An Investigation of Changes in Social-Pragmatic Communication Following Participation in the PEERS Program

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science

in

SPEECH-LANGUAGE PATHOLOGY

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Abstract

Background: The Program for the Educational Enrichment of Relational Skills (PEERS) is a manualized social skills program designed to help teenagers diagnosed with Autism Spectrum Disorder make and maintain friendships. To date, outcomes of PEERS have primarily related to social skills knowledge and frequency of teen get-togethers, assessed by caregiver, parent and teacher report. No studies have looked in-depth at changes in social-pragmatic communication experienced by participants of PEERS. There has also been a lack of direct observational methods used to assess gains documented from participation in PEERS.

Objective: The purpose of this research was to obtain preliminary data, using measures that include direct observation, of changes in adolescents' social-pragmatic communication, following completion of the PEERS program.

Method: We conducted a multiple case series study with three participants. Raters, blinded to the pre- and post-PEERS intervention condition, rated social-pragmatic communication behaviours for each participant from video taken based on the Yale *in vivo* Pragmatic Protocol (Y*i*PP; Simmons, Paul and Volkmar, 2014), a semi-structured conversational interview. A portion of each video was also rated based on the Pragmatic Rating Scale (PRS; Landa et al., 1992), a coding schema used to assess social-pragmatic communication. Parents rated their teen's communication pre- and post-PEERS using the Children's Communication Checklist – Second Edition (CCC-2; Bishop, 2003). Parents also participated in a semi-structured interview about their subjective impressions of the changes experienced by their children after taking part in PEERS.

Results: Findings illustrated potentially meaningful changes on the YiPP in the domain of Discourse Management as well as on the PRS in the category of Pragmatic Behaviours, further concentrated in the subcategory of Exchange of Information. Participants improved on the Interests subscale of the CCC-2 and an indicator of potential positive change was observed for Initiation. All parents subjectively rated that their teen's communication ability had improved. A theme of increased social awareness, sensitivity and understanding of others emerged from the analysis of the semi-structured parent interview.

Discussion: Results suggest meaningful and observable social-pragmatic communication changes occurred after the teens had participated in PEERS. Future larger scale research on social-pragmatic changes is warranted, with a focus on conversational back-and-forth. Methodological challenges and considerations for future work are considered.

Acknowledgements

This was the most challenging project that I have ever undertaken. I firmly believe that our successes are never solely our own and are the culmination of the efforts of many people. I cannot stress enough that this accomplishment was made possible by the support of many individuals. My parents, Bernard and Sylvie, have always served as an example of what is possible with hard work. They have backed my many years of post-secondary education for which I will always be grateful. I hope to be as generous and loving a parent as they have been to me. I can never express enough appreciation for my supervisors, Monique and Sandy for the countless hours spent helping me craft this thesis. Their patience, guidance and mentorship shepherded me through this unknown process. My sister Audrey and my Brother-in-law Eitan, thank you for the support and keeping me sane. My partner and fiancée, Jessica, started this journey with me almost three years ago. Having you in my corner has made it possible to never lose sight of my goals even through the ups and the downs. I need to extend my gratitude to The Centre for Autism Services Alberta. Without the help of their staff, this project would not have been achievable. To the parents and teens that shared their time and insights with me: without your participation, there would be no research. Your willingness to open yourselves up to a stranger is truly inspiring – thank you. Lastly, I want to end this section by saying that this research stemmed from a desire to help those with communication challenges. It is my hope, that this research can add the tiniest drop in a bucket that leads towards more compassion, empathy and fulfilment for teens with ASD and the people who surround them.

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Introduction

Autism Spectrum Disorder (ASD) is characterized by "persistent impairment in reciprocal social communication and social interaction (Criterion A), and restricted, repetitive patterns of behavior, interests, or activities (Criterion B)" (American Psychiatric Association, 2015, p. 26). In particular, a deficit in the social use of language (pragmatics) is the consistent, and unique, characteristic of this disorder (Colle, Baron-Cohen, Wheelwright & van der Lely, 2008). Pragmatic language is defined by the American Speech-Language Hearing Association (ASHA) as: "effective and appropriate use of language to accomplish social goals, manage turns and topics in conversation, and express appropriate degrees of politeness, awareness of social roles, and recognition of others' conversational needs" (ASHA, 2014). Language use in individuals with ASD is often characterized by monopolizing the conversation, and challenges adding pertinent information to the conversation, talking about common interests, and attending to their conversation partner (Paul, Orlovski, Marcinko & Volkmar, 2009). These pragmatic deficits can severely affect the quality and quantity of platonic and romantic relationships for individuals, including teenagers, with ASD (Cederlund, Hagberg, Billstedt, Gillberg & Gillberg, 2008; Liptak, Kennedy & Dosa, 2011).

The terms "pragmatic language" and "social communication" are sometime used interchangeably. Scholars in the field, however, have noted that the term "social communication" acknowledges a wider set of skills and behaviours, all important to social interaction, than might be considered to fall under traditional definitions of pragmatic language. Miller et al. (2015) define pragmatic language as "the appropriate use of language in context, including the use of

both verbal and nonverbal information." We favour this definition; however, to acknowledge the variation in terminology used within the field, this paper will use the term social-pragmatic communication (SPC). Social-pragmatic communication encompasses pragmatic behaviours (e.g., register, appropriateness, initiation of conversation, etc.) as well as speech (e.g., rate, timing, volume, affect) and nonverbal behaviours such as physical distance, gestures, facial expression and gaze (Landa, et al., 1992). Each component is important in interpersonal interactions, and impairment in the receptive or expressive elements of these communicative building blocks may result in difficulties creating and maintaining friendships for teens with ASD.

It is well documented that children with ASD experience challenges developing relationships, securing employment and living independently (Liptak et al., 2011). Out of 48 young adults with ASD, Eaves and Ho (2014) found that only 33% of young adults had at least one close friend. White and Roberson-Nay (2009) reported a significant relationship between depression and withdrawal and social dysfunction in children with ASD. In a comparison of neuro-typical children and children with high functioning ASD, Bauminger and Kasari (2000) found that children with ASD reported greater and more frequent feelings of loneliness than neuro-typical children. Mazurek and Kanne (2010) hypothesized that adolescents with ASD who have developed at least one friendship have better social skills and social awareness than those adolescents with ASD that have not developed relationships. Children and adolescents with ASD experience significantly more bullying than their neuro-typical peers (Campbell et al., 2017; Hebron, Oldfield, and Humphrey 2017), and students with ASD were less likely to be included or receive social support from friends and classmates, and more likely to be excluded and bullied than their peers with no or other special needs (Symes & Humphrey, 2011). Adams et al. (2016)

investigated the effect of different types of bullying on educational outcomes for adolescents with ASD. They found that all types of bullying (particularly verbal bullying) impact academic achievement in students with ASD. These findings provide evidence for the significant challenges associated with social function experienced by children with ASD.

