = .03$, and social motivation $t(10) = 2.24$, $p = .05$, as reflected in the analysis of pre-test to follow-up, although they did not appear to continue in improvement. Gains made by the CFT group did not reach significance at post-test or at follow-up in social awareness, social cognition, restricted interests and repetitive behaviors or the total SRS-2.

DTC Outcomes

In contrast to the S.S.ToM and CFT groups who demonstrated improvements on all measures at post-test, the DTC group did not improve on any of the measures. Furthermore, there was a significant regression observed on the social awareness subtest, $t(18) = -2.37$, $p = .03$, for this group (see Fig. 2).

Discussion

The current study evaluated the effects of a visually scaffolded, social skills and ToM intervention (S.S.ToM) by measuring it against CFT, a well-respected parent-assisted social skills intervention, and a delayed treatment control (DTC). As predicted, both the CFT and S.S.ToM treatment recipients made improvements in social responsiveness. Specifically, significant changes were observed in the social communication and social motivation subtests of the SRS-2, suggesting that both interventions have the potential to improve social responsiveness among children with HFASD. These improvements stand in contrast to the DTC group that did not demonstrate improvements from pre-test to post-test, and appeared to regress in social awareness. Frankel et al. (2010) reported modest group effects following CFT on parent measures of play date quantity and

Table 4 Within-group comparisons of means for outcome variables (standard deviations are in parentheses) at pre-test, post-test, and follow-up assessments

Group	Variable	Time			<i>p</i>		
		Pre-test T1	Post-test T2	Follow-up T3 ^a	T1–T2	T2–T3	T1–T3
S.S.ToM (<i>n</i> = 19)	Social responsiveness scale-2 total	79.79 (8.0)	73.89 (7.3)	70.33 (9.7)	<.01	<.01	<.01
	SRS–social awareness	76.53 (8.4)	73.11 (9.4)	68.89 (11.5)	<i>ns</i>	<.01	<.05
	SRS–social cognition	77.58 (7.0)	73.47 (6.6)	71.33 (10.5)	<i>ns</i>	<.01	<.01
	SRS–social communication	76.16 (7.5)	71.79 (6.7)	67.61 (9.2)	<.01	<.01	<.01
	SRS–social motivation	69.47 (12.2)	62.79 (9.5)	59.94 (8.7)	<.01	<.01	<.01
	SRS–restricted int. and repetitive behaviours	80.42 (8.6)	75.95 (9.3)	73.50 (10.3)	<.01	<.01	<.01
	Strange stories test	10.89 (4.9)	13.63 (6.4)	17.17 (5.2)	<.01	<.01	<.01
	Theory of mind inventory	11.94 ^b (2.9)	12.86 ^b (2.8)	13.33 ^b (3.0)	<.05	<i>ns</i>	<.01
CFT (<i>n</i> = 11)	Social responsiveness scale-2 total	75.36 (10.5)	72.64 (11.0)	69.27 (9.2)	<i>ns</i>	<i>ns</i>	<i>ns</i>
	SRS–social awareness	70.82 (12.4)	67.82 (11.0)	67.18 (9.2)	<i>ns</i>	<i>ns</i>	<i>ns</i>
	SRS–social cognition	71.27 (10.7)	69.64 (10.2)	66.73 (10.0)	<i>ns</i>	<i>ns</i>	<i>ns</i>
	SRS–social communication	71.27 (10.7)	72.45 (10.7)	69.55 (8.9)	<.05	<i>ns</i>	<.05
	SRS–social motivation	68.0 (8.4)	62.91 (9.2)	62.0 (10.0)	<.01	<i>ns</i>	<.05
	SRS–restricted int. and repetitive behaviours	75.18 (9.9)	74.0 (9.4)	71.82 (10.5)	<i>ns</i>	<i>ns</i>	<i>ns</i>
	Strange stories test	10.91 (5.9)	13.45 (6.7)	14.45 (5.8)	<i>ns</i>	<i>ns</i>	<.01
	Theory of mind inventory	14.34 (1.5)	15.02 (1.9)	15.05 (2.5)	<i>ns</i>	<i>ns</i>	<i>ns</i>
DTC (<i>n</i> = 19)	Social responsiveness scale-2 total	72.11 (9.4)	72.05 (8.9)		<i>ns</i>		
	SRS–social awareness	67.47 (9.5)	72.05 (8.2)		<.05 ^c		
	SRS–social cognition	69.47 (10.1)	71.32 (9.0)		<i>ns</i>		
	SRS–social communication	70.89 (9.8)	71.32 (9.0)		<i>ns</i>		
	SRS–social motivation	63.42 (12.0)	62.26 (11.6)		<i>ns</i>		
	SRS–restricted int. and repetitive behaviours	72.0 (11.2)	73.0 (10.2)		<i>ns</i>		
	Strange stories test	9.63 (5.4)	11.75 (5.2)		<i>ns</i>		
	Theory of mind inventory	12.44 (2.9)	13.68 (.6)		<i>ns</i>		

