

The Effectiveness of a School-Based Social Cognitive Intervention on the Social Participation of Chinese Children with Autism

Phoebe P. P. Cheung^{a*}; Ted Brown^b; Mong-lin Yu^b and Andrew M. H. Siu^a

^a Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

^b Department of Occupational Therapy, School of Primary Health Care, Faculty of Medicine, Nursing and Health Sciences, Monash University, Peninsula Campus, Frankston, VIC, Australia

* Correspondence email: pp.cheung@polyu.edu.hk

Abstract

This study evaluates the efficacy of a school-based social cognitive intervention for children with autism. Seventy-four children and adolescents were taught visually scaffolded, theory of mind-based social skills program. Using a mixed-methods approach, children's social competence was assessed at pre-test and post-test. Compared to a waitlist control group, children in the intervention group demonstrated significantly greater gains on theory-of-mind and social skill measures. Focus groups and interviews were conducted to explore parents' views and generalization of children's social skills across settings. Children's social participation exhibited improvement in home, community, and school settings. The study findings offer promising evidence for a cost-effective program and support of the school-based social skills intervention for children with ASD in Hong Kong context.

Key words: Social skills training; Autism; Social participation; Social-cognitive intervention; Theory of mind

Introduction

Autism spectrum disorder (ASD) is a developmental disability that not only affects individuals, but also hinders their relationships with family, school, and community (Barnhill et al. 2002; Maenner et al. 2020). According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association [APA] 2013), people with ASD typically exhibit qualitative impairments in communication and social interaction across multiple contexts. Marked deficits in social reciprocity are postulated to be the core and most defining characteristic of ASD (American Psychiatric Association 2013). The resulting consequence of social dysfunction can be disabling (Attwood 1998; Bellini et al. 2007).

Autism manifests uniquely in each child, with varying degrees of severity, but profoundly affects school-aged children with the ASD diagnosis. For example, limited social interaction, poor weak eye contact and inability to read social cues from others in their living environment can disrupt children's ability to form and maintain social relationships. The repetitive, ritualized patterns of verbal and non-verbal behavior may hinder their communication skills. These difficulties may result in increased anxiety and withdrawal, and possibly lead to more marked outcomes such as social isolation, peer rejection, depression, and school refusal (Bellini 2006; Petersen 2002; Stewart et al. 2006; Tantam 2000).

Research has determined that many children with ASD may have atypical and extreme differences in sensory processing that can interfere with their social functioning (Case-Smith and Arbesman 2008; Tomchek et al. 2015). Skills that are learned via the auditory domain, such as speech and language, are often challenging for children with ASD (Wang et al. 2019). However, people with ASD are reported as visual learners because they are good at visually-based skill tasks such as computer games, puzzles, and visual recognition of items such as

numbers (Arthur-Kelly et al. 2009; Koenig 2012). Visual strategies, in the form of thought bubbles or picture-in-the-head are adopted in the social skills training for children with ASD (Paynter et al. 2013). Thus, effective social skill interventions need to incorporate visual strategies to support and facilitate their social participation.

In the last decade, there is a rising trend of newly diagnosed cases of ASD both globally and locally in Hong Kong (Maenner et al. 2020; Sun et al. 2013). In overseas studies, the medium occurrence of ASD is 62 to 70 per 10,000 people (Elsabagh et al. 2012). Though there is a lack of academic studies that document the prevalence of ASD in the Hong Kong region, it has been estimated that ASD occurs in 1.7 to 1.9 per 10,000 citizens in Hong Kong (Wong and Hui 2008; Sun et al. 2013). With the increasing number of children with ASD, there is a need to develop intervention programs and provide support for these children and their families. Overcoming the social barriers faced by children with ASD is a critical step to enhance their participation in play and educational activities. Research literature lends some support that intervention programs focused on the social skills of children with ASD can promote their academic performance, social participation, and mental wellbeing (Montroy et al. 2014).

Theory of Mind and ASD Intervention

Current interventions for ASD are based on diverse underlying theoretical foundations (Fisher and Happé 2005). One of the emerging intervention approaches that aims to facilitate social participation in children with ASD is referred to as "theory of mind (ToM) interventions" (Begeer et al. 2011; Fletcher-Watson et al. 2014). ToM, also referred to as "perspective taking" (Birch et al. 2014) is the cognitive ability to understand the "mind" of

others as well as one's self (e.g. their intention, knowledge, desires, belief). 1995, 2000) hypothesizes that the social impairments in ASD are the result of specific deficits in ToM. ToM-based interventions are different from other types of treatment for ASD which focused on behavioral management and personal skills training or using a basic conditioning model for learning (ie. children with ASD receive a reward or some type of positive reinforcement for a designed behavior or response). ToM postulates that by improving the child with ASD's capacity to perceive the thoughts, beliefs, desires and intentions of others as well as their own increased social awareness of themselves, social deficits can be addressed (Brown and Whiten 2000). Following that, a number of intervention studies have been developed worldwide that target the ToM skills of persons with ASD (Hess et al. 2008; Waugh and Peskin 2015).

Evidence-based practice has called for a consideration of culture and context in competence psychological practice, including targeted intervention (APA 2006). It has been suggested that cultural factors have an influence on intervention approaches used with people with ASD. These factors include social context and language use, available resources, family support, professional relationship, and expectation of service users (Chan et al. 2018). However, most studies published were designed, implemented, and validated in a Western cultural environment. Likewise, relatively fewer studies have been conducted in Asia–Pacific cross-cultural context (Chan et al. 2018).

While evidence-based social cognitive intervention programs for children and adolescents with ASD have already developed and evaluated in some countries, there is a lack of evidence in Hong Kong settings for this type of service. This study adopted the social

cognitive intervention program which was originally developed by Waugh and Peskin (2015) in Canada. The social cognitive intervention program was designed to enhance the social cognitive development of children with ASD by integrating both visually scaffolded social skills and ToM principles. It is designed by Waugh and Peskin (2015) to teach children with ASD how to think and infer regarding other people—in other words, how to understand others' thoughts and to predict others' social behavior (Gevers et al. 2006). Previous research studies indicated that a 10-week social cognitive intervention markedly improved the ToM measure scores and friendship-making skills in children with ASD (Waugh and Peskin 2015; Cheung et al. 2017a, b). This raises the question of whether the social cognitive intervention program designed by Waugh and Peskin (2015) would also have a positive response with children with ASD residing in Hong Kong.