There is evidence in the research literature to suggest that challenges in SPC and the social outcomes of individuals with ASD are related. In a longitudinal study, Liptak et al. (2011) used data from 725 individuals with ASD collected at baseline and again four years later to investigate the factors that impact social participation and how it is described in teens and young adults with ASD. They found that socioeconomic status, comorbid conditions, and the ability to communicate predicted a teen/young adult's social participation later on in life. With regard to communication, when asked about their "ability to converse" 12.4% of respondents reported "no trouble conversing", 34.4% "a little trouble", 38.9% "much trouble" and 14.2% "does not converse". Additionally, when asked how often they had get-togethers with friends in the past 12 months, 55.4% of respondents responded "never" (Liptak et al., 2011). The findings that almost 80% of respondents had at least "a little trouble" conversing and over half of respondents reported not having get-togethers suggest that there is potentially a strong relationship between SPC and social outcomes. Laws, Bates, Feuerstein, Mason-Apps and White (2012) compared peer acceptance in children attending mainstream school and students attending specialist units for speech, language and developmental difficulties housed in mainstream schools in the United Kingdom. They further compared the students being taught in the specialist units by assigning them to either a specific language impairment group (individuals with impairment in the form or content of language such as phonetics, morphology or syntax) or an ASD group based on their profile. The ASD group differed from the specific language impairment group in difficulty with

SPC. Students with an ASD profile were socially rejected more than those with a specific language impairment profile, and language and social communication abilities were significantly correlated with peer acceptance. In a comparison of individuals with specific language impairment, pragmatic language impairment, or ASD, Whitehouse, Watt, Line and Bishop (2009) found that the ASD group had considerable challenges in social relationships. When they compared friendship quality between groups, the ASD and pragmatic language impairment groups had significantly worse friendship quality than the neuro-typical control group. The difference between the specific language impairment and the pragmatic language impairment groups was not significant; however, the ASD group had significantly poorer friendships than the specific language impairment group.

Impairment in SPC is the hallmark of ASD. In combination, when looking at how communication, as a whole, impacts social outcomes, the studies previously mentioned show that SPC impairment isolated from impairments in formal aspects of language (phonetics, morphology, syntax, semantics) may be one of multiple factors that influence social outcomes. This is reflected in the findings that individuals with specific language impairment do not experience the same extent of difficulty developing and maintaining relationships as individuals with impairments in SPC (ASD and pragmatic language impairment). Explicitly stated, impairment in SPC negatively impacts friendships and peer acceptance in individuals with ASD.

The Program for the Education and Enrichment of Relational Skills

The Program for the Enrichment and Education of Relational Skills (PEERS) is a manualized intervention that uses a cognitive-behavioural approach to teach social skills to teenagers with ASD (Laugeson & Frankel, 2010). PEERS targets include: conversational skills, how to make and maintain friends, social etiquette, and how to deal with bullying. Each week,

for 14 weeks, a new social skill is taught to adolescents by PEERS trained teen-group facilitators (see Table 1 for lesson overview). Built into each lesson are role-playing exercises, activities and homework checks. Teens are given homework each week to practice skills that they learned during the lesson. Additional motivation is added in each lesson through a point system. Teens are told that the points they earn (for participation, effort, homework completion, etc.) will be individually tallied to determine the order in which they get to select prizes at their graduation party (the last PEERS lesson), and collectively tallied to determine the size of their graduation party. While the teen group is in session, parents meet with an adult-group facilitator to talk about any problems that arose from the previous week's homework assignment, what the teens are learning about in their current lesson, and how to troubleshoot any future problems with the homework assigned that week.

Table 1
PEERS Lesson Overview (Laugeson & Frankel, 2010)

Week	Lesson Topic
1.	Introduction and trading information
2.	Conversational skills
3.	Electronic communication
4.	Choosing appropriate friends
5.	Appropriate use of humor
6.	Peer entry strategies
7.	Peer exit strategies
8.	Get-togethers
9.	Good sportsmanship
10.	Handling teasing
11.	Handling bullying and bad reputations
12.	Handling arguments and disagreements
13	Handling rumors and gossip
14.	Graduation party and ceremony

PEERS uses a modified cognitive behavioural therapy (CBT) framework as a foundation for the intervention (Laugeson & Park, 2014). "CBT is broadly defined as brief, structured therapy focused on context-driven problem-solving by linking thoughts, feelings and behaviours to develop effective behaviours" (Koning, Magill-Evans, Volden and Dick, 2013, p. 1283). The approach used to teach social skills in PEERS includes small group formats, didactic instruction, concrete step-by-step explanation of the rules of social behaviour, Socratic questioning, role playing demonstrations of good and bad interaction strategies, cognitive strategies, reading social cues, perspective taking questions, social problem solving, repeated behavioural rehearsal, performance feedback, and homework assignment and review (Laugeson & Park, 2014). The effectiveness of this approach is credited to "increasing the structure and predictability of therapy sessions, incorporating visual supports, using explicit verbal cues and feedback, drawing explicit attention to important social cues, including parents in treatment, and providing multiple opportunities for rehearsal of skills" (Laugeson & Park, 2014, p. 85-86).

Since its inception, the evidence base for PEERS has grown. Table 2 presents a detailed summary of papers reporting on PEERS outcomes. PEERS studies often use the same outcome measures. These include: the Quality of Play Questionnaire (QPQ; Frankel & Mintz, 2010) which measures the quantity and quality of teen get-togethers; the Social Responsiveness Scale (SRS; Constantino, 2005), which measures autistic symptom severity; the Social Skills Rating System (SSRS; Gresham & Elliot, 1990), which assesses the use of social skills in different environments; and the Test of Adolescent Social Skills Knowledge (TASSK; Laugeson & Frankel, 2010), which measures knowledge of the skills taught in PEERS. All the measures are questionnaire format. Caregivers complete the QPQ, SSRS and the SRS, and teens complete the QPQ and the TASSK, before and after participation in PEERS. General findings for PEERS