^a *N* = 18^b *N* = 17^c Regression in skills

quality with over 87 % of children demonstrating reliable change on at least 1 out of 12 outcome measures although the number of participants showing reliable change at follow-up had eroded. Although we used different measures, the outcomes for our CFT group were similar in that improvements were maintained at follow-up. In comparing the social responsiveness of the S.S.ToM and CFT groups in this study, it appears that the S.S.ToM group may have made greater gains. An analysis of pre-test to post-test scores, suggests that the CFT group improved on 2 of the 5 subscales of the SRS-2 but not the SRS-2 total, whereas the S.S.ToM group improved significantly on 3 of the 5 subscales as well as on the SRS-2 total.

The second prediction that the S.S.ToM groups would demonstrate improvement in ToM was partially realized. In comparison to their own pre-test scores, the S.S.ToM group made significant gains on the Strange Stories test whereas

within-group improvement was not observed for either of the two control groups. These results suggest that participation in the S.S.ToM intervention resulted in some improvement in ToM for this group replicating the findings of other interventions targeting the mentalizing abilities of children with HFASD, and supporting the prediction that they can be taught ToM through the use of visual information. The S.S.ToM group did not, however, significantly outperform the two control groups on the Strange Stories test during the immediate post-test. Practice effects may have contributed to gains made by all study participants on this test therefore reducing statistical differences between groups.

The third prediction that S.S.ToM participants would maintain gains at a 3-month follow-up was not only fulfilled, but results demonstrated that the children continued to make gains beyond the intervention. By way of contrast,

the CFT group maintained gains made during their intervention but did not make any further gains from post-test to follow-up. The enhanced performance of the S.S.ToM group as compared to the CFT group seems to suggest that ToM information, and visual supports, which were not part of CFT, played important roles. Loth et al. (2008) suggest that it is not sufficient to ‘teach’ social skills to individuals with ASD using social scripts, nor provide them with a template of core elements comprising different events. Individuals with ASD typically have difficulty generalising skills and therefore interventions must account for the specific cognitive abnormalities that impact the way events are experienced and represented (Loth et al. 2008). To realize social success, they need to learn to recognize and respond to aspects of events or interactions that are likely to be variable rather than predictable since real life situations are inherently inconstant, and require the individual to respond flexibly rather than rigidly. In this study we intentionally set out to embed ToM within social skills training by explaining and illustrating *how* to think about other people, how *other* people think, and to *predict* others’ behaviors; we deliberately steered away from teaching scripted social behaviors. For example, as can be seen in Fig. 1, comic characters demonstrated the strategies that socially accepted children use to engage with peers, paired with their thinking about these social interactions. Throughout the comic stories, thought-bubbles illustrated for the children what people typically think and feel in similar situations. The encouraging outcomes of this study, in terms of social responsiveness, seem to indicate that the highlighting of characters’ mental states as well as the illustration and modeling of the flexible use of strategies across numerous and varied scenarios, resulted in some improvement in mentalizing abilities and recognition of when strategies should be used in children’s own real life settings.

Regarding the use of visual supports, visually scaffolded information may have compensated for general impairments in processing relational information (Davies et al. 1994), specific deficits in processing faces and emotions (Hopkins et al. 2011), and deficits in ToM. Perhaps the visual illustrations assisted the children in recognizing and interpreting complex emotions and subtle context clues necessary for understanding others’ perspectives. Research has demonstrated that all learners benefit from having information explained by means of both verbal propositions and visual representations (Paivio 1990, 2013). For example, Kelemen et al. (2014) found that by using picture books as a scaffold, 5–8 year old TD children were able to learn very difficult concepts pertaining to within-species adaptation by natural selection. Similarly, avatars and animated characters have been successfully used in social skills interventions for children with HFASD to improve

emotional understanding (Beaumont and Sofronoff 2008; Hopkins et al. 2011) and social engagement (Radley et al. 2014). It may be that individuals with ASD, having a bias towards visual rather than verbal information (Kunda and Goel 2011), are especially in need of, and responsive to, information provided visually.

Research has shown a significant relationship between time-on-task and learning (Marks 2000). In the present intervention the use of visual information in the form of comic strip stories displayed via PowerPoint® appeared to increase participant engagement and maximize time-on-task during instructional sessions. As the leader read the stories, the children followed along. When a story character asked a question, the leader would pause to allow the children to answer thereby encouraging their active participation. Since all lesson elements, including group rules and instructions, ToM concepts and social strategies, and homework assignments, were embedded into the projected stories, content delivery and group management were simplified for the group leaders and treatment integrity was maintained. High interest and engagement appeared to result in few distracting or disruptive behaviors, and therefore group leaders were able to focus their attention and effort upon lesson content and upon reinforcing the children’s attempts to use the target skills.

