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A multi-component social skills intervention for children with Asperger syndrome: The Junior Detective Training Program

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Background: The study aimed to investigate the effectiveness of a new multi-component social skills intervention for children with Asperger syndrome (AS): The Junior Detective Training Program. This 7-week program included a computer game, small group sessions, parent training sessions and teacher handouts. **Method:** Forty-nine children with AS were recruited to participate and randomly assigned to intervention (n = 26) or wait-list control (n = 23) conditions. **Results:** Relative to children in the wait-list group, program participants showed greater improvements in social skills over the course of the intervention, as indicated by parent-report measures. Teacher-report data also confirmed that children receiving the intervention made significant improvements in social functioning from pre- to post-treatment. Treatment group participants were better able to suggest appropriate emotion-management strategies for story characters at post-intervention than at pre-intervention, whereas control participants were not. However, there was no difference in the improvements made by children in the intervention and control conditions on facial expression and body-posture recognition measures. Follow-up data suggested that treatment gains were maintained by children at 5-months post-intervention. **Conclusions:** The Junior Detective Training Program appeared to be effective in enhancing the social skills and emotional understanding of children with AS. Limitations and suggestions for future research are discussed. **Keywords:** Asperger syndrome, social skills. **Abbreviations:** AS: Asperger syndrome; ASDs: autism spectrum disorders; HFA: high-functioning autism; JDTP: Junior Detective Training Program; CAST: Childhood Asperger Syndrome Test; SSQ-P: Social Skills Questionnaire-Parent version; SSQ-T: Social Skills Questionnaire-Teacher version; ERSSQ: Emotion Regulation and Social Skills Questionnaire.

Asperger syndrome (AS) is a pervasive developmental disorder characterized by a qualitative impairment in social skills. These include peculiarities in eye contact and facial expression and turn-taking difficulties in conversation and play. One of the most influential etiological theories for this disorder, the 'theory of mind' deficit account, posits that the social challenges apparent in autism spectrum disorders (Asbs) are due to a lack of understanding of feelings, thoughts, and intentions in oneself and others (Baron-Cohen, 1995). Substantial empirical evidence exists to support this notion (e.g., Beaumont & Newcombe, 2006; Golan, Baron-Cohen, & Hill, 2006), and recent intervention efforts have attempted to remediate this 'theory of mind' deficit through direct instruction (e.g., Hadwin, Baron-Cohen, Howlin, & Hill, 1996, 1997; Ozonoff & Miller, 1995).

Hadwin et al. (1996, 1997) demonstrated the effectiveness of 8-session emotion- and belief-understanding interventions for children with autism on tasks that simulated training activities, and showed that treatment gains were maintained at 2-month follow-up. However, teaching effects did not generalize to non-training domains, and there was no improvement in children's ability to use mental state terms in conversation following intervention. Ozonoff and Miller (1995) examined the progress of 5 adolescent boys with high-functioning autism (HFA) who participated in a four and a half month program. Target skills included conversational turn taking, emotion identification and perspective taking. Relative to matched controls, improvements were noted on false belief tasks from pre- to post-treatment, although parent and teacher post-treatment ratings failed to show generalization.

More recent studies evaluating social skills programs for individuals with HFA or AS have generally shown limited treatment effects (e.g., Barnhill, Cook, Tebbenkamp, & Myles, 2002; Barry et al., 2003), and investigations that have reported more promising results (e.g., Bauminger, 2002; Solomon, Goodlin-Jones, & Anders, 2004) are characterized by small sample sizes, the absence of no-treatment control groups, and/or a failure to collect follow-up data.

Computerized interventions for individuals with ASDs

Computers represent a highly effective teaching medium for individuals with ASDs. They capitalize

Conflict of interest statement: Renae Beaumont, as the developer of The Junior Detective Training Program, is in the process of having the program made ready for dissemination.

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on a common special interest (Gray, 1998), allow for self-paced learning, provide immediate feedback, and minimize the need for 'real world' social interactions for the acquisition of information: a common source of anxiety for individuals with ASDs (Golan & Baron-Cohen, 2006). Research has shown that computerized programs can be used to teach people with ASDs to pass false belief tasks (Swettenham, 1996), recognize simple emotions from static photographs and cartoons (Bölte et al., 2002; Silver & Oakes, 2001), and identify complex emotions from facial expressions and prosody of speech (Golan & Baron-Cohen, 2006). However, generalization of knowledge to non-training tasks and real-life contexts appears to be limited, even when computerized instruction is supplemented with group training activities (e.g., Golan & Baron-Cohen, 2006).

The present study

This study aimed to develop and evaluate a new program to enhance the emotional understanding and social skills of children with AS. This program, entitled 'The Junior Detective Training Program' (JDTP), was comprised of four components: group social skills training, parent training, teacher handouts and a computer game.

The study was designed as a randomized controlled trial, comparing the efficacy of the 8-session social skills intervention to developmental maturational effects. A comparatively large sample size (49) was recruited for the study, and participants were followed up 6 weeks and 5 months post-intervention.

The hypothesis for the study were as follows:

1. *Children who participated in the JDTP would make greater gains on parent-and teacher-report measures of social competence at post-intervention than wait-list control participants. Improvements in children's social competence were predicted to be maintained at 6-week and 5-month follow-up.*

For the purposes of this study, 'social competence' was operationally defined as engaging in reciprocal positive interactions with others, and responding appropriately to others' behavior. This encompassed skills as such as controlling feelings of anxiety and anger, initiating and maintaining conversations, engaging in interactive play, and coping with bullying. As the JDTP followed the guidelines provided by Klin and Volkmar (2000) for optimizing the effectiveness of social skills programs for individuals with ASDs (e.g., using visual supports, training social perception skills, using a step-by-step protocol to teach conversational rules), and included several components to promote skills generalization (e.g., parent training, teacher handouts, child home missions, in-session role-plays), we were cautiously optimistic that improvements in children's social competence would be observed in home and school settings. Although limited research has examined the durability of treatment gains, we predicted that treatment gains would be maintained at 6-week and 5-month follow-up based on similar findings reported by Hadwin et al. (1996).