include increases in social skills knowledge (Laugeson et al., 2009, 2012, 2014, 2015; Gantman et al., 2012; Van Hecke et al., 2012; Schohl et al., 2013; Yoo et al., 2014; Madelberg 2014; McVey et al., 2016), increased get-togethers/social contacts (Laugeson et al., 2009, 2012, 2014, 2015; Gantman et al., 2012; Van Hecke et al., 2012; Schohl et al., 2013; Yoo et al., 2014; Madelberg 2014), improved social skills (Laugeson et al., 2009, 2012, 2014; Frankel et al., 2010; Gantman et al., 2012; Schohl et al., 2013; Yoo et al., 2014; Madelberg 2014; Marchino & D'Amico, 2016), increased empathy (Gantman et al., 2012; McVey et al., 2016), increased popularity (Frankel et al., 201) and increased social responsiveness (Laugeson et al., 2012, 2014, 2015; Gantman et al., 2012; Mandelberg et al., 2014; Yoo et al., 2014; McVey et al., 2016), as well as decreased loneliness (Frankel et al. 2010; Gantman et al., 2012), decreased depressive symptoms (Yoo et al., 2014; Shiltz et al., 2017), decreased social anxiety (Schohl et al., 2013; Laugeson et al. 2014; Lordo et al., 2016; McVey et al., 2016) and decreased autistic symptoms (Van Hecke et al., 2013; Schohl et al., 2013; Laugeson et al., 2015). In the first published study investigating the efficacy of PEERS, participants showed significant gains in social skills knowledge, increased frequency of hosted get-togethers, and improved overall social skills as reported by parents (Laugeson, Frankel, Mogil, & Dillon, 2009; see Table 2 for a summary of PEERS outcome measures). Schohl et al. (2013) replicated and expanded on the findings of Laugeson et al. (2009). In addition to corroborating the previous findings, they also reported decreased anxiety, autistic symptoms and problem behaviour after participation in PEERS. Support for implementation of PEERS in different cultures was reported by Yoo et al., (2014) where the findings of the previous studies were replicated in Korea. Additionally, secondary measures investigating psychosocial outcomes in caregivers found decreased depressive symptoms and anxiety in the mothers of the teens who participated in PEERS (Yoo et al., 2014).

Although positive outcomes related to social skills emerged from these studies, there was still a question of whether the gains reported in PEERS were maintained. In a follow-up study, Mandelberg et al. (2014) found that participants and their parents were still reporting positive gains in social functioning, social skills knowledge and frequency of peer get-togethers 1-5 years after completion of PEERS. In culmination, the research base for PEERS is becoming stronger, which is establishing it as a leader in group social skills training for teens with ASD.

Table 2
Review of Measures Used in PEERS Studies

			Measures				
Year	Authors	Population	Parent	Self	Teacher	Observed	Results
2009	Laugeson et al.	Adolescents	SSRS QPQ	SSRS QPQ TASSK FQS	SSRS		Teens reported significant improvement in: social skills knowledge (TASSK), number of hosted get-togethers (QPQ). The delayed treatment group reported significant decrease in friendship quality (FQS) while the treatment group did not. Parents reported significant improvement in social skills (SSRS).
2010	Frankel et al.	Children	QPQ SSRS	LS PHS	PEI		Children reported significant: improvement in loneliness (LS) and popularity (PHS). Parents reported significant improvement in: the number of hosted play dates and disengaged behaviors on play dates (QPQ); and self-control (SSRS). Three-month follow-up revealed that gains had not be maintained in child or teacher measures but had in some parent measures: number of hosted get-togethers and disengagement during play (QPQ); self-control (SSRS).
2012	Gantman et al.	Adults	SRS	SELSA			Significant improvement in young adult measures: social and emotional

			SSRS EQ QSQ	EQ QSQ SSI TYASSK		loneliness (SELSA) and knowledge of social skills (TYASSK). Significant improvement in caregiver measures: social responsiveness, social communication, autistic mannerisms (SRS); social skills, cooperation, self-control and assertion (SSRS); empathizing (EQ); and frequency of hosted and invited get-togethers (QSQ).
2012	Laugeson et al.	Adolescents	SSRS SRS QPQ	QPQ TASSK-R	SSRS SRS	Improvement reported by parents in: overall social skills and in the areas of cooperation, assertion and responsibility (SSRS-P); decreased autistic symptoms related to social responsiveness, and autistic mannerisms and improvements in social awareness, social cognition, social communication, social motivation (SRS-P); increased hosted get-togethers (QPQ-P). Teens reported increased hosted get-togethers (QPQ-A) and social skills knowledge (TASSK-R). At follow-up 14 weeks later parents also reported decreased problem behavior, externalizing behavior (SSRS-P); improvements in autistic symptoms in the areas of social communication and autistic mannerisms. Additional group treatment effects were observed in

							improved social awareness (SRS-P) and hosted get-togethers (QPQ-A and QPQ-P).
2013	Schohl et al.	Adolescents	TASSK QSQ SRS SSRS	QSQ FQS SIAS SSRS	SRS SSRS		Adolescents reported significant improvement in: social skills knowledge (TASSK); frequency of hosted and invited get-togethers (QSQ); decrease in anxiety in social interaction (SIAS); no significant results were found in conflict (QSQ) or the adolescent perceptions of their best friendships (FQS). Parents reported significant improvement in: social responsiveness (SRS); problem behavior (SSRS). No significant results were found in parent reported: frequency of invited get-togethers, hosted get-togethers, conflicts (QSQ); and social skills (SSRS). Teachers reported significant decrease in problem behavior (SSRS) but no significant improvement in overall social skills (SSRS) or social responsiveness (SRS).
2013	Van Hecke et al.	Adolescents	SRS QSQ	TASSK		EEG	Experimental group shifted to left-hemisphere dominant gamma band activity (taken as an indication of decreased autistic symptomology and increased social contacts and social

					skills knowledge) whereas the waitlisted group showed no significant changes in gamma band asymmetry. Caregivers rated significant decrease in autistic symptoms (SRS), a significant increase in hosted and invited get-togethers compared to the waitlisted group (QSQ-R), and an increase in social skills knowledge (TASSK). Teens who obtained better scores on SRS, QSQ-R and TASSK showed greater left-hemisphere dominant gamma band asymmetry. Adolescents with ASD who took part in PEERS did not differ significantly from neurotypical peers in left-hemisphere gamma band asymmetry whereas waitlisted adolescents who had not undertaken PEERS had significantly less left-hemisphere dominant gamma band asymmetry in comparison to neurotypical peers.
2014	Chang et al.	Adolescents	SSRS	PHS-2	Social functioning reported by caregivers (SSRS) and popularity reported by adolescents (Piers-Harris-2) were significant predictors of variance in social skills after treatment. Responsibility and self-control subscales of the SSRS were significant predictors of social skills after PEERS,