The Present Study

The overall objective of this study was to evaluate the effectiveness of the implementation of a school-based social cognitive intervention program, originally designed in a Canadian setting by Waugh and Peskin (2015), in a Hong Kong cross-cultural context with children with ASD. To accomplish this, a group of children with ASD from Hong Kong were assigned to take part either in a social cognitive intervention group or a waitlist control group. Three research questions were posed:

- What is the impact of social cognitive intervention on parent-perceived changes in social skills of school-age children and adolescents with ASD in Hong Kong?
- Will increased knowledge of theory-of-mind concepts result in improvements in the social skills of school-age children with ASD?

- How is the generalized intervention transferred into the daily lives of children and adolescents with ASD after attending the 10-week social cognitive intervention?

Methods

Participants

Seventy-four children and adolescents with ASD, aged from 6 to 14 years ($M = 9.91$ years, $SD = 24.7$), completed this study along with their caregivers. Parents provided evidence of their child's diagnosis of ASD either from a medical practitioner or educational psychologists. School social workers or parents had reported that the children exhibited poor social skills, limited interaction with their peer group or had a lack of friends. Current autistic symptoms were further confirmed by the screening test Autism Quotient (Lau et al. 2013). In addition to the 74 participants, 12 child participants were originally tested but were not included in the study due to their absence from the scheduled assessment session. In the waitlist control group, four of the children were excluded due to having provided incomplete information.

Since the social cognitive program requires those with good cognitive function to understand other's mental states, children with ASD were included if they fulfil the following criteria: an interest in playing with peers of similar ages and could read, understand, and complete the questionnaires, the children had a parent or guardian who was fluent in Cantonese and willing to participate in the study and the parents and children had resided in Hong Kong for a minimum of 2 years. Children were excluded if they had a confirmed intellectual disability, severe, challenging behaviors, or a lack of interest in developing friendships, failure to participate in a two-way conversation, less than grade two reading level or notable hearing or visual impairment that would affect their participation in receiving group instructions

verbally. Inclusion and exclusion criteria were confirmed before the group commenced. No children were excluded from the study.

All participants were recruited through mainstream schools or community-based organization that offered services to children with ASD. Five mainstream schools and one parent support organization consented to participate in the study. The process started with advertising the study's details in schools and community-based organizations. A convenience sampling method was used to recruit the participants as they responded to the advertisement. Interested individuals were asked to give their contact details to the school or fill out the contact details form in the information fliers which place it in the designated box placed at the recruitment sites. Prospective parents who expressed interest in taking part in the study were contacted via telephone contact and informed of the date and time for their pre-intervention session.

In the second phase of recruitment, between February 2017 and July 2018, families were invited to participate in the social cognitive intervention. Forty-five children were assigned to the experimental group and took part in the 10-week social cognitive training and twenty-nine were included in the waitlist control group. The uneven group sizes were due to parents' preference for dates regarding when the social cognitive group was conducted. All participants were Chinese, with Cantonese as their first language. The average ages of the child participants in the intervention group and the waitlist control group were 9.91 ± 2.05 and 9.33 ± 1.58 years, respectively. 91% were male in the intervention group and 83.8% were in the control group (refer to Table 1).

Table 1 Characteristics and pretest scores of experimental and waitlist control groups

Variables	Experimental (n = 45)	Control (n = 29)	Statistic	
	Mean (SD)/%	Mean (SD)/%	t/ χ^2	p
Age (years)	9.91	9.33	1.53 (74)	0.22
Male (%)	41 (91)	26 (83.8)	0.922 (1)	0.272
Diagnosis			1.246 (3)	0.742
ASD (%)	31 (68.9)	18 (58.1)		
Co-morbidity (%)	14 (31.1)	13 (41.9)		
Medication			0.769 (1)	0.261
No med (%)	23 (51.1)	19 (45.2)		
With med (%)	22 (48.9)	12 (38.7)		
Grade			9.022 (7)	0.251
Primary (%)	35 (77.7)	31 (100)		
Secondary (%)	10 (22.3)	0		
Autism quotient	80.27 (18.6)	85.3 (18.6)	0.01 (69)	0.91
GAS score	- 0.70 (0.7)	- 0.77 (0.5)	0.56 (74)	0.45
TOMI-2—Total	12.46 (2.7)	11.10 (3.1)	0.29 (74)	0.59
TOMI-2—Early score	13.78 (2.8)	12.91 (3.4)	0.85 (74)	0.35
TOMI-2—Basic score	13.54 (2.7)	12.48 (3.2)	0.00 (74)	0.95
TOMI-2—Advanced score	10.49 (3.1)	8.84 (3.2)	0.00 (74)	0.95
Strange Stories Test	7.44 (4.5)	5.17 (4.4)	0.13 (74)	0.71
SSIS-RS-C total	75.04 (17.9)	66.03 (18.3)	0.21 (74)	0.64
SSIS-RS-C Communication	11.48 (3.6)	10.41 (2.8)	0.08 (74)	0.77
SSIS-RS-C Cooperation	11.08 (2.8)	10.34 (1.8)	4.19 (74)	0.04*
SSIS-RS-C Assertion	12.77 (3.9)	10.24 (4.0)	0.10 (74)	0.74
SSIS-RS-C Responsibility	9.48 (3.0)	8.24 (3.2)	0.86 (74)	0.35
SSIS-RS-C Empathy	9.22 (3.3)	8.00 (3.0)	0.07 (74)	0.79
SSIS-RS-C Engagement	11.88 (4.0)	9.79 (4.2)	0.29 (74)	0.58
SSIS-RS-C Self-control	9.11 (3.9)	9.00 (4.3)	0.92 (74)	0.34
Problem behavior	65.86 (14.7)	67.58 (15.0)	0.00 (74)	0.94
ASD score	21.95 (4.5)	21.65 (4.4)	0.00 (74)	0.93