2. *Treatment group participants would show greater gains on measures of facial-expression- and body-posture-recognition (e.g., happy, sad, angry, afraid) than wait-list participants. These improvements would be maintained at 6-week follow-up.*

As the JDTP provided specific instruction on facial expression and body posture recognition, it was predicted that treatment gains in these domains would be reflected on the evaluation measures. Similar results were reported by Solomon et al. (2004) using comparable assessment instruments.

3. *Treatment participants would show greater improvements than wait-list controls on measures examining their knowledge of appropriate anxiety- and anger-management strategies. These gains would be maintained at 6-week follow-up.*

The JDTP provided children with explicit training in emotion identification and emotion regulation skills. Thus, it was predicted that recipients would be able to apply this knowledge to suggest appropriate emotion management strategies for characters featured in test stories. Similar treatment effects were reported by Sofronoff, Attwood, and Hinton (2005) at 6-week follow-up.

4. *Treatment effects would be replicated when the wait-list group received the intervention.*

As the wait-list and intervention groups were matched on key predictive variables (e.g., age, IQ, ASD symptom severity; see Method for further details), treatment effects were predicted to be equivalent for both groups.

Method

Participants

Ethical approval for this study was granted by the University of Queensland and Mater Children's Hospital. Child participants were recruited via a local newspaper, the Queensland Asperger Syndrome Support Network newsletter and letters forwarded to eligible clients of practitioners specializing in the field. Interested persons were forwarded study information sheets and parental consent forms, and intake assessments were scheduled upon the return of signed consent forms. Requirements for participation included an AS diagnosis confirmed by a pediatrician, achievement of a WISC-III pro-rated IQ score of 85 or above, and child aged 7½–11 years at the time of the intake assessment. To confirm that participants met DSM-IV-TR criteria for Asperger disorder, parents were asked to complete a questionnaire battery including diagnostic items and the Childhood Asperger Syndrome Test (CAST; Scott, Baron-Cohen, Bolton, & Brayne, 2002).

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Table 1 Demographic details for participants in the treatment and wait-list control conditions

Group	Age	IQ	SSQ-P	CAST
New treatment				
N = 26				
Mean	9.64	107.15	25.30	21.63
Std. dev.	1.21	11.94	7.43	3.51
Minimum	7.5	85	12	17
Maximum	11.7	130	41.50	29
Wait-list group				
N = 23				
Mean=	9.81	107.43	23.07	21.61
Std. dev.	1.26	14.21	8.85	2.78
Minimum	8.1	85	7.50	17
Maximum	11.7	138	44	26

IQ = Short-form WISC-III, 3 verbal and 3 performance subscales.
SSQ-P = Spence's (1995a) Social Skills Questionnaire- Parent Version.
CAST = Childhood Asperger Syndrome Test.

Participants were randomly assigned to the JDTP (n = 26) and wait-list control (n = 23) conditions. A series of one-way ANOVAs indicated that the groups were matched on age, IQ, social competence as measured by the Spence (1995a) Social Skills Questionnaire-parent-version and ASD symptom severity as measured by the CAST (see Table 1 for demographic details). Chi-square analyses indicated no significant differences between the groups in the proportion of males (n = 23 treatment group; n = 21 wait-list control group) and females (n = 3 treatment group; n = 2 wait-list control group), $\chi^2 < 1$.

Materials

Intervention: Junior detective computer game. The chief investigator collaborated with University multimedia students to design a computer game to teach children skills in emotion recognition, emotion regulation and social interaction. Child and adult actors were recruited from local acting schools to record voice-overs for the characters featured in the program.

The game was set in the year 2030, where postnatal genetic screening indicated that the central character in the game (the 'junior detective') was best suited to a career as a secret agent, specializing in the field of controlled remote viewing (i.e., decoding suspects' thoughts and feelings). In level one of the game, the user decodes how suspects are feeling from their facial expressions, body postures and prosody of speech, and calibrates physiological scales to detect emotions in themselves. Children are taught how to recognize complex emotions (e.g., guilt, embarrassment, suspicion and teasing) in computer-animated and human characters. In level two, the user deciphers how cartoon characters are feeling in different situations from non-verbal and environmental clues, and this knowledge is applied in level three to complete a series of 'virtual reality missions' such as dealing with bullying, playing with others and trying new things. An example of a virtual reality mission is as follows: the junior detective is playing a board game with a fellow trainee at the Detective Academy. He feels frustrated at losing the game on his first attempt, and the user must firstly identify how he is feeling, and secondly choose an option for how he can cope with the situation (e.g., think helpful thoughts and congratulate his opponent, yell at his opponent, talk to the Master Special Agent, jump on a trampoline, or punch the wall). Different outcomes ensue depending on the response selected and the user must detect how other characters think and feel as a result of the character's actions. On completion of level three, the junior detective graduates from the academy, and is awarded promotions and detective gadgets throughout the game for successful completion of missions. A 'secret agent journal' is included in the game to enable children to document between-session activities using graphics from a picture library.

The game was initially piloted on five boys with AS aged 10 to 12 years and three typically developing children aged 8 to 11 years to ensure that it was engaging and of an appropriate difficulty level.

Small group therapy materials. Group therapy sessions were conducted to facilitate participants' generalization of computer game content and teach additional social and problem-solving skills. Session activities allowed children to practice the emotion recognition and social skills that they learnt in the computer game in interactions with peers; a closer approximation to real-life scenarios. Children were also taught a generic formula for solving social problems, and provided with step-by-step guidelines for performing the social skills modeled in the computer game, including talking and playing with others, coping with making mistakes and dealing with bullying. Additional details of session content are provided in Appendix A. Session content was manualized to optimize treatment integrity.