							other subscales were not.
2014	Laugeson et al.	Adolescents	SRS SSRS QPQ SAS	QPQ SAS FQS PHS-2 TASSK	SRS SSRS		Teens reported significant improvement in social skills knowledge (TASSK-R) and quality of play and hosted get-togethers (QPQ). Parents reported significant decrease in autistic symptoms (SRS). Invited get-togethers (QPQ) social anxiety showed improvement despite failing to reach significance.
2014	Mandelberg	Young Adults	SSRS SRS QPQ FII	QPQ TASSK			1-5 year follow-up of PEERS found maintained improvement in social responsiveness (SRS), social skills and problem behavior (SSRS); total get-togethers reported by parents and teens; and improvement in social skills knowledge (TASSK).
2014	Yoo et al.	Adolescents	QPQ SCQ SRS ASDS CBCL BDI STAI-T	TASSK-R QPQ K-SSRS CDI STAIC-T STAIC-S		ADOS EHWA-VABS	Parents reported significant improvement in teen: ASD symptomology (SCQ); social responsiveness (SRS); hosted get-togethers (QPQ); assertion and overall social skills (SSRS); anxiety/depression withdrawal, somatization, social problems, thought problems inattention, delinquent behavior aggressive behavior, internalizing problems, externalizing problems and

			STAI-S		total emotional and behavioral problems (K-CBL); interpersonal relationships, play/leisure time and coping skills (EHWA-VABS; language and communication, social interaction and stereotyped behaviors and restricted interests (ADOS). Teens reported significant improvement in: depressive symptoms (CDI); and social skills knowledge (TASSK-R). Secondary measures in caregivers found significant decrease in depressive symptoms in mothers (BDI) and state based anxiety (STAI-S).
2015	Laugeson et al.	Young Adults	SRS SSRS QSQ	QSQ EQ TYASSK	In comparison to the delayed control group, young adult measures indicated significant improvement in: social skills knowledge (TYASSK) and total get-togethers (QSQ). In comparison to the delayed control group, caregiver measures indicated significant improvement in: social responsiveness, social motivation and autistic mannerisms (SRS); overall social skills, cooperation and assertion (SSRS); and total get-togethers and hosted-get-togethers. No changes in empathy were observed (EQ). Differences in pre and post young adult measures indicated significant

							improvement in: social skills knowledge (TYASSK); total get-togethers and invited get-togethers (QSQ). Caregivers reported significant improvement in social responsiveness, social motivation, autistic mannerisms, social communication and social cognition (SRS); total get-togethers, hosted get-togethers and invited get-togethers; and overall social skills, cooperation and assertion (SSRS). In a 16 week post treatment follow-up, only hosted get-together (QSQ) and cooperation reported by caregivers failed to reach significance despite previous significant results. However, empathy (EQ) and responsibility (SSRS) reached significance.
2016	Dolan et al.	Adolescents	TASSK			CASS	Significant improvement in vocal expressiveness and a positive trend towards improved overall quality of rapport. Improvements on the TASSK were significantly correlated with overall quality of rapport on the CASS.
2016	Lordo et al.	Adolescents	BASC-2 PRS PANAS-C-P	ERICA PANAS-C	NEPSY-II		Significant behavioural functioning improvement reported by parents on BASC-2 in the areas of: Aggression, anxiety, withdrawal, adaptability leadership, and activities of daily

			ABAS-2 GARS-3		functioning; no significant differences NEPSY-II, PANAS-C, PANAS-C-P, ERICA; significant improvement pre-post on GARS-3.
2016	Marchico et al.	Adolescents	SSIS-RS QPQ-P	SSIS-RS QPQ-A	Self-report at post test showed improved assertion on SSIS-RS and quality of play on QPQ, at 7 week follow-up self-report on SSIS-RS indicated improvement in across most social skill areas, QPQ in pre-post and 7 week follow-up found significant decrease in conflicts.
2016	McVey et al.	Adolescents	SSIS-RS SRS	TYASSK QSQ-YA EQ SELSA LSAS SPIN	Significant improvements were found in social responsiveness, PEERS knowledge, empathy, interacting with others, and social anxiety.
2017	McVey et al.	Adolescents, Young Adults	SRS SSIS-RS QSQ	TASSK TYASSK QSQ	No difference in social skills knowledge, interacting with others and social responsiveness were found between male and females with ASD participating in PEERS. Both genders respond similarly to the program.

2017	Schiltz et al.	Adolescents	CDI QSQ	A significant relationship was found between depressive symptoms and social contact. Significantly less depressive symptoms as measured by CDI observed from pretest to post-test. After participation in PEERS, decreased risk of suicide.

Note. Measure acronyms: Adaptive Behaviour Assessment System—Second Edition (ABASII Parent Form 5—21; Harrison and Oakland 2003), Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, and Risi, 2008), Behaviour Assessment System for Children—Second Edition Parent Rating Scale (BASC-2 PRS; Reynolds and Kamphaus 2004), Beck Depression Inventory (Korean version BDI; Han, Yom, Shin, Kim, Yoon, Chung, 1986), Children's Depression Index (CDI; Kovacs, 1992) Child Depression Inventory (CDI Korean version; Cho & Lee, 1990), The Contextual Assessment of Social Skills (CASS: Ratto, Turner-Brown, Rupp, Mesibov, and Penn, 2010), Empathy Quotient (EQ; Baron-Cohen and Wheelwright 2004), Emotion Regulation Index for Children and Adolescents (ERICA; MacDermott, Gullone, Allen, King, and Tonge, 2010), Friendships and Interventions Interview (FII; Mandelberg, Laugeson, Cunningham, Ellingsen, Bates and Frankel, 2014), Friendship Qualities Scale (FQS; Bukowski, Hoza, and Boivin, 1994), Gilliam Autism Rating Scale—Third Edition (GARS-3; Gilliam 2014), Korean Version of the Child Behavior Checklist (K-CBCL; Oh, Lee, Hong, & Ha, 1997), Korean Version of the Social Skills Rating System (K-SSRS; Graham & Elliot, 1990; Moon, 2003), Korean version of the Vineland Adaptive Behavior Scale (EHWA-VABS; Kim and Lee, 1992), Quality of Play Questionnaire (QPQ; Frankel & Mintz, 2008), Quality of Socialization Questionnaire (QSQ; Adapted from Frankel, Myatt, Sugar, Whitham, Gorospe and Laugeson, 2010), Quality of Socialization Questionnaire for Young Adults (QSQ-YA; Gantman, Kapp, Orenski, Laugeson 2012), Loneliness Scale (LS; Asher, Hymel and Renshaw, 1984), Liebowitz Social Anxiety Scale—Self-Report (LSAS-SR; Fresco, Coles, Heimberg, Liebowitz, Hami, Stein, and Goetz 2001), A Developmental Neuropsychological Assessment – Second Edition (NEPSY-II; Korkman & Kemp 2007), Positive and Negative Affect Schedule for Children (PANAS-C; Watson, Clark, and Tellegen, 1998), Piers-Harris Self-Concept Scale (PHS; Piers 1984), Piers–Harris Self-Concept Scale-Second Edition. (PHS-2; Piers, Harris, Herzberg, 2002), Pupil Evaluation Inventory (PEI; Pekarik, Prinz, Liebert, Weintraub, Neil, 1976), Social Anxiety Scale (SAS; La Greca and Lopez 1998), Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003), Social and Emotional Loneliness Scale for Adults (SELSA; DiTommaso and Spinner 1993), Social Interaction Anxiety Scale (SIAS; Mattick and Clarke, 1998), Social Phobia Inventory (SPIN; Connor, Davidson, Churchill, Sherwood, Weisler, Foa, 2000)Social Responsiveness Scale (SRS; Constantino, 2005), Social Skills Inventory (SSI; Riggio 1989), Social Skills Improvement System-Rating Scales (SSIS-RS) (Gresham & Elliot, 2008), Social Skills Rating System (SSRS; Gresham & Elliott, 1990), State and Trait