Comparisons of means were performed using analysis of variance (ANOVA), and comparisons of frequency variables were performed using a chi-squared test *SSIS-RS-C* Chinese version of the Social Skills Improvement System Rating Scales, *GAS* Goal Attainment Scaling, *TOMI-2* Theory-of-Mind Inventory Second Edition, *ASD* Autism Spectrum Disorder, *SD* Standard Deviation * $p < 0.05$

Measures

The outcome variables of this study included social skills, knowledge of the concepts of the theory of mind, and quality of friendships. To determine whether there were any changes in participants' behaviors following their attendance in the social cognitive intervention program, valid and reliable instruments were used. The instruments included the Chinese version of the Social Skills Improvement System Rating Scales (SSIS-RS-C) (Cheung et al. 2017a, b), Goal Attainment Scaling (GAS) (Hilton 2012), the revised version of the Strange Stories Test (O'Hare et al. 2009), and the Theory of Mind Inventory-Second edition (TOMI-2) (Hutchins et al. 2016). The English versions of the SSIS-RS, TOMI-2, AQ and FQS were then translated into Chinese by a professional qualified translator and field-tested on a group of eight parents. This was done to ensure the items from the four measures were valid and appropriate for use in the Hong Kong cultural environment and the measures have linguistic validity for the target for respondents whose primary language was Cantonese. Permission was received from the authors of the respective measures for them to be translated into the target language as well.

The Chinese Version Social Skills Improvement System Rating Scales

The Social Skills Improvement System Rating Scales (SSIS-RS) is a 79-item measure of social skills performance for children with ASD and is designed to support clinical intervention. The SSIS-RS consists of seven social skills subscales, the Communication Subscale, the Cooperation Subscale, the Assertion Subscale, the Responsibility Subscale, the Empathy Subscale, the Engagement Subscale, and the Self-control Subscale. The SSIS-RS Problem Behaviors Subscale is composed of five scales: externalizing, bullying, hyperactivity/inattention, internalizing, and autism spectrum (Gresham and Elliott 2008).

The SSIS-RS has been translated into different languages and has demonstrated excellent psychometric properties in cross-cultural validation studies (Klaussen and Rasmussen 2013). The manual is clearly written, and the rating scales are easy to understand and use. The SSIS-RS behavioral rating scale was translated into Chinese and validated in Hong Kong with 567 typical developing children and matched with 30 children with disabilities, referred to as the Chinese version Social Skills Improvement System Rating Scales (SSIS-RS-C) (Cheung et al. 2017a, b). The Cronbach's α for the 12 SSIS-RS-C subscales indicate moderate to good levels of internal consistency with values ranging from 0.71 to 0.90.

Goal Attainment Scaling

Goal attainment scaling (GAS) is an effective tool for developing client-centered goals, and it can be used to measure progress toward achieving children's social skills (Hilton 2012).

Goals are written with five levels of description and are weighted by the parents or caregivers, according to the level of importance. Examples of social skills goals in this study are "to be able to read other people's emotions" and "to initiate conversations with others."

Studies have demonstrated that the GAS method has been widely used in assessing children with ASD and their social participation (Dunn et al. 2012; Miller-Kuhaneck and Watling 2010).

Strange Stories Test

The Strange Stories Test evaluates ToM capabilities in individuals with ASD. It consists of 12 scenarios and includes advanced concepts such as white lies, persuasion, and double

bluffing (O'Hare et al. 2009). It has been demonstrated to be a good outcome measure for evaluating changes in the ToM. In this study, administration of the Strange Stories Test adhered to the standard procedure of reading the scenarios aloud to participants and writing their answers in a recorded form. The assessment was recorded and scored by two people, one who administered the stories and another rater who was blind to the intervention (Kaland et al. 2005). Inter-rater reliability of the pilot study showed a high degree of concordance on each item (Cohen's $\kappa = 0.936$). This scale was translated into Chinese, backward translated by qualified translators, and then field-tested to ensure its cross-cultural validity.

The Theory of Mind Inventory, Second Edition

The Theory of Mind Inventory, second edition (TOMI-2) consists of 60 caregiver items designed to assess a wide range of social cognitive understanding (Hutchins et al. 2016). Each item was developed to serve as a face valid indicator of dimension of the theory of mind. The content of the TOMI-2 was guided by the immense theoretical and empirical research base in this area. The content decisions involved consideration of the theory of mind literature for typically developing children (from infancy to late childhood and early adolescence) as well as for individuals with ASD from across the spectrum (i.e., nonverbal to high functioning). Each of the 60 items comprising the TOMI-2 belongs to one of three empirically derived subscales (i.e., Early, Basic, and Advanced) that reflect a developmental progression in theory-of-mind development. Three additional rationally derived subscales (i.e., emotion recognition, mental state term comprehension, and pragmatics) are also available. This inventory demonstrated adequate test–retest reliability ($\kappa > 0.40$) and high internal consistency ($\alpha = 0.91$ at T1 and $\alpha = 0.94$ at T2) (Hutchins et al. [31]).

Design and Procedures

The social cognitive intervention program and waitlist control groups were matched according to chronological age, social skills and theory of mind measures, and autism symptom severity. Groups of between 6 to 9 children were met once a week for 10 sessions to take part in the social cognitive intervention program. A two-group, pre- and post-test design were used to compare the social cognitive intervention program and control groups. The mixed-methods design was adopted to examine the impact of social cognitive intervention program on children with ASD, in the Hong Kong context (Creswell 2018; Tashakkori and Teddlie 2003). The rationale for this design was that the quantitative data provided a general understanding of the first two research questions. The qualitative data refined and explained those statistical results by exploring participants' views in more depth (Creswell 2005, 2018; Ivankova et al. 2006). In this phase, parents' views and the generalizability of the social cognitive intervention program after attendance in the program were examined.