Therapeutic material was presented through multiple modalities including posters, modeling, role-plays and group discussions. Children were provided with collector 'code cards' to keep with them which displayed symbols and skill steps. To facilitate generalization, role-play games and 'home missions' were integrated into the program. Home missions involved participants detecting emotions in themselves and others from non-verbal clues, practicing using 'relaxation gadgets' (e.g., slow breathing, exercising) in stressful situations and implementing social skills during 'play dates' with peers. Parents typically prompted and rewarded children's skill usage and helped with the completion of 'Secret Agent Journal' entries. A token economy was implemented in session to reward children for home mission completion and appropriate behavior.

Teacher handouts. One- to two-page weekly teacher handouts were forwarded to teachers via parents. The content of these handouts is summarized in Appendix A.

Measures

Developmental history questionnaire. Parents were asked to complete a Developmental History Questionnaire at the intake assessment to check that their child met inclusion criteria.

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Childhood Asperger Syndrome Test (CAST: Scott et al., 2002). The CAST was used to check that participants met DSM-IV-TR criteria for Asperger disorder. The measure has high sensitivity (100%) and specificity (97%) (Williams, Goldstein, & Minshew, 2005), and has been shown to discriminate well between children with AS and typically developing children (Scott et al., 2002).

Social Skills Questionnaire: Parent and teacher forms (Spence, 1995a). The parent and teacher versions of the Social Skills Questionnaire (SSQ) were used to evaluate children's social competence. The measure requires the respondent to indicate how accurately each of 30 statements describes his/her child's social behavior over the past four weeks. The SSQ has been shown to have good internal consistency (Spence, 1995a), and has been used in previous studies examining the effectiveness of social skills programs for individuals with AS (e.g., Broderick, Caswell, Gregory, Marzolini, & Wilson, 2002).

Emotion Regulation and Social Skills Questionnaire (ERSSQ). A social skills measure was designed for the study to specifically examine competency in the skills taught in the program. This measure involved the respondent rating how often his/her child engaged in each of 27 social behaviors on a 5-point scale, ranging from never (0) to always (4). After reverse scoring two items (6 and 15), responses to all items were summed to yield a total score. The questionnaire demonstrated good internal consistency, with a Cronbach's alpha of .89 for the population in this study. Support for the concurrent validity of the ERSSQ was provided by the strong relationship between parents' ratings on this measure, and their scores on the Spence (1995a) Social Skills Questionnaire, $r = .73$, $p < .01$.

Results of an exploratory factor analysis showed that a single factor best captured the interrelations among the questionnaire items, justifying the use of a single total score to represent a child's social skillfulness. The ERSSQ is provided in Appendix B.

WISC-III Short-form. Donders' (1997) short-form of the WISC-III was used to match groups on intellectual ability and ensure that participants' cognitive functioning was within normal range. This short form consists of the Vocabulary, Similarities, Picture Completion, Block Design, Arithmetic and Coding subtests of the WISC-III. The measure has been shown to yield high reliability and validity coefficients (>.90) when compared to WISC-III full-scale scores (Donders, 1997).

Assessment of Perception of Emotion from Facial Expression (Spence, 1995b). This 24-item measure examines children's ability to identify facial expressions displayed in black and white photographs of four children and adults. The emotions depicted include happy, sad, angry, afraid, disgusted and nicely surprised.

Assessment of Perception of Emotion from Posture Cues (Spence, 1995c). This measure involves the same presentation format and administration procedure as the previous task. However, the test stimuli were photographs of body postures rather than facial expressions.

James and the Maths Test (Attwood, 2004a). This task involved participants listening to an examiner read aloud a story about a young boy, James, who felt anxious about completing a math test in class. Participants were asked to offer suggestions for how James could cope with his anxiety. Responses were transcribed by the assessor, and later scored by the chief investigator. One point was awarded for each appropriate response. Thirty-three percent of children's responses at pre-treatment, post-treatment and 6-week follow-up were scored by a second rater, blind to participants' treatment condition. Inter-rater agreement values were within acceptable limits (K = .84; $r = .98$). This task has been used previously to evaluate treatment effects for children with AS (Sofronoff et al., 2005). Although an alternative, multi-item assessment tool would have provided a more valid measure of treatment outcome, no such measures appear to have been published.

Dylan is Being Teased (Attwood, 2004b). The procedure for this task mirrored that for 'James and the Maths Test'. Participants were asked to generate ideas for how a story character (Dylan) could effectively cope with bullying at school. A research assistant, blind to condition, independently coded 33% of children's responses to this task at pre-treatment, post-treatment and 6-week follow-up, yielding inter-rater agreement values of K = .82 and $r = .98$. This task has been used previously to evaluate treatment outcome in children with AS (Sofronoff, Attwood, Hinton, & Levin, 2007). Training exemplars were different to the scenarios presented in the James and Dylan stories to enhance the social validity of these measures.

Procedure

Following the return of signed parental consent forms, the intake assessments and intervention were conducted at the University of Queensland. The intervention commenced with a 2-hour training session, in which the chief investigator explained to parents the structure of the therapy program, and demonstrated how to play the Junior Detective game.

Children and their parents subsequently attended seven consecutive weekly sessions. For the first two sessions, parents and children went to their allocated rooms to play the computer game for the first hour, and moved to the small group therapy and parent training sessions for the second hour. Each family was allocated a separate room to complete the computer game, and the chief investigator and two therapists were available to assist with conceptual or technical difficulties. The third and fourth sessions comprised 45 minutes of computer time, and 75 minutes of small group/parent session time. Sessions 5 and 6 consisted only of small group therapy/parent session time. The program was structured in this way to provide children with increasingly more time to practice learned skills in role-plays that simulated real-life interactions. Sessions 7 and 6-week follow-up consisted of one hour small group therapy/parent session time, and one hour re-assessment time.

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Each child group comprised two therapists and three children. The therapists were interns enrolled in post-graduate clinical psychology and counseling degrees. Make-up appointments were scheduled for children who missed sessions to optimize treatment integrity. To check treatment fidelity, therapists completed session checklists. Twenty-five percent of sessions were video-taped and examined by two independent raters to assess the accuracy of checklist data. There was 100% agreement between the two data sources.