Anxiety Inventory (Korean version STAI-T and STAI-S; Lee, Hahn, & Chon, 1996), State and Trait Anxiety Inventory for Children (Korean version of STAIC-T and STAIC-S; Cho and Choi, 1989), Test of Adolescent Social Skills Knowledge (TASSK; Laugeson and Frankel 2006), Test of Adolescent Social Skills Knowledge-Revised (TASSK-R; Laugeson and Frankel, unpublished), Test of Young Adult Social Skills Knowledge (TYASSK; Adapted from Laugeson, Frankel, Mogil and Dillon, 2009).

Studies of PEERS have demonstrated improved social outcomes, operationalized as increased frequency of get-togethers and the quality of friendships experienced by its teen participants measured by the QPQ-P and the QPQ-A and FQS (Laugeson et al., 2009). As noted above, deficits in SPC have been shown to be one, but not the only, factor contributing to the challenges adolescents with ASD face in making and maintaining friendships (other factors include, but are not limited to, social economic status, cognition, social skills knowledge, comorbid conditions; Liptak et al., 2011). The PEERS program explicitly teaches elements of SPC, which are implicitly understood by neuro-typical adolescents. These include: discourse management (sharing the conversation, finding common interests, personal details not to share, asking too many one-sided questions, being overly repetitive, listening, avoiding the use of criticism), nonverbal communication (body boundaries, eye contact), how and when to use humour, and entering and exiting a conversation. It is important to note that PEERS also teaches many other concepts peripherally related to SPC: what makes a good friend, how to find good friends, which social group adolescents identify with, electronic communication etiquette, sportsmanship and conflict resolution. Thus, there are several potential areas of knowledge and skill that may change following PEERS. The focus of the current study is on change in SPC skills.

Current Limitations in PEERS Research

Despite all the positive findings in the PEERS literature there is a lack of observation-based measures used to substantiate the findings. The gains reported from participation in the PEERS program are primarily based on parent, teacher and self-report. PEERS is not the only social skills program with this short-coming. In a review of group based social skills programs for adolescents with high functioning ASD (including PEERS), McMahon, Lerner & Britton

(2013) discussed that most social skills training programs rely on parent- and self-questionnaires to measure social skills. They further discussed the need for social skills training programs to use observational measures to properly assess social skill outcomes. Their recommendation to assess through observations was to use multiple coders blind to the status of the intervention, allowing for the establishment of inter-rater reliability to control for potential bias. In our review of the PEERS literature, 17 studies looked at outcomes achieved by adolescents and young adults with ASD after they participated in the PEERS program (See Table 2). Of those 17 studies, two contained direct observation of targeted behaviour, and only one specifically focused on SPC. In a randomized control trial, Yoo et al. (2014) reported significant improvement in the language and social communication and the reciprocal social interaction domains measured by the Autism Diagnostic Observation Schedule (ADOS) following PEERS within the treatment group, and between the treatment and control group. Only one study directly observed aspects of SPC pre- and post-PEERS (Dolan et al., 2016). Using the Contextual Assessment of Social Skills (CASS; Ratto et al. 2010), they evaluated vocal expressiveness, gestures, positive affect, kinesic arousal, social anxiety, overall interest/involvement, and overall quality of rapport demonstrated by adolescents with ASD during 10-minute interactions with a teen confederate before and after completion of PEERS. Dolan et al. (2016) found a trend of improvement for overall quality of rapport and a significant increase in vocal expressiveness following participation in PEERS. This study was the first to use an in vivo social interaction in order to measure improvement in social skills after participation in the PEERS program. There are a number or aspects of social-pragmatic communication that the CASS does not measure, such as conversational repair, topic maintenance and conversation sharing. Dolan et al. (2016) serves as a template to incorporate observational measures for the assessment of change in social skills. In fact, they stated that an

"exciting avenue of future research may be to create an in vivo observational measure that assesses specific skills taught during the program" (Dolan et al., 2016, pp. 8). With the exception of Dolan et al., (2016), we were unable to find any research that examined observed and specific changes in communication after taking part in PEERS, which reinforced the need for the current research.

Research Objective

The purpose of this pilot study was to provide preliminary data addressing the identified gaps in research related to outcomes following participation in the PEERS program: (1) evaluation of changes in adolescents' SPC, and (2) evaluation of outcomes based on direct observation of targeted behaviours (See Table 2). We hypothesized that adolescents who participated in the PEERS program would demonstrate improved SPC skills following participation across multiple measures.

Method

Participants

Seven participants in a single PEERS group at the Centre for Autism Services Alberta (Edmonton, Alberta) were eligible to participate in the present study. Admission into the PEERS group required teens to meet criteria defined by the PEERS program: (1) a diagnosis of ASD, (2) 13-17 years old, (3) IQ of 70 or higher, (4) willingness to participate in PEERS, (5) no significant disruptive behaviours, (6) fluency in English, and (7) consistent caregiver to participate in the parent portion of the program.

Recruitment into the research study occurred after teens had been accepted into PEERS and families were told explicitly that participation in this research would in no way influence the services they would receive. Upon acceptance to the program, parents were given a recruitment

flyer summarizing the aim of the prospective research and the principal researcher's contact information. Parents were asked to contact the principal researcher if they were interested in participating. During the first meeting of the program (week one) the principal researcher attended the first part of the lesson where he introduced himself, made a brief presentation about the aim of the research, and answered parent questions.