Written informed consent was obtained from all participating parents, and verbal assent was obtained from all children who participated in this study after the initial assessment. All procedures were implemented following the ethical standards of the Institutional Review Board of Monash University (National Health and Medical Research Council 2007; reference number HSEARS20161208002). For participants in the intervention group, testing sessions took place 2 weeks before receiving the intervention (pre-test, T1) and during the last session of the intervention (post-test, T2). Participants were assigned to either the social cognitive intervention program group or waitlist control group based on the availability of their child's schedule. Randomization of the child participants to different groups was not performed as

parents had preferences to join different groups due to their children's school schedule and outside school activity commitments. The children and their parents from the waitlist control group completed the outcome measures upon entering the study (pre-test) and 10 weeks after pre-test. During testing sessions conducted at pre-test and 10-week follow-up, children completed Strange Stories Test while parents completed the SSIS-RS-C, TOMI-2, and GAS.

On the final session of the social cognitive intervention program group, children participating in the group were tested by research assistants. After parents completed the outcome measures, they were invited to attend a concurrent focus group in voluntary participation. If the parents were not available, they were invited to participate in an individual interview. Based on the research question, the semi-structured interview's questions were formed (refer to Appendix A). The focus groups and individual interviews were conducted according to preset guiding questions in the Cantonese language, as it was the parent participants' first language. This method was used to obtain in-depth information relating to the efficacy of the intervention, its impacts on both the child with ASD and his or her parents and its transfer of generalized intervention into the daily lives of children with ASD after they had attended the program. The first researcher conducted six focus groups that involved twenty parents and three individual interviews. All interviews lasted for 40 to 60 min. Housewives made up 91% of the parents, and most were 36–40 years of age with high school education. The majority had only one child.

Parents' interviews were audio-recorded and transcribed verbatim. All recorded interviews, including the focus group and individual interviews, were transcribed and translated into English by the research assistant. The transcriptions were read through several times to obtain

a sense of the whole. In some of the individual interviews' transcripts, there are parts that the interviewer answered parents' questions related to other issues. These parts of the transcripts were labelled irrelevant and excluded from the analysis as it did not relate to the research question.

Intervention and Control Groups

Social Cognitive Intervention Program Group

The social cognitive intervention program was administered to the intervention group in blocks of 10-week at a time. Each lesson lasted for one hour and was equally divided into a teaching session and a practical session (which consists of games and role-play). During the teaching session, visually scaffolded materials (such as comic-style short stories) were illustrated using Microsoft PowerPoint slides and were presented to the participants with verbal instructions. In addition to the teaching content, the slides also included a lesson schedule, homework assignment for the forthcoming week, and a summary of social skill tactic reminders. An overview of the social cognitive intervention program and core skills taught in each session are listed in Table 2.

Table 2 Overview of the social cognitive program and core social skills taught delivered in each session

Session	Concepts of Social cognition	Social skills
1	Seeing or hearing leads to knowing Predicting actions on the basis of one's knowledge	Two-way conversation Two-way conversations
2	Situation-based emotions	Phone calls: beginning and endings
3	Desire-based emotion (happiness)	Rules for being a good sport Rules for being a good sport
4	Desire-based emotion (sadness/disappointment)	Accepting "no" for an answer
5	Belief-based emotions	Rules for being a good sport
6	Deception Belief-based emotions	Honesty: determining how much of the truth to tell
7	False beliefs (fulfilled and unfulfilled desires)	Group entry: slipping in
8	Malicious intentions	Dealing with teasing and malicious intentions Making a good impression on others
9	Persuasion and influence	Demonstrating respect for adults
10	Child session: graduation	Parent session: Where do we go from here?

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Permission was received from the original authors to adopt the social cognitive intervention program. It was translated into Chinese by a professional translator and an expert panel of four experienced occupational therapists critically reviewed the contents and cultural relevance of the translated program. The panel members provided constructive feedback on

the cultural relevance of the social cognitive intervention program. According to their feedback, some minor revisions were made to the text of the teaching materials and handouts to ensure consistency, relevance, and semantic parity with the original English version of the materials. To incorporate culturally sensitive elements in the training context, everyday social contexts were used as a basis for training. These social contexts included dining out with family members, joining games at schools and being a good host when visitors came. Besides, training activities were designed relating to the local popular culture. Common local board games were also prepared during the naturalistic game time in each session. Examples of homework activities that children were asked to complete included making a phone call to another child in the group.

Waitlist Control Group

Children recruited for participation in the waitlist control group were initially tested to establish pre-test scores and then tested 10 weeks later which was equivalent to the timespan between the pre-test and post-test for the social cognitive intervention program group. In between these two testing sessions, the waitlist control group did not receive a social skills intervention. For ethical reasons, following the second testing session, the participants in the control group were allowed to participate in the social cognitive intervention program.

Treatment Fidelity

Treatment fidelity of the social cognitive intervention program was ensured when an intervention was repeated across various groups. All activities and session objectives were standardized with the same set of training materials which included the manual with worksheets for children, parents, and teachers' handouts. All teaching sessions were presented

to the participants with using PowerPoint slides and verbal instructions. Moreover, all trainers took part in training before the actual implementation of the social cognitive intervention program. Prior training and supervision by the first researcher were done to ensure the fidelity of how the group was supposed to be run. Trainers were also asked to record children's performance after each session and the researcher reviewed with them throughout the session. Two groups were led by occupational therapy practitioners and four groups were by occupational therapy students with supervision by the first researcher.

Data Analyses

Quantitative Component

A power analysis, using G Power 31.7, employing the interaction effect, was conducted to determine the minimum sample size needed and to detect a significant interaction effect. It was estimated with an effect of 0.5, alpha 0.05, and desired power of 0.80, that the total sample size required for this study was 45 participants. It was estimated that this sample size was sufficiently large to detect the effect of the magnitude listed above. In this study, the sample size of 74 children and adolescents was thus sufficient for adequate power.

Repeated-measures ANOVA was used to analyze differences in outcome measures (including data from the GAS, SSIS-RS-C, TOMI-2, and Strange Stories Tests) between the intervention and control groups, after accounting for changes over two time periods (T1 and T2). Statistical analyses were performed using SPSS 25.0 software (IBM Corporation, New York, USA). Data were presented as the mean plus or minus the standard deviation for continuous variables and as the percentage for the frequency variable.