During group sessions, concurrent parent training sessions were facilitated by the chief investigator. These sessions were designed to help parents understand the skills that their children were learning in the program, and teach them how to support their children in using these skills in real-life. Parent session material paralleled child session content, and was taught via didactic presentation, role-plays and group discussion. At the close of each parent session, home missions were discussed, and potential obstacles were problem-solved. Teacher handouts were also distributed.

Pre-treatment assessment measures were re-administered to parents and children at the post-treatment and 6-week follow-up sessions. Once the treatment group completed the intervention, the program was offered to the wait-list group. To gather longer-term follow-up data, parents were forwarded copies of the parent-report measures five months after the completion of the program. Teacher follow-up data was not collected at 5-months follow-up, as children had progressed to a new school year, resulting in inconsistency in teacher ratings.

Results

Improvement in social functioning made by participants in the treatment and control groups from pre- to post-treatment was evaluated using repeated measures multivariate analyses of variance (MANOVA).

Social skills measures: parent report

To evaluate whether social functioning showed greater improvement in the treatment group than in the wait-list condition, a mixed-model MANOVA was performed on participants' pre- and post-treatment scores on the parent-report social skills measures. Group (treatment vs. control) constituted the between-subjects factor, and Time of Assessment (pre-treatment vs. post-treatment) was the within-subjects factor. Group means and standard deviations for the Spence (1995a) Social Skills Questionnaire-parent version (SSQ-P) and the ERSSQ are shown in Table 2. Results showed a significant overall main effect of Group collapsed across the two parent-report measures, $F(2, 45) = 6.52$, $p < .01$, $\eta^2 = .23$, a significant main effect of Time, $F(2, 45) = 17.80$, $p < .001$, $\eta^2 = .44$, and a significant Group × Time interaction, $F(2, 45) = 13.14$, $p < .001$, $\eta^2 = .37$. Follow-up analyses showed that for the SSQ-P, there was a significant improvement from pre-to post-treatment for the treatment group at $p < .001$, $\eta^2 = .54$, but not for the control group, $p > .28$, $\eta^2 = .02$. A similar pattern of results was found for the ERSSQ ($p < .001$, $\eta^2 = .57$ for treatment group and $p > .83$, $\eta^2 < .01$ for the control group).

Examination of the SSQ-P data revealed that the mean SSQ-P score for both the control and treatment groups was more than two standard deviations below the normative mean at pre-treatment. However, at post-treatment, the mean SSQ-P score for the treatment group was within normal range. Furthermore, of the sub-sample of participants (33) who completed the JDTP and attained pre-treatment SSQ-P scores within the clinical range (i.e., more than 2 standard deviations below the normative mean), 25 (76%) obtained post-treatment and/or

Table 2 Means, standard deviations and ranges of scores on the dependent measures at pre- and post-treatment for the treatment group, control group, and normative sample (where data is available)

	Treatment Group			Wait-list Control Group		Normative
Sample	Mean (SD)	Range		Mean (SD)	Range	Mean (SD)
Social Skills						
SSQ-P Pre-tx	25.30☆ (7.43)	12–41		23.16 (9.05)	7–44	46.11 (9.03)
SSQ-P Post-tx	38.08 (9.84)	15–55	★	25.11 (7.91)	7–42	
ERSSQ Pre-tx	39.78☆ (10.17)	23–64		39.64 (12.52)	17–64	
ERSSQ Post-tx	57.38 (13.40)	32–80	★	40.14 (10.69)	12–64	
Emotion Recognition						
Facial Expression Pre-tx	17.44☆ (2.67)	12–24		18.30☆ (2.46)	13–22	
Facial Expression Post-tx	19.92 (2.67)	13–24		19.73 (2.80)	15–24	
Body Posture Pre-tx	20.48☆ (3.15)	14–24		20.96☆ (2.44)	16–24	
Body Posture Post-tx	21.81 (2.97)	13–24		21.32 (2.82)	15–24	
Emotion Management						
Dylan is being Teased Pre-tx	2.93☆ (1.62)	0–6		2.78 (1.59)	0–6	
Dylan is being Teased Post-tx	5.08 (2.23)	2–10	★	2.64 (1.56)	0–7	
James and the Maths Test Pre-tx	1.70☆ (1.07)	0–4		1.74 (1.21)	0–4	
James and the Maths Test Post-tx	3.81 (1.58)	1–7	★	2.00 (1.11)	0–4	

Note:
☆ = Significant difference from pre- to post-treatment.
★ = Significant difference between groups.

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follow-up scores that were within one standard deviation of the normative mean. Collectively, this data suggests that the majority of children who participated in the JDTP made clinically significant improvements in social functioning as reported by parents.

Social skills measure: teacher report

Teachers of only seven children in the treatment condition returned completed measures at pre- and post-treatment and meaningful statistical analyses could not be performed. However, across both treatment groups, teachers of 19 children completed and returned the Spence (1995a) Social Skills Questionnaire-teacher version (SSQ-T) at pre- and post-intervention. A one-way ANOVA performed on this data showed that there was a significant improvement in children's social skills as rated by their teachers from pre-treatment ($M = 29.22$, $SD = 10.92$) to post-treatment ($M = 37.90$, $SD = 10.55$), F (1, 18) = 38.50, $p < .001$, $\eta^2 = .68$. However, it is questionable whether this improvement is clinically significant, as participants' scores remained close to one and a half standard deviations below the normative mean ($M = 52.28$, $SD = 10.09$) at post-treatment.