Three male teens and their parents consented to participate. Language testing with the Clinical Evaluation of Language Fundamentals – 5th edition (CELF-5; Wiig, Semel & Secord, 2013) was completed during week one of the PEERS program and provided further documentation of the participants' language ability. An earlier version of the CELF - the CELF-4 - has been used in past pragmatic language research in adolescents with ASD as a baseline for language ability and to provide a description of participants' language profile (Volden et al., 2009; Volden & Phillips, 2010; Adams et al., 2012). The CELF-5 was rigorously developed, with documented validity, reliability and diagnostic accuracy, and is demonstrated to be a good measure of language abilities (CELF-5; Wiig, Semel & Secord, 2013). Standard scores for the Core, Receptive and Expressive Language Indices have a mean of 100 and a standard deviation of 15. Table 3 provides a summary of the CELF-5 with a classification based on standard scores and standard deviations with respect to the mean (See Table 3).

Table 3
Guidelines for Describing the Severity of Language Disorder (CELF-5; Wiig, Semel & Secord, 2013)

Core Language Score, Receptive Language Index, or Expressive Language Index	Classification	Relationship to Mean
115 and above	Above average	+1 SD and above
86 to 114	Average	Within + or -1 SD
78 to 85	Borderline/Marginal/At risk	Within -1 to -1.5 SD
71 to 77	Low range/Moderate	Within -1.5 to -2 SD
70 and below	Very low rage/Severe	-2 SD and below

As Table 3 shows, Participant 1's scores for Core Language and Receptive Language Index fall in the Borderline/Marginal/At risk range (78-85) and his Expressive Language Index score falls in the Average range (86-114). Participant 2's Core Language Score falls in the Average range (86-114) and his Receptive Language Index and Expressive Language Index scores fall in the upper limit of the Borderline/Marginal/At risk range (78-85). Participant 3's Core Language and Expressive Language Index scores fall in the Above average range (115 and above) and his Receptive Language Index score falls in the upper limit of the Average range (86-114). See Table 4 for a summary of participants CELF-5 scores.

Table 4
Descriptive Summary of PEERS Participants

	Participant 1	Participant 2	Participant 3
Age	14;4	17;3	13;5
CELF-5			
Core Language Score (CLS)	79	91	125
Receptive Language Index (RLI)	80	84	114
Expressive Language Index (ELI)	93	85	120

Procedure and Measures

Treatment. The PEERS intervention was administered at the Centre for Autism Services Alberta in Edmonton, Alberta. This study was not affiliated with the delivery of the program. The PEERS intervention lasted 14 weeks, with meetings once per week for approximately 90 minutes. Each week, a new lesson was taught to the adolescents by PEERS trained teen-group facilitators following the lesson overview presented in the introduction. Each lesson was structured to check/discuss home practice, review the concepts taught in the previous PEERS session and teach teens a new concept. While the teen group was meeting, parents concurrently participated in a parent group lead by a trained parent-group facilitator. A similar formula was used, but focused on parental guidance. The parent-group facilitator presented the information that their children were learning and coached parents through any difficulties that their teens' were experiencing. A homework check was administered by both the parent and teen-group facilitators. The researchers did not request to access the homework data because it would have alerted facilitators to which teens were participating in the research.

Administration of measures. Pre-intervention measures were administered during week 1 of PEERS and post-intervention measures were administered one to three weeks after the program had ended. Administration occurred in each participant's home. The parent interview for Participant 3 took place in-person and during the same administration time as the other post measures. Due to scheduling logistics, the parent interview for Participants 1 and 2 took place one week after the other post measures had already been administered. For convenience, these interviews were conducted by telephone rather than in person. All post measures were completed within three weeks of completion of PEERS. Table 5 summarizes the timeline for all pre- and post-intervention measures used in the study.

Outcome Measures

Social-pragmatic communication is widely agreed to be difficult to assess due to a lack of clear norms for the development of SPC and the naturalistic context in which it is used. Furthermore, the structured or restrictive nature of standardized tests (i.e., removal of naturalistic context) does not account for the increased cognitive demands that the environment requires for SPC (Adams, 2002). This naturalistic context adds complexity to both the receptive and expressive use of language and communication, which may account for the discrepancy between formal language and SPC (i.e., why formal language can remain intact while SPC is impaired). Additionally, this observation can account for the reason why individuals with ASD often perform very differently on standardized tests of SPC or social skills knowledge compared to observations of their real-life functioning; that is, individuals with ASD can perform within the norms on standardized tests despite having SPC impairment (Volden, Coolican, Garon & Bryson, 2009). This highlights the benefits of using observation measures, rather than standardized tests, in the assessment of SPC. This study used the Yale in vivo Pragmatic Protocol (Y*i*PP) and the Pragmatic Rating Scale (PRS) to collect data on direct observation of targeted behaviours.

Table 5

Overview of Measure Administration to Pre and/or Post Conditions of PEERS

Pre-intervention	Post-intervention
CELF-5	
CCC-2	CCC-2
Conversational interview (*YiPP* and PRS)	Conversational interview (*YiPP* and PRS)
	Parent interview

The Yale in vivo Pragmatic Protocol (YiPP) (Simmons, Paul and Volkmar, 2014).

The Y*i*PP is a semi-structured conversational interview designed to assess conversational ability. It was administered during week 1 of PEERS and within three weeks of completion of program. Interviews were video recorded with a Samsung Galaxy Tablet and downloaded on a computer for future viewing. The Y*i*PP consists of a 10-minute conversation with 19 probes adapted from Creaghead's (1984) Peanut Butter Protocol. The Y*i*PP is administered like a semi-structured conversation. An examiner follows a script and provides the examinee 19 probes to elicit a response within four domains (discourse management, communicative functions, conversational repair and presupposition; see Table 6). If the response to a probe is absent, inappropriate or mildly inappropriate/unusual a designated cue is provided by the examiner. Scoring of the Y*i*PP reflects the appropriateness of the child's response and, if necessary, the level of cueing that was required to elicit a response.

The Y*i*PP was chosen as a conversational structure and coding schema for three reasons. First, it provides a systematized framework for assessing social-pragmatic communication. With this protocol, procedural replication between participants is possible which allows for the comparison of results within and between subjects. While still artificial, the Y*i*PP strikes a balance between natural conversation and standardization. Second, Simmons et al., (2014) developed the Y*i*PP with participants that met similar criteria to the PEERS intake criteria (diagnosed with ASD and an IQ of 70 or higher). Third, the Y*i*PP has been shown to provide a sensitive assessment of SPC. Simmons et al. (2014) successfully used the Y*i*PP to categorize their participants into ASD and typically developing groups. Table 6 summarizes the type of verbal cue administered in each of the communication domains of the Y*i*PP.