Qualitative Component

This study employed content analysis (CA) outlined by Schreier (2012) to systematically describe and analyze the experiences and views of the parents gathered from the focus group and individual interviews in the social cognitive intervention program (Schreier 2012). Steps involved in the qualitative content analysis process were listed: (1) building a coding frame, (2) dividing materials into units of coding, (3) testing the coding frame, (4) evaluating and modifying the coding frame, (5) coding all materials using the revised coding frame, and (6) interpreting and presenting the findings (Schreier 2012). All transcriptions were first analyzed by the first researcher and validated by the third researcher using the coding frame. The text was abstracted and labelled with a code using inductive analysis (Graneheim and Lundman 2004). The various codes were compared based on differences and similarities and sorted into categories and sub-categories. The revised coding frame was formed by identifying recurrent themes and under each theme, category, and sub-categories were built (Schreier 2012). Representative quotations from the transcribed text were extracted to illustrate each category in the next section to reflect the words of the parents. Member checking was established by summarizing information and questioning the participants during the interview process to ensure comprehensiveness and enhance the credibility of data analyses. Parent participants were also invited to evaluate the transcripts on completion to ensure clarity and resonance with their experience of participating in this study.

Results

Preliminary Analyses

Baseline characteristics of participants in the intervention and waitlist control groups are shown in Table 1. No significant group differences were found at the pre-test with chronological age, gender, diagnosis, medication, grade, and mean autism quotient score using Chi-square. No significant group differences were found with GAS, TOMI-2, Strange Stories Test and the SSIS-RS-C scores, except the SSIS-RS-C Cooperation subscale using t-tests.

The first research question was related to parent-perceived changes in the social skills GAS and SSIS-RS-C measures related to their children with ASD. The perceived changes in the children were assessed using the GAS and SSIS-RS-C at two data points—pre-test and post-test—and comparing the results with those of the waitlist control group. Repeated measures ANOVAs were employed in all outcome measures using a test of mean differences. There were significant differences between groups on three outcome measures, including the GAS scores ($p = 0.047$, $F = 4.09$, partial $\eta^2 = 0.052$), the SSIS-RS-C-total scores ($p = 0.005$, $F = 8.52$, partial $\eta^2 = 0.103$), and the SSIS-RS-C-Engagement scale ($p = 0.046$, $F = 4.12$, partial $\eta^2 = 0.00$). The group differences on the SSIS-RS-C Problem behavior subscale ($p = 0.056$) and Responsibility subscale ($p = 0.069$) approached significance (refer to Table 3). The multivariate ANOVA indicated that there were no significant differences in the social skills measures (12 measures in all) between the intervention and waitlist control groups (Wilk's $\lambda = 1.30$, $p = 0.24$). There were significant changes in the outcomes over pre- and post-measures (Wilk's $\lambda = 7.39$, $p < 0.001$) and a significant interaction between between-group and within-group effects (Wilk's $\lambda = 2.53$, $p < 0.01$).

Table 3 Between-group comparisons of outcomes on the social skills measures at pretest and posttest

Variables	Group	Pre-test T1 Mean SD	Post-test T2 Mean SD	F	p	η^2	Observed power
GAS score	Experimental group	-.70 .70	.28 .85	4.09	.047*	.052 ^{††}	.514
	Control group	-.77 .57	-.41 1.04				
SSIS-RS-C Total scale	Experimental group	75.04 17.97	81.42 22.44	8.52	.005**	.103 ^{†††}	.821
	Control group	66.03 18.39	71.06 16.79				
SSIS-RS-C Communication subscale	Experimental group	11.48 3.64	12.51 3.46	1.80	.183	.024 [†]	.263
	Control group	10.41 2.82	10.89 3.109				
SSIS-RS-C Cooperation subscale	Experimental group	11.64 2.40	11.64 2.40	1.05	.309	.014 [†]	.173
	Control group	11.06 2.32	11.06 2.32				
SSIS-RS-C Assertion subscale	Experimental group	12.77 3.96	12.44 3.80	2.80	.098	.037 [†]	.380
	Control group	10.24 4.06	11.41 4.51				
SSIS-RS-C Responsibility subscale	Experimental group	9.48 3.04	10.57 3.22	3.41	.069	.044 [†]	.446
	Control group	8.24 3.23	8.55 2.61				
SSIS-RS-C Empathy subscale	Experimental group	9.22 3.38	9.22 3.38	0.86	.356	.012 [†]	.150
	Control group	8.00 3.09	8.55 3.18				
SSIS-RS-C Engagement subscale	Experimental group	11.88 4.03	12.91 3.88	4.12	.046*	0.00	.106
	Control group	9.79 4.26	10.86 4.42				
SSIS-RS-C Self-control subscale	Experimental group	9.11 3.92	10.44 4.05	3.20	.077	.042 [†]	.424
	Control group	9.00 4.34	8.89 3.82				
SSIS-RS-C Problem behavior subscale	Experimental group	65.86 14.76	58.28 16.87	3.78	.056	.049 [†]	.484
	Control group	67.58 15.06	68.96 14.52				
ASD score	Experimental group	21.95 4.54	21.53 4.92	0.56	.454	.008 [†]	.115
	Control group	21.65 4.47	22.86 4.77				

Differences between pretest and posttest variables and comparisons of the intervention effects

among experimental and control groups were analyzed using repeated-measures ANOVA

SSIS-RS Chinese version of the Social Skills Improvement System Rating Scales, ASD

Autism Spectrum Disorder *Significant differences between pretest and posttest ($p < 0.05$)

**Significant differences between pretest and posttest ($p < 0.01$) η^2 is partial Eta-squared

[†]Small effect size ^{†††}Large effect size

The second question assessed ToM knowledge changes as perceived by GAS and ToM measures. Univariate ANOVA results revealed significant differences in outcomes between groups on the Strange Stories Test ($p < 0.001$, $F = 10.56$, $\eta^2 = 0.128$) and the TOMI-2 Advanced score ($p = 0.003$, $F = 9.43$, $\eta^2 = 0.116$). The group differences on the TOMI-2 Early ($F = 2.83$, $p = 0.097$) and Basic ($F = 3.75$, $p = 0.057$) scores approached significance (refer to Table 4). Furthermore, there were significant differences in five theory-of-mind measures between the intervention group and the control group (Wilks's $\lambda = 4.14$, $p = 0.005$). There were significant increasing changes between the outcomes at pre-test and post-test times (Wilks's $\lambda = 5.29$, $p = 0.001$), but no significant interaction occurred between the between-group effects and the within-group effects (Wilks's $\lambda = 2.10$, $p = 0.09$).