Examination of data indicated that a greater proportion of teachers of wait-list participants returned assessment forms. Eleven of the children in the original wait-list condition had teacher report-data available from 2 months pre-treatment (Time 1), immediately pre-treatment (Time 2) and post-treatment (Time 3). A repeated-measures ANOVA performed on this data showed a significant main effect of time, F (2, 9) = 16.75, $p < .01$, $\eta^2 = .79$, with follow-up analyses indicating a significant improvement from Time 2 ($M = 25.27$, $SD = 11.68$) to Time 3 ($M = 35.91$, $SD = 9.87$), F (1, 10) = 23.79, $p < .01$, $\eta^2 = .70$, but no significant improvement from Time 1 ($M = 23.23$, $SD = 8.45$) to Time 2, $F < 1$, $\eta^2 = .07$. These findings suggest that maturational effects alone cannot explain the school-based improvements in social competence noted in the intervention group. However, caution is warranted when interpreting these findings due to high attrition rates.

Emotion recognition

A mixed-model MANOVA was performed to examine whether intervention recipients made greater improvement on the emotion recognition measures from pre- to post-treatment than children in the wait-list condition. Results showed a significant main effect of Time, F (2, 45) = 10.13, $p < .001$, $\eta^2 = .31$, but no significant main effect of Group, $F < 1$, $p > .84$, $\eta^2 < .01$, and no significant Time × Group interaction, F (2, 45) = 1.16, $p > .32$, $\eta^2 = .05$. Follow-up analyses for the significant Time main effect revealed that participants in both groups made significant improvements on both the Facial Expression Recognition Measure, F (1, 46) = 19.13, $p < .001$, $\eta^2 = .29$, and the Body Posture Recognition Measure, F(1, 46) = 5.92, $p < .02$, $\eta^2 = .11$, over the course of the program (Table 2). Owing to concerns about ceiling effects potentially masking differences between the groups, results were confirmed using Mann–Whitney non-parametric tests.

Knowledge of emotion management strategies

To examine differences between the treatment and control groups in their knowledge of appropriate anxiety- and anger-management strategies over the course of the intervention, a mixed-model MANOVA was performed on test scores. Results showed a significant main effect of Group, F(2, 45) = 6.82, $p < .01$, $\eta^2 = .23$, a significant main effect of Time, F(2, 45) = 11.57, $p < .001$, $\eta^2 = .34$, and a significant Group × Time interaction, F(2, 45) = 9.61, $p < .001$, $\eta^2 = .30$. Planned follow-up comparisons indicated that for both the Dylan and James measures, there was a significant improvement in the pre- to post-treatment scores for the treatment group, ps < .001, η^2s > .35, but not in the wait-list group, ps > .53, η^2s ≤ .01 (Table 2).

Maintenance of treatment gains

To examine whether gains in emotional and social understanding for both Treatment Group 1 and Treatment Group 2 (i.e., the initial wait-list control group) were maintained after the intervention ended, a series of repeated measures ANOVAs was conducted. One participant from the original treatment group could not be contacted, and parents of two children from the second intervention group failed to return the parent-report measures at 5-months follow-up. Thus, follow-up data was available for 25 participants from Treatment Group 1, and 21 participants from Treatment Group 2.

Results showed that for both intervention groups, parent-reported improvements in social skills on the SSQ-P and ERSSQ were maintained at 6-week follow-up and 5-month follow up (Time 1 vs. Times 2, 3 and 4, $ps < .001$, η^2 s ≥ .45; see Table 3). For both groups, parent ratings on the SSQ-P at 5-months post-intervention were still within the range for typically developing children.

Although teachers were administered the SSQ-T at 6-week follow-up, only eight teachers across both participant samples completed the measure at pre-treatment, post-treatment and 6-week follow-up (less than 20% of the sample). Thus, caution is warranted when interpreting these findings. A repeated-measures ANOVA performed on the SSQ-T data showed a significant main effect of Time, F (2, 6) = 6.14, $p < .05$, $\eta^2 = .67$. Planned follow-up analyses indicated that whilst there was a significant improvement in teachers' scores from pre-treatment

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Table 3 Performance of participants in treatment groups 1 and 2 at pre-treatment, post-treatment and follow-up on the emotion recognition and emotion management measures

	Treatment group 1		Treatment group 2	
	Mean (SD)	Range	Mean (SD)	Range
Social Skills				
SSQ-P Pre-tx	25.30☆$_{z\#}$ (7.43)	12–41	25.09☆$_{z\#}$ (7.34)	7–42
SSQ-P Post-tx	38.08 (9.84)	15–55	41.50 (8.55)	29–58
SSQ-P 6-week	43.24 (8.81)	24–58	39.96 (9.46)	22–59
SSQ-P 5-month	40.64 (12.85)	13–60	41.17 (8.48)	28–58
ERSSQ Pre-tx	39.78☆$_{z\#}$ (10.17)	23–64	39.96☆$_{z\#}$ (10.27)	12–64
ERSSQ Post-tx	57.38 (13.40)	32–80	61.87 (8.91)	47–81
ERSSQ 6-week	64.24 (9.27)	45–82	58.61 (11.99)	36–83
ERSSQ 5-month	62.12 (12.90)	36–88	61.19 (10.96)	46–79
Emotion Recognition				
Facial Expression Pre	17.40☆ (2.75)	12–24	19.35☆ (2.82)	15–24
Facial Expression Post	19.88 (2.71)	13–24	20.65 (2.46)	14–24
Facial Expression 6	20.32 (4.76)	17–24	21.35 (2.31)	16–24
Body Posture Pre	20.44☆$_{z}$ (3.16)	14–24	21.57 (2.76)	15–24
Body Posture Post	21.76 (3.02)	13–24	22.57 (1.95)	17–24
Body Posture 6	22.20 (2.52)	15–24	22.91 (1.98)	17–24
Emotion Management				
Dylan is being Teased Pre	3.00☆ (1.55)	0–6	2.39☆ (1.67)	0–7
Dylan is being Teased Post	5.16 (2.23)	2–10	4.04 (2.31)	1–10
Dylan is being Teased 6	4.36 (2.27)	1–9	4.22 (2.32)	1–9
James and the Maths Test Pre	1.76☆ (1.09)	0–4	1.91☆$_{z}$ (.95)	0–4
James and the Maths Test Post	3.92 (1.50)	1–7	2.87 (1.63)	1–8
James and the Maths Test 6	2.76 (1.33)	1–5	3.48 (2.02)	1–8

☆ = Significant improvement from pre- to post-treatment.
$_{z}$ = Significant improvement from pre-treatment to 6-week follow-up.
$_{\#}$ = Significant improvement from pre-treatment to 5-month follow-up.