Although the S.S.ToM group outperformed the CFT group, the children receiving CFT training also demonstrated improvements. It may be that gains made by both groups can be attributed to the use of a manualized curriculum (Goldstein et al. 2012) and parental involvement (Frankel and Mintz 2011; Frankel et al. 2010). The most obvious advantage of parental participation is that they are able to continue supporting skill development between sessions and beyond the end point of the intervention. And perhaps parents, having learned to support skill acquisition, became more confident in their parenting and optimistic about their child’s potential in a broader sense. Having gained insight into how and why their children have difficulty with friendship formation, and then knowing how to encourage more prosocial behaviors, parents who were previously anxious about exposing their children to new social situations may have gained the courage to support play dates with potential friends. Future research should consider changes in parents’ knowledge and confidence as a result of the training and the relationship of these parental factors to the children’s improvement in social skills development.

The above elements, hypothesized as possibly contributing to the success of the intervention, are somewhat speculative. Future research is needed to disentangle them, and in particular, the effect of visual scaffolding from that of the ToM instruction. There are also several limitations to this study that need to be considered. First of all, although

there was an attempt to randomize the groups, full randomization was not possible due to the need to control for the age range of children participating in each group and the availability of families to travel. There were accommodations made for seven participating families to ensure that their participation was not hindered due to distance. Secondly, although inclusion criteria included a diagnosis of an Autism Spectrum Disorder by a clinical professional, and this diagnosis was confirmed by the AQ-child (or adolescent), the Vineland II, and the SRS-2, due to both time and cost the diagnoses were not confirmed with either the Autism Diagnostic Interview-Revised (Lord et al. 1994) or the Autism Diagnostic Observation Schedule (Lord et al. 2008). Thirdly, while all participants demonstrated age-appropriate levels of verbal communication by capably answering questions during the initial interview, and achieving sufficient communication skills as measured by the VABS-II, formal tests for intellectual abilities were not administered. Finally, the sample size of the study, and in particular the CFT group ($n = 11$) was small and so results comparing S.S.ToM and CFT must be interpreted with caution.

Among currently implemented social skills interventions in the field of autism, emotion recognition training and social scripts are immensely popular. However, social competence is more than being able to identify and label an expression of emotion, or being able to recite social rules. Social competence is the knowledge of when behaviors are appropriate or not, and being able to flexibly use this knowledge. Being alert to what a person knows, wants, thinks or believes, and whether that person's expectations have been met or not, in other words having a well-developed ToM, is critical to the fostering of reciprocated friendship. Since having stable long-lasting reciprocal friendships is considered to be a hallmark of a 'good adult outcome' (Calder et al. 2012; Lotter 1978) and children with HFASD are more likely to be on the periphery of social networks and report higher rates of loneliness and victimization than their typical peers (Bauminger and Kasari 2000), the need for interventions targeting ToM and friendship-making skills is critical. The present study provides evidence that this need for improved social understanding and functioning among children with HFASD might be remediated by teaching them about mental states in conjunction with friendship-making skills and strategies. Following 10-weeks of ToM and social skills training, children demonstrated significant improvement in ToM as measured by the Strange Stories test. They also exhibited greater change in social responsiveness, as measured by the SRS-2, than either of the two control groups suggesting that, by learning how people think and how to think about other people's mental states, children with HFASD can more flexibly apply social knowledge.

In the field of autism education, best practice includes the use of visual supports. Research has demonstrated the efficacy of visual supports for improving communication, promoting independence in self-care, and facilitating transitions for young children and for those with ASD and intellectual impairment. However, there is still little research on the use of visual supports for improving higher level cognitive skills among those with HFASD and in particular, to support ToM development. The positive outcomes of the present study add to the literature regarding the use of visual supports to teach social cognitive skills to children with HFASD while at the same time helping to improve their social interaction skills.

There is emerging evidence that social skills interventions conducted in clinics or universities with highly qualified therapists do make a difference. However, only a very few children, relative to the number that require intervention, can access this kind of help and so there is an urgent need for efficacious, cost-effective interventions that can be delivered in the community. The improvements of children participating in the S.S.ToM intervention are therefore encouraging. The small group format, short duration of 10 one-hour sessions, and the ease with which group leaders were able to manage the group suggests that S.S.ToM is an ecologically-valid and cost-effective program for providing social skills instruction in non-clinic settings and that it successfully promotes positive change, and maintenance of such change, in the social development of children with HFASD.

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