Table 4 Between-group comparisons of the outcome on the Theory of Mind measures at pretest and posttest

Variables	Group	Pre-test T1		Post-test T2		F	p	η_p^2	Observed power
		M	SD	M	SD				
Strange Stories Test	Experimental group	7.44	4.58	9.55	5.42	10.56	.002**	.128†††	.894
	Control group	5.17	4.40	5.03	4.41				
TOMI-2 Total score	Experimental group	12.46	2.72	13.52	2.43	1.10	.297	.015†	.179
	Control group	11.10	3.15	11.80	2.72				
TOMI-2—Early score	Experimental group	13.78	2.89	14.55	2.25	2.83	.097	.038†	.382
	Control group	12.91	3.49	13.33	2.87				
TOMI-2—Basic score	Experimental group	13.54	2.78	14.39	2.42	3.75	.057	.049†	.48
	Control group	12.48	3.20	13.06	2.87				
TOMI-2—Advance score	Experimental group	10.49	3.17	12.11	2.91	9.42	.003**	.116†††	.857
	Control group	8.84	3.24	9.60	3.30				

Differences between pretest and posttest variables and comparisons of the intervention effects among experimental and control groups were analyzed using repeated-measures ANOVA TOMI-2 Theory-of-Mind Inventory Second Edition *Significant differences between pretest and posttest ($p < 0.05$) **Significant differences between pretest and posttest ($p < 0.01$) η_p^2 is partial Eta-squared †Small effect size †††Large effect size

The third research question was related to the generalization effect of the intervention program. Two primary themes emerged from the focus group and individual interviews using content analysis. The themes captured from the interviews were (a) improvements and changes in the children's abilities and skills in multiple settings, and (b) challenges in implementation and engagement in the program (see Table 5).

Table 5 Summary of the manual coding categories

Theme

Theme one: Improvements and changes in the children's abilities and skills

Improvements in the children's social participation at home

Improvements in the children's social participation at school

Improvements in the children's social participation in the community

The child(ren) gained knowledge but exhibited no change in behavior

Theme two: Challenges in implementation and engagement in the program

Challenges to engaging in the program due to a parental factor

Challenges to engaging in the program due to a children's factor

Challenges to engaging in the social skills program due to siblings of the child with ASD

Theme One: Improvements and Changes in the Children's Abilities and Skills in Multiple Settings

Theme one focused on the improvements that parents perceived their children with ASD made after the social skills program had been implemented for 10 weeks. Parents reported a variety of their children's behaviors and skills that had changed over time after the children had attended the program and implemented the homework in multiple settings. Those changes included: (1) improvements in the children's social participation at home, at school, and in the community, and (2) knowledge gained but with no change in behaviors.

Children with ASD were also reported to demonstrate improvements in their social interaction skills with parents and family members. Several parents shared that their children with ASD had developed better relationships with them and other family members. The improvements that the children with ASD made at home included using more expressive language and more positive social behaviors, having better social interactions with parents and family members, and exhibiting increased play skills. Children with ASD demonstrated improvements in their expressive language skills, including requesting permission to play with peers and sharing things with parents about school events. The mother of John, age 9, said during her interview, "... a few days ago... my boy has never requested before... to go downstairs and play with peers. When he saw the peer, he said to me [mother of child], 'could I play with other children?' I was overjoyed."

Moreover, improvement in social participation at school that was seen in the children with ASD was further supported by more social interaction skills and engagement with teachers and peers, and by positive social behaviors. The children's social interaction skills and

engagement with teachers and peers also improved. Child participants were reported to have demonstrated improvement in their social interaction skills at school. One father said that he had received positive feedback from his 9-year-old son's teacher, who maintained that the son had improved significantly at school. "In school, his teacher said he was more willing to share his problem with the teacher. He only shared his problem with the class teacher. He told the teacher that he has no friend."

The children with ASD who took part in the social skills groups exhibited improvement, with more positive social behavior in their school environment. Mother of Tin described a "special" incident happening at school. He [the child with ASD] shared his flute with a school mate [who forgot to bring his own] in a music lesson. I think this was extraordinary because he never shared things with others, not even stationery. Even if the teacher asked if he would help to [lend] to others, he would cry. (Mother of Tin, age 6).

Furthermore, many parents noted that their children with ASDs were able to participate more in community settings. Those changes were further described as better social play, increased expressive language, and positive social behavior. Improvements in the children's social play happened in a variety of community settings, for examples, church. The parents said that their children with ASD would invite other children in church and the neighborhood to play. One parent stated, "I now understand why my son was asking me to make a booking for a table tennis session. He wanted to play table tennis with his friends." Another parent stated with joy that "My son asked friends out to watch a movie after school. He has never done it before."

Most of the parents stated that their children with ASD improved in social participation across many different settings, including at home, at school, and in their community. Only one mother reported that her child with ASD had no observable change at home; however, the child did perform better in the program. During the program, he was very attentive, but he turned into his real self when he was at home. For example, he always cheats when he played games with his sibling. Another example happened during mealtime. He ate all the food in the dishes but left nothing to his family members. (Mother of Wai, age 12).

Theme Two: Challenges In Implementation And Engagement In The Program

Although the parents reported positive changes in their children with ASDs for various reasons, they also stated that, for a handful of reasons, they encountered several challenges to implementation and engagement in the program. The first challenges that affected the parents' engagement with the program were due to the parents' limited time. For most of the child participants (48%), both parents were working full time, and the parents had limited time to engage in the program. Those parents reported that there was no time to observe their children's behaviors at home and at the same time to manage the children's schoolwork and implement the home program. Moreover, since the parents spent most of their time in managing their children's schoolwork, they did not expect their children to meet friends and practice social skills at all.