(M = 27.69, SD = 11.98) to post-treatment (M = 37.50, SD = 9.23), $p < .02$, $\eta^2 = .60$, improvements from baseline were not maintained at 6-week follow-up (M = 33.75, SD = 11.90), $p > .09$, $\eta^2 = .35$.

Follow-up analyses on Facial Expression and Body Posture recognition test scores indicated that for both intervention groups, there was a trend for improvements on these measures to be maintained at 6-week follow-up, and this trend reached statistical significance in some cases (Time 1 vs. time 3, $ps < .02$, η^2s > .11: Bonferroni-adjusted α for comparison = .008). Means and standard deviations for these analyses are shown in Table 3.

To examine whether participants' gains in knowledge of emotion management strategies were maintained after the completion of the JDTP, repeated measures MANOVAs and follow-up analyses were conducted (Table 3). Results for Treatment Groups 1 and 2 showed that for the James and the Dylan measures, there was a strong trend for treatment gains to be maintained at 6-week follow-up ($ps < .02$; η^2s > .11 for pre-treatment vs. follow-up comparison; Bonferroni-adjusted α for comparison = .008).

Discussion

As predicted in the first hypothesis, treatment participants made greater improvements on the parent-report social skills measures than wait-list controls. Furthermore, the average score obtained by the treatment group on the SSQ-P improved from the clinically significant range to within normal range, suggesting that participants' treatment gains were clinically meaningful. As few teachers returned the teacher-report social skills measure, it could not be determined whether treatment participants showed greater improvements in social functioning at school than did wait-list participants. However, analysis of available SSQ-T data suggested that children's improvements in social functioning at school from pre- to post-treatment were greater than those made during an equivalent baseline period. Collectively, these results support the efficacy of the JDTP in enhancing the social skills of children with AS.

Extending on previous research, this study provided some evidence that improvements in social functioning were maintained at 6-week and 5-month follow-up, as expected. Parent-report data suggested that treatment gains were maintained in the home environment at 5-months follow-up, although available teacher follow-up data suggested that school-based improvements had eroded within 6 weeks of the program ending. Few conclusions can be drawn from this finding, however, as small numbers of teacher respondents reduced the power to detect statistically significant effects, and may have resulted in response bias. Further research is needed to evaluate efficacy in school settings.

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Emotion recognition

Contrary to predictions made in the second hypothesis, treatment recipients did not make greater improvements than wait-list control participants on the emotion-recognition measures over the course of the program. This may be partially due to ceiling effects on the measures; a finding that is consistent with research demonstrating that individuals with AS are not impaired in their recognition of simple emotions (e.g., Loveland et al., 1997). Practice effects also appear to have contributed to this finding, as both the treatment and control groups made statistically significant improvements on the emotion recognition measures from pre- to post-treatment. Finally, program content focused on complex emotion-recognition as opposed to simple emotion identification. This may account for why treatment recipients did not show marked improvements on the simple emotion recognition measures.

Knowledge of emotion management strategies

Consistent with the third hypothesis, participants in the treatment group made greater improvements on the emotion-regulation measures than participants in the wait-list control group. This finding suggests that the intervention was effective in improving knowledge of effective anxiety- and anger-management techniques. No specific measure examined whether participants applied this knowledge in everyday contexts, however, limiting the conclusions that can be made about the efficacy of the program in improving emotional control. Although it was intended for the ERSSQ to include an emotion-regulation subscale to examine this, exploratory factor analysis indicated that information from the measure was best captured by a single factor. Thus, additional measures are needed to assess treatment gains in this domain. Nevertheless, this study appears to be the first to include any measure of self-regulation in the treatment-outcome assessment battery, and as such, it is an important step forward in ASD social skills research. It is arguable that the effective management of anxiety and anger is a crucial prerequisite for the development of social competence in children with ASDs.

As expected, participants' improvements on the emotion management measures appeared to be maintained at 6-week follow-up. This suggests that treatment gains in this domain were reasonably enduring, although longer-term follow-up data would be needed to confirm this.

Limitations and future directions

Several limitations should be acknowledged when interpreting the results from this study. Firstly, although participants' clinical diagnoses were checked using caregiver questionnaire responses and CAST ratings, it would have been preferable for more rigorous screening methods to be used. The cost and limited availability of training in such measures (e.g., the ADOS and ADI-R) precluded this from occurring. Secondly, the simple emotion-recognition measures used to evaluate treatment outcome were not sensitive enough to detect possible treatment effects. More complex emotion recognition measures such as Golan and Baron-Cohen's (submitted) CAM-C are recommended for future evaluation trials. Thirdly, parents and teachers were both the intervention agents and the primary evaluators of the intervention. Although parent- and teacher-report data corroborated the results obtained from the child social-cognition measures (James and the Maths Test and Dylan is Being Teased), there is a possibility that parent- and teacher-responses were influenced by expectations following participation. In future investigations, children's social competence in the playground should be observed at pre- and post-intervention to more rigorously evaluate treatment effects. This did not occur in the present study owing to funding constraints. The inclusion of self- and peer-report measures of popularity would also enable the social validity of treatment outcomes to be explored. To examine the enduring effects of the program, the collection of longer-term follow-up data should also be considered a matter of priority.

The multi-component nature of the JDTP rendered it difficult to pinpoint the factors responsible for children's treatment gains. Furthermore, although teachers were forwarded weekly handouts, education board ethical constraints precluded the chief investigator from contacting teachers to discuss their responsiveness to, and implementation of, treatment recommendations. To address concerns about teacher uptake of strategies and to enhance the generalization of treatment gains, a school-based version of the JDTP is currently being developed.