Table 6
Social-Pragmatic Communication Domains from Simmons et al., 2014

Discourse Management
Initiation
Request Information
Background Information
Termination
Response to cues to change speakers
Topic maintenance
Communicative Functions
Muffled speech
Decreased volume
Unfamiliar acronym
Ambiguous statement
Presupposition
Comment contingently
Ambiguous article
Too little verbal information
Ambiguous pronoun
Too little written information
Conversation Repair

The Pragmatic Rating Scale (PRS) (Landa et al., 1992).

The PRS codes 30 pragmatic behaviours on a 3-point scale (0 = normal, 1 = moderately inappropriate, 3 = absent or highly inappropriate). The PRS was chosen because it evaluates some behaviors that are not assessed on the Y*i*PP and it can be scored to reflect a global impression of interactions in contrast to the Y*i*PP which focuses on specific responses to specific presses. The PRS was originally developed to evaluate pragmatic language in parents of children with ASD (Landa, Piven, Wzorek, Gayle, Chase & Folstein, 1992; Paul, Orlovski, Marcinko & Volkmar, 2009) adapted this schema to assess the conversation behaviours of teenagers with ASD. The PRS was used to code the conversation between an examiner and participant during the administration of the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000).

Paul et al. observed significant differences between the teens with ASD and the neuro-typical control group. While Paul et al. used the PRS to code the conversation during the administration of the ADOS, we used the PRS to code behaviours that occurred during the Y*i*PP conversational interview. Table 7 lists all the communicative behaviours assessed on the PRS, organized into their respective categories.

Table 7

The Pragmatic Rating Scale (PRS) from Landa et al., 1992

Pragmatic behaviors

1. Inappropriate/absent greeting
2. Strikingly candid
3. Overly direct or blunt
4. Inappropriately formal
5. Inappropriately informal
6. Overly talkative
7. Irrelevant/inappropriate detail
8. Out of sync content/unannounced topic shifts
9. Confusing accounts
10. Topic preoccupation/perseveration
11. Unresponsive to examiner's cues
12. Little reciprocal to-and-fro exchange
13. Terse
14. Odd humor
15. Insufficient background information
16. Failure to reference pronouns, terminology
17. Inadequate clarification
18. Vague

Speech/prosody behavior

19. Scripted, stereotyped sentences or discourse
20. Awkward expression of ideas
21. Indistinct speech/mispronunciations
22. Rate of speech is too rapid
23. Intonation is unusual
24. Volume is inappropriate (note too loud/soft)
25. Unusual timing of responses, reformulations
26. Unusual rhythm of speech such as stuttering

Paralinguistic behaviors

27. Physical distance
28. Gestures
29. Facial expressions
30. Gaze

Parent measures.

Parents completed a standardized questionnaire assessing SPC pre- and post-PEERS, and participated in a semi-structured interview to provide a qualitative description of communication following PEERS. The parent interview was audio recorded for later analysis.

The Children's Communication Checklist – Second Edition (CCC-2): The CCC-2 (Bishop, 2003). The CCC-2 is a parent questionnaire consisting of 70 questions, across 10 subscales (seven questions per subscale). Those subscales include: (A) Speech, (B) Syntax, (C) Semantics, (D) Coherence, (E) Inappropriate Initiation, (F) Stereotyped Language, (G) Use of Context, (H) Nonverbal Communications, (I) Social Relations and (J) Interests. The CCC-2 was designed to:

> … identify children with pragmatic language impairment [,] identify children who may have a speech and language impairment, and whose receptive and expressive language skills should be further evaluated with a comprehensive speech and language assessment [and] assist in identifying children who may require further assessment for an autistic spectrum disorder" (Bishop, 2003, pp. 1).

The CCC-2 was selected as a standardized measure of SPC for the following three reasons. (1) It has been in other SPC intervention studies, such as Adams et al. (2012)'s randomized control trial of the Social Communication Intervention Project. (2) It is able to focus on pragmatic impairment that is characteristic of ASD. In a comparison of the CCC-2 and the *Test of Pragmatic Language* (*TOPL*), 13 out of 16 children with ASD were correctly identified as having pragmatic language impairment with the CCC-2 in comparison to only 9 out of 16 with the *TOPL* (Volden & Phillips 2010). (3) It is more comprehensive than similar measures. In an evaluation of 24 pragmatic language competency instruments, Russle and Grizzle (2008) ranked

the CCC-2 highest due to it probing 15/17 domains of pragmatic language (the most in comparison to other tests). Additionally, the CCC-2 was found to be one of four instruments with the best content validity, able to provide a profile of strengths and weaknesses across its subscales, and one of two tests with norms (Russle & Grizzle, 2008).

Semi-structured parent interview. A semi-structured interview was conducted in order to collect a qualitative description of participants' SPC after taking part in PEERS. One parent of each participant individually participated in an interview 1-3 weeks after the program had ended. A standard set of questions was used. Questions were first asked in a broad manner (e.g., "What changes in your teen's communication have you noticed?") and then more specifically focusing on aspects of communication taught in PEERS (e.g., Do you find any difference in the way your teen initiates or ends conversations?"). This was to record the overall impression that parents had formed about their child's communication and to avoid leading questions and biases. Follow-up questions differed between participants due to the varying nature of the responses that were given (see Table 8). These interviews lasted 17-25 minutes.

Table 8
Semi-Structured Parent Interview Questions

1.	Tell me about your teen's experience in PEERS?
2.	What changes do you noticed in the way your teen communicates with you?
3.	What do you notice in the way that your teen communicates with other teens
4.	Do you find any difference in the way that you teen initiates or ends conversations?
5.	Do you find any difference in the way that they speak to teens around their age?
6.	Do find any difference in the way your teen exchanges information?
7.	Do you find any difference in the way your teen shares the conversation?
8.	Do they listen to others talk and make comments or ask questions that further the conversation?
9.	Do you find your teen's body language any different after taking part in PEERS?
10	Does your teen more readily maintain eye contact and maintain the appropriate distance from their conversation partner?
11.	Has your teen changed how they feel or feel about others after taking peers?
12.	Has your child changed or made any comments about how they view communicating?
13.	How does your teen use the concepts taught in PEERS?
14.	What other changes have you noticed in your teen since they participated in PEERS? How about in terms of get-togethers, or extra curricular?
15.	Do you think the skills that your teen learned in PEERS have helped him to have stronger relationships with peers or siblings (if relevant)? How so?
16.	On a scale of one to ten what would you rate your teen's communication before peers. How about after?
17.	Is there anything else about the program or process, that I should no or that you would like to share?
18.	Is there anything that you'd like to change?