Similarly, children with ASDs faced time-constraint challenges as well. One parent expressed the dilemma when raising her child, "regarding social skill development ... because we spent most of the time in school work... I did not expect him [child with ASD] to go out and meet friends...".

Some parents also reported that their adolescent children with SD often felt embarrassed about having to leave their regular class to attend the social skills group. [B]ecause we devote the most effort to his homework and academic performance, we feel remorseful about his delay in social skills." I think this kind of intervention can be done earlier, like in primary school. Now they need to receive a note to join this group training, and they feel uneasy about leaving the classroom. (Mother of LT, age 14).

Besides, the parents expressed difficulty in managing the progress of their children with ASD because there were other siblings in the home that also required attention and care. I have two children at home. The elder brother [child with ASD] needed me to accompany and bring him to attend the program. At the same time, I have to pick up his younger brother from school. Then I need to re-arrange the time and asked my husband to take a day off. I don't want to miss any session [of the program] but sometimes I have to struggle with the time demand (Mother of Yin, age 11).

Discussion

This study investigated the impact of the social cognitive intervention on children with ASD. The first research question explored parents' perceived changes in the social skills of their children with ASD after the children had completed the social cognitive program. The GAS and SSIS-RS-C results provided evidence that the social cognitive program can lead to improvements in specific aspects of ASD children's friendship and social skills. The improvements in the social skills and ToM measures in the intervention group of children, were consistent with the results indicated by the GAS score findings. The quantitative

findings were aligned with results from the parent participants in the focus group and interview. Furthermore, the children's improvements in social skills and conversation skills were noted across different contexts, including in the home, at school, and in community settings. Children with ASD demonstrated improvement in taking initiative and interacting with others. The integration of social skills and ToM concepts into the social cognitive program may be one potential reason why better friendship outcomes were achieved in the experimental group. This finding is particularly useful since it has been suggested that children with ASD often have difficulties understanding social cues in their daily living environments which can, in turn, affect their understanding of the intentions and actions of other people (Senju et al. 2009). Those improvements were noted across various settings, and the parents also observed a generalization of skills.

The second research question assessed whether there were any changes in theory-of-mind concepts in the child participants after they had attended the 10-week social cognitive intervention. Evidence of notable gains was observed in the children with ASD's Strange Stories Test scores in the intervention group, but not in the scores of the waitlist control group. Between their pre-intervention scores and the post-intervention scores, the intervention group made significant gains in their Strange Stories scores, and in their TOMI-2 Total scores, Early scores, Basic scores, and Advanced scores.

In the social cognitive program, ToM concepts were included to teach the children with ASD how to interpret and react to others more accurately and consistently in different social scenarios. Social skills were integrated with the ToM concepts to facilitate the correct use of social strategies, such as "praising others so that they feel happy". The integration of social

skills and ToM concepts can help to promote positive social responses from other people and enhance their engagement in meaningful social relationships (Waugh and Peskin 2015).

The third research question addressed whether the children with ASD who completed the social cognitive program could subsequently generalize the skills they had learnt to daily life. The interview findings indicate that the current social cognitive program promotes improvements in ASD children's positive social behaviors, communication abilities, and social interaction skills with parents, classmates and peers in the community. The interviews also revealed generalization of skills across different daily life settings, including home, school, and community.

Furthermore, the qualitative results from this study also provided evidence that children with ASDs can apply the theory-of-mind concepts that they learn in the program, and they can improve their social skills. Children with ASD have a better understanding when a social situation is presented in visual form (Arthur-Kelly et al. 2009). Hence, the positive changes that the children made in decoding others' emotions and presenting appropriate behavior can be explained by the learning method that the program used because it put a strong emphasis on visually based strategies. Such an approach can enhance ASD children's understanding of social situations, and later, when they are asked to practice their social skills in a role-play scenario. Dramatic play enables children with ASD to improve their understanding of others' perspectives (Corbett et al. 2011).

Both the quantitative and qualitative results of the study suggested that the program increases child with ASD's engagement in terms of taking initiative and interacting with others. Such

positive changes were shown across different settings, including in the home, at school, and in the community. By providing feedback to the participants, they were prompted in a positive way to consider the character's viewpoint. More specifically, providing opportunities to practice ToM-related skills greatly enhanced the participants' ability to integrate ToM concepts and to more fully understand different social situations. In the study's social cognitive program, ToM concepts were included to teach the children with ASDs how to interpret and react to others more accurately and consistently in different social scenarios (Hofmann et al 2016). Literature also supported that when children with ASD were taught to use thought-bubble pictures to represent protagonists' beliefs about object locations, significant gains were made by trained children that generalized beyond false belief to other ToM concepts and these gains were maintained for at least 3 weeks (Paynter and Peterson, 2013).

The results are consistent with findings from previous social skills studies, including the Programme for the Education and Enrichment of Relational Skills (PEERS; Laugeson and Frankel 2010). PEERS is a widely known 12-week social skills program that adopts a cognitive behavioral therapy approach and teaches social skills to children and adolescents with ASD using a behavioral and social learning procedure. The effectiveness of the program has been demonstrated in teacher-reported social responsiveness, social communication, social motivation, social awareness and decreased autistic mannerisms after children were involved in a 10-week program (Laugeson and Park 2014; Laugeson et al. 2012).

The key intervention elements used in this study that are similar to PEERS include a manualized curriculum that focused on friendship-making skills, the use of role-play and

games to practice pivotal skills, a training component for parents and homework assignments intended to provide children with additional practice (Bellini et al. 2006; William et al. 2007). Although there are many similarities between the social cognitive program used in this study and PEERS, such as the lesson format and parental involvement, there are also some notable differences. Critical and unique to the social cognitive program was the inclusion of ToM concepts such as emotions, false beliefs, persuasion, sarcasm and malicious intentions (O'Connor and Evans 2019). In addition, unlike PEERS, where lessons are presented aurally using a didactic approach, the current program implemented a visually scaffolded instructional approach delivered by means of comic-style illustrated stories.