Clinical implications

The study presented results demonstrating the efficacy of an 8-session multi-modal social skills intervention for children with AS. This program is one of few that is supported by empirical evidence, and for which follow-up data has been collected. Results suggested that the majority of children who completed the intervention showed some improvements in social functioning. Furthermore, the comprehensive nature of the therapist manual accompanying the intervention enables it to be implemented by a wide range of personnel, including special education teachers and other allied health professionals. Although the program is reasonably labor intensive in terms of staff contact hours, its short duration and small-group format suggest that it is a cost-effective option for social skills instruction for children with AS.

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References

Attwood, T. (2004a). James and the maths test. In *Exploring feelings: Cognitive behaviour therapy to manage anxiety*. Arlington, TX: Future Horizons Inc.

Attwood, T. (2004b). Dylan is being teased. In *Exploring feelings: Cognitive behaviour therapy to manage anger*. Arlington, TX: Future Horizons Inc.

Barnhill, G.P., Cook, K.T., Tebbenkamp, K., & Myles, B.S. (2002). The effectiveness of social skills intervention targeting nonverbal communication for adolescents with Asperger syndrome and related pervasive developmental delays. *Focus on Autism and Other Developmental Disabilities*, *17*, 112–118.

Baron-Cohen, S. (1995). *Mindblindness: An essay on autism and theory of mind*. Boston, MA: MIT Press.

Barry, T.D., Klinger, J.G., Lee, J.M., Palardy, N., Gilmore, T., & Bodin, D. (2003). Examining the effectiveness of an outpatient clinic-based social skills group for high-functioning children with autism. *Journal of Autism and Developmental Disorders*, *33*, 685–701.

Bauminger, N. (2002). The facilitation of social-emotional understanding and social interaction in high-functioning children with autism: Intervention outcomes. *Journal of Autism and Developmental Disorders*, *32*, 283–298.

Beaumont, R., & Newcombe, P. (2006). Theory of mind and central coherence in adults with high-functioning autism and Asperger syndrome. *Autism*, *10*, 365–382.

Bölte, S., Feineis-Matthews, S., Leber, S., Dierks, T., Hubi, D., & Poustka, F. (2002). The development and evaluation of a computer-based program to test and to teach the recognition of facial affect. *International Journal of Circumpolar Health*, *61*, 61–68.

Broderick, C., Caswell, R., Gregory, S., Marzolini, S., & Wilson, O. (2002). 'Can I join the club?' A social integration scheme for adolescents with Asperger syndrome. *Autism*, *6*, 427–431.

Donders, J. (1997). A short form of the WISC-III for clinical use. *Psychological Assessment*, *9*, 15–20.

Golan, O., & Baron-Cohen, S. (2006). *The Cambridge Mindreading Face-Voice Battery for children (CAM-C): Testing basic and complex emotion recognition in children with and without autism spectrum conditions*. Unpublished manuscript: University of Cambridge.

Golan, O., & Baron-Cohen, S. (2006). Systemizing empathy: Teaching adults with Asperger syndrome or high-functioning autism to recognize complex emotions using interactive multimedia. *Development and Psychopathology*, *18*, 591–617.

Gray, C. A. (1998). Social stories and comic strip conversations with students with Asperger syndrome and high-functioning autism. In E. Schopler, G.B. Mesibov, & L.J. Kunce, (Eds), *Asperger syndrome or high-functioning autism? Current issues in autism* (pp. 167–198). New York: Plenum Press.

Hadwin, J., Baron-Cohen, S., Howlin, P., & Hill, K. (1996). Can we teach children with autism to understand emotions, belief or pretence? *Development and Psychopathology*, *8*, 345–365.

Hadwin, J., Baron-Cohen, S., Howlin, P., & Hill, K. (1997). Does teaching theory of mind have an effect on the ability to develop conversation in children with autism? *Journal of Autism and Developmental Disorders*, *27*, 519–537.

Klin, A., & Volkmar, F.R. (1995). Autism and the pervasive developmental disorders. *Child and Adolescent Psychiatric Clinics of North America*, *4*, 617–630.

Loveland, K.A., Tunali-Kotoski, B., Chen, Y.R., Ortegon, J., Pearson, D.A., Brelsford, K.A., & Gibbs, M.C. (1997). Emotion recognition in autism: Verbal and nonverbal information. *Development and Psychopathology*, *9*, 579–593.

Ozonoff, S., & Miller, J.N. (1995). Teaching theory of mind: A new approach to social skills training for individuals with autism. *Journal of Autism and Developmental Disorders*, *25*, 415–433.

Scott, F. J., Baron-Cohen, S., Bolton, P., & Brayne, C. (2002). The CAST (Childhood Asperger Syndrome Test): Preliminary development of a UK screen for mainstream primary school-age children. *Autism*, *6*, 9–31.

Silver, M., & Oakes, P. (2001). Evaluation of a new computer intervention to teach people with autism or Asperger syndrome to recognise and predict emotions in others. *Autism*, *5*, 299–316.

Sofronoff, K., Attwood, T., & Hinton, S. (2005). A randomized controlled trial of a CBT intervention for anxiety in children with Asperger syndrome. *Journal of Child psychology and Psychiatry*, *46*, 1152–1160.

Sofronoff, K., Attwood, T., Hinton, S., & Levin, I. (2007). A randomized controlled trial of a cognitive behavioural intervention for anger management in children diagnosed with Asperger syndrome. *Journal of Autism and Developmental Disorders*, *37*, 1203–1214.

Solomon, M., Goodlin-Jones, B.L., & Anders, T.F. (2004). A social adjustment enhancement intervention for high functioning autism, Asperger's syndrome and pervasive developmental disorder nos. *Journal of Autism and Developmental Disorders*, *34*, 649–668.

Spence, S. H. (1995a). Social skills questionnaire. In *Social skills training: Enhancing social competence with children and adolescents: Photocopiable resource book*. Windsor: NFER-Nelson.

Spence, S. H. (1995b). Assessment of perception of emotion from facial expression. In *Social skills training: Enhancing social competence with children and adolescents: Photocopiable resource book*. Windsor: NFER-Nelson.