Coding

Y*i*PP. The Y*i*PP was scored for Initial Response, Cue Given, Cued Response and Best Response. Initial Response demonstrated the degree to which participants' responses to the Y*i*PP script was appropriate or inappropriate. Cue Given indicated whether specific verbal cues were given to necessitate a response. Cued Response demonstrated the degree to which participants' responses after a verbal cue had been given was appropriate or inappropriate. Best Response gave participants credit for their most appropriate response to the Y*i*PP script. If their Cued

Response was more appropriate than their Initial Response score, participants were awarded the higher score.

In the original Y*i*PP coding, Initial Response ranged from 0 to 2 (where 0 = correct/appropriate response, 1 = mildly inappropriate, unusual response, and 2 = incorrect/no response). In this study, Initial Response also ranged from 0 to 2, but differed from the original scale by an inverted score allocation (0 =incorrect/no response; 1 = mildly inappropriate, unusual response; 2 = correct/appropriate response and; n/o = no opportunity given). Initial Response was changed because raters felt that they would be more reliably able to score videos when 0 corresponding to an incorrect response.

The initial Y*i*PP scoring protocol for Cue Given involved seven potential levels (0 = no response to any prompt, 1 = specific verbal cue, 2 = nonspecific verbal cue/repetition, 3 = gesture/facial expression, 4 = expectant waiting, 5 = mildly inappropriate response, and 6 = appropriate spontaneous response). Our video samples did not enable scoring of Cue Given at this level (e.g., we could not score for gesture/facial expression because the interviewer was not in the video), so a modified version of the Y*i*PP coding rubric was used (1 = cue was given, 2 = no cue needed as spontaneous response was appropriate, and N/O = no opportunity given). Also differing from the original scoring protocol, a two additional score types were added, Cued Response and Best Response. Cued Response used the same scale as Initial Response but pertained to a response after a cue was given. Initial Response and Cued Response were later compared and participants' highest score was kept for Best Response scores. Introduction of Best Response ensured that participants were given credit for potential improved performance once a verbal cue was given.

PRS. A portion of each Y*i*PP video recording that best reflected natural conversation was selected. These videos ranged from 3 minutes and 41 seconds to 5 minutes and 21 seconds (*M* = 4-minutes and 33 seconds). They were primarily the first few minutes of the video where the participants responded to the question "what would you like to talk about?".

The PRS as developed by the authors was coded on a 3-point scale (0 = normal, 1 = moderately inappropriate, 3 = absent or highly inappropriate); however, a 5-point scale was used in this study (0 = never, 1 = occurs almost never, 2 = occurs sometimes, 3 = occurs almost always, 4 = always) to provide a more accurate rating of behaviours. Two additional ratings (CNR = could not rate and N/O = no opportunity given) were introduced to the scale in the event that a rater was unable to come to a decision or there was no possibility to see a behavior. We merged items 25 and 26 from the PRS in our analysis because the items were felt to be closely related and the raters had difficulty distinguishing between them.

Inter-Rater Reliability

After the pre and post measures were administered, all videos were compiled and aliases were given to each video. Any audio that was suspected to alert raters to the pre or post condition of the video was muted. See Appendix A for PRS and Y*i*PP rating forms.

All independent raters were trained to code using the PRS and Y*i*PP schemas before coding participant videos. A pilot video of the administration of the Y*i*PP was used for training. The video was a recording of a 15-year old boy with ASD who had previously taken part in PEERS. All items on the PRS were independently coded by each rater and operationalized by the research team during this process. During the training phase, if a researcher was unsure of an item/definition on the Y*i*PP or PRS, the operational definition was refined until a consensus in coding was reached.

The Y*i*PP was coded by two independent raters blind to the pre and post nature of the videos. Both researchers coded all six videos (pre and post for Participant 1, 2 and 3). There was no limit to the number of times that the researchers were allowed to review the videos. Ratings were compiled and inter-rater agreement was calculated for each video (*n*=6) for Initial Response scores, Cue Given, Cued Response scores, and overall agreement. Item-by-item agreement across the six videos was also calculated (i.e., IRR for each of the 19 items). Based on the initial two raters, overall agreement ranged from 74% to 100% for the score types within each video (Initial Response, Cue Given, Cued Response), 79% to 93% for overall agreement across all three score types for each video, and 67% to 100% for individual items compiled across the six videos (M = 86.7%). In the event of disagreement on an item, a third, trained blind rater independently scored each item for which agreement was not achieved. If the score matched one of the initial rater's scores, then that score was used as the consensus score. Incorporating the third rater, overall agreement for the score types within each video (Initial Response, Cue Given, Cued Response) improved to 95% to 100% within each score type, 98% to 100% for overall agreement across all three score types for each video, and 94% to 100% for individual items compiled across six videos (M = 99.3).

The PRS was coded by three raters: the principal investigator, who was not blind to pre-post condition, and 2 independent raters blind to the pre and post nature of the videos. All six videos were coded by each of the three raters. Raters were allowed to view videos as many times as necessary. Ratings were later compiled and inter-rater agreement was calculated for each video (n=6) for the two raters who were blind to pre-post condition. Inter-rater reliability ranged from 43% to 71% for videos and 0% to 100% by item (M = 54%). In the event of disagreement on an item, the principal investigator independently scored each item for which agreement was

not achieved. If the score matched one of the initial rater's scores, then that score was used as the consensus score. Incorporating the principal investigator's ratings, overall agreement for each video improved to 79% to 96% for each participant, and 33% to 100% for individual items compiled across six videos (M = 90%). Table 9 summarizes IRR based on videos and items.

Table 9
Summary and Comparison of Inter-Rater Reliability on the YiPP and PRS with the Addition of a Third Rater

		Participant 1		Participant 2		Participant 3	
		Pre	Post	Pre	Post	Pre	Post
Y*i*PP	Two raters	82%	91%	93%	86%	91%	81%
	Three raters	100%	100%	98%	100%	98%	100%
PRS	Two raters	46%	43%	36%	50%	61%	71%
	Three raters	93%	82%	79%	86%	96%	93%

Semi-Structured Parent Interview. Parent interviews took place in person or over the phone. All three interviews were audio recorded for future analysis. All recordings were transcribed by the principal investigator. Interviews were listened to as many times as required to accurately transcribe the content of the interview.

Analysis