The findings of this study are in agreement with studies by Rickards et al. (2007) and Frankel et al. (2010), who found that family reinforcement of skills learnt in a program enhances development in children with disabilities. Homework and parent training were introduced in the program which may facilitate continuous support of the use of skills beyond the social-cognitive program. In addition, the applicability of the program given the time constraints and the under-emphasis on social skills in the Hong Kong context may have been an issue. Literature supports the fact that families with ASD children have higher levels of stress compared to families with children with Down syndrome or behavioral disorders or children with typical development (Ilias et al. 2018; Miranda et al. 2019). As shown in the literature, parental stress was readily elevated and mostly associated with children with various developmental disorders. In this current study, during their interviews, parents expressed stress during the intervention period. As a result, a cost-effective social cognitive program with parent coaching would be one of the choices to provide ongoing support to these families with ASD.

Limitations

This study had several limitations. First, although Waugh and Peskin (2015) measured the maintenance of effects through a three-month follow-up, this study measures the post-intervention effect after 10-week. Thus, longitudinal studies are needed to determine whether gains observed after attending the program are maintained for a longer time.

Second, since most parents preferred their children to participate in the intervention group and the best design would be the use of a waitlist control group. As a result, the study's group sizes were uneven, with a smaller size ($n = 29$) in the control group, whereas the intervention group was able to recruit 45 participants. The uneven, small groups resulted in interpretations that must be made with caution. Furthermore, the study groups' homogeneous characteristics may have contributed to higher internal validity but lower external validity. There is a lack of random assignment of the participants in the group which may weaken the power of the study.

Third, the effects of concurrent treatments were not completely controlled during the social cognitive intervention, therefore, there is a possibility that the participants were under other kinds of psychosocial interventions. The findings of this study were demonstrated to be effective for children with ASD of good cognitive function whereby the results may be less generalizable to other groups of ASD (e.g. intellectual disabilities and non-verbal communication).

In the qualitative data collection, both focus group discussions and individual interviews were completed with the parents due to their' availability. This was to gain insights about the generalization of social skills intervention transferred into daily life. There was no teacher involved in the interview due to limited resources. It would be insightful to interview teachers to understand the impact of social skills group intervention in the child's school setting.

Future Directions

The effectiveness of social skills intervention depends on whether one can acquire, generalize, and maintain the skills that one learns. Research has shown that children with ASDs have a deficit in their ability to generalize and apply learned skills to a new social situation (Church et al. 2015; Mottron and Burack 2006). In the social cognitive program that we used in this study, homework that required the children to practice social tasks was given to them to promote skill generalization by encouraging them to apply the social skills they learned from the session to their daily life practices (Kazantzis and L'Abate 2007). However, the huge academic burden that students in Hong Kong experience caused the program's homework to have low practicability in the present study. To promote generalization in future implementations of social cognitive intervention groups, the amount of homework could be reduced to a more practical level, or a technology-assisted device could be used.

Another possible modification would be to change the social tasks, from out-of-school tasks, like phone calls, into school-based tasks, like chatting with friends at school. Future trials could include more intensive parent training and face-to-face teacher training, to further consolidate the information about handling ASD children in the home and school settings. Moreover, therapists could coach parents by providing continuous feedback on the children's

performance after each session so that the parents could shift their focus from an academic context to a social one.

There is emerging evidence indicating that social skill-based interventions conducted in clinical or educational settings by highly qualified and experienced therapists can improve children's social skills (Laugeson and Park 2014). However, only a small proportion of children, relative to the number of children that require intervention, can access this type of service. Therefore, there is an urgent need for efficacious, cost-effective interventions that can be delivered in the community, especially in school settings. The improvements of children participating in the experimental group of this study are therefore encouraging. The cost-effectiveness of one and half hour sessions and in a small group format, suggests that school-based social cognitive program led by occupational therapists are ecologically valid and cost-effective programs in enhancing social skills for children and adolescent with ASD. Another format is to co-lead the social cognitive program with school personnel where group leaders (teachers or teacher assistants) are able to manage social cognitive intervention groups, and findings suggest positive changes and maintenance of such change in the social development of children with ASD (Waugh and Peskin 2015). The study showed promising evidence that a 10-week social cognitive intervention program that targets children's social skills and knowledge in theory of mind can contribute to cost-effective, school-based intervention programs for children and adolescent with ASD.

Conclusions

The present study examined the implementation and effectiveness of a school-based social cognitive program for children with ASDs. School-based social skills intervention, which

promotes the generalization of social skills in a naturalistic environment, has become a promising new trend for intervention (Waugh and Peskin 2015). Because the number of students with ASD has been increasing worldwide, it is expected that more children with ASD in mainstream schools will encounter problems in social integration. Manualized and group-based social cognitive intervention are easy to implement and serves as a cost-effective intervention for students with ASD. The intervention effects of the study's social cognitive intervention in promoting the development of prosocial skills in children and adolescents with ASDs in mainstream schools were potentially efficacious. The continued use of the social cognitive program is recommended as the generalizability and applicability in cross-cultural context such as Hong Kong were examined and supported.

Acknowledgments

This study was completed by the first author in partial fulfilment of the requirements for a PhD degree in occupational therapy at Monash University under the supervision of the second, third, and fourth authors. The authors are grateful to Dr Cynthia Waugh for giving permission to use her social cognitive intervention. We would like to thank the parents and children who participated in the groups.

Author Contributions

PC designed the study and carried out the implementation. TB and MY helped supervised the project. AS contributed to the data analysis. PC wrote the manuscript with the support from TB, MY, and AS.

Compliance with Ethical Standards

Conflict of interest

The authors declare that they have no conflicts of interest.

Appendix A

Key informant intervention question schedule for parents of children with ASD.

- Do you think the program is helpful to your child, and does it have any impact on your child's social skills?
- Have you noticed any positive changes in your child's behavior or social skills?
- Have you noticed any changes in your child's peer or social relationships?
- From your perspective, what were three positive features about the program your child took part in?
- From your perspective, what were three limitations of the program your child took part in?
- What are the areas of improvement in social participation for your child?
- What were some of the challenges and barriers, as related to relationship building with your child?? What were those faced by your family?
- Do you have any suggestions about how the program could be improved?

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