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Spence, S. H. (1995c). Assessment of perception of emotion from posture cues. In *Social skills training: Enhancing social competence with children and adolescents: Photocopiable resource book*. Windsor: NFER-Nelson.

Swettenham, J. (1996). Can children with autism be taught to understand false belief using computers? *Journal of Child Psychology and Psychiatry*, *37*, 157–165.

Williams, D. L., Goldstein, G., & Minshew, N.J. (2005). Impaired memory for faces and social scenes in autism: Clinical implications of memory dysfunction. *Archives of Clinical Neuropsychology*, *20*, 1–15.

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Appendix A: Content for group sessions and teacher handouts

Session number	Group session content	Teacher handout recommendations
1	Negotiation of rewards; detecting emotions from facial expressions and body postures game.	Implementation of a school-based star chart to reward child for demonstrating a targeted social skill. Back-up rewards to be delivered by child's parents. Prompt child to identify peers' emotions from face and body clues.
2	'Walkie-talkie' game: emotion identification from voice tone; creation of anxiety and anger 'emotionometers' to identify body clues associated with degrees of these emotions.	Information provided on clues that indicate child is feeling mild, moderate or high levels of anxiety or anger, and school situations that elicit these feelings. Prompt child to identify feelings when clues are noted, and to guess how peers are feeling from their voice tone.
3	'Movie mania' role play game: identifying emotions in others through nonverbal and contextual clues; training in use of 'relaxation gadgets': e.g., slow breathing, exercise, reading, drawing.	Information provided on 'relaxation gadgets' child plans to use at school. Negotiate visual cue/ hand signal with child that signifies the need to go to a quiet area to calm down. Review stressful situation later with child using a 'comic strip conversation' (instructions provided).
4	Challenging unhelpful thoughts ('thought missile' game); use of relaxation imagery; use of DECODE formula to solve social problems (i.e. Define the problem; Explore solutions; Consider consequences and choose a solution; Organize a plan; Do it; Evaluate how it went).	Continue prompting the child to use 'relaxation gadgets' when distressed in the classroom or playground; prompt child to use the DECODE formula to solve social problems at school.
5	Steps taught for playing with others; initiating and maintaining a conversation. Skills practiced through detective role-play board game.	Praise/reward child's attempts to talk and play with others; conduct an Asperger syndrome education session with class members if child's social difficulties are obvious to others; implement a rotational peer buddy program with incentives for friendly behavior towards others (e.g., class party/ free time).
6	Steps taught for differentiating friendly joking from mean teasing; dealing with bullying and coping with mistakes. Solutions practiced using role-play board game.	Praise/reward child for following the steps for dealing with bullying and making mistakes. Continue praising and rewarding pre-social behaviour and emotional control.
7	Steps taught for trying new things and coping with uncertainty. Revision of program content and scheduling of home review sessions.	Praise/reward child for implementing the steps for trying new things and not understanding something. Continue prompting and praising child's use of other skills at school.
6-week follow-up	Program skills reviewed with role-play board game. Current and future challenges problem-solved.	–

Appendix B: Emotion Regulation and Social Skills Questionnaire

Directions: This questionnaire is designed to measure **how often** your child displays certain skills and behaviors. Read each of the questions and answer them in terms of your child's behavior **at the moment.** Consider how often your child does each of the behaviors described:

If your child **never** does the behavior, circle the **0**.

If your child **rarely** does the behavior, circle the **1.**

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If your child **sometimes** does the behavior, circle the **2**.
If your child **often** does the behavior, circle the **3.**
If your child **always** does the behavior, circle the **4**.

There are no right or wrong answers. Please **do not skip any items** when completing the questionnaire. Thank you.

Child's Name: _____ Child's Date of Birth: _____ Date: _____

How are you related to the child? *(please circle the appropriate response):*

Mother Father Guardian Other _____ (please specify)

	HOW OFTEN?				
SKILL/BEHAVIOR	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
1. Is aware of other people's thoughts and feelings.	0	1	2	3	4
2. Is able to correctly identify other people's feelings from their facial expression, voice tone and/or body posture.	0	1	2	3	4
3. Is aware of his/her own thoughts and feelings.	0	1	2	3	4
4. Controls his/her anger effectively at school.	0	1	2	3	4
5. Controls his/her anger effectively at home.	0	1	2	3	4
6. Has temper tantrums.	0	1	2	3	4
7. Controls his/her anxiety effectively at school.	0	1	2	3	4
8. Controls his/her anxiety effectively at home.	0	1	2	3	4
9. Uses effective strategies to deal with feelings of sadness and disappointment.	0	1	2	3	4
10. Thinks about different ways of responding to a problem situation before reacting.	0	1	2	3	4
11. Considers the consequences of his/her behavior before acting.	0	1	2	3	4
12. Chooses appropriate solutions to social problems.	0	1	2	3	4
13. Deals with social problems successfully.	0	1	2	3	4
14. Recognizes when other people are bored by his/her conversation, and changes the topic.	0	1	2	3	4
15. Makes comments that embarrass others.	0	1	2	3	4
16. Invites other to play with him/her in a friendly manner.	0	1	2	3	4
17. Asks other children if s/he can play with them in a friendly manner.	0	1	2	3	4
18. Starts conversations with other children in a socially appropriate way.	0	1	2	3	4
19. Is able to maintain a conversation with other children.	0	1	2	3	4
20. Talks to other children about topics that they are interested in.	0	1	2	3	4
21. Deals effectively with bullying and teasing.	0	1	2	3	4
22. Recognizes when other people are being sarcastic or teasing.	0	1	2	3	4
23. Copes effectively when s/he makes a mistake.	0	1	2	3	4
24. Copes effectively when s/he loses a game.	0	1	2	3	4
25. Apologizes when s/he has done something wrong, or hurt someone's feelings.	0	1	2	3	4
26. Asks for help when s/he needs it.	0	1	2	3	4
27. Tries new tasks or activities.	0	1	2	3	4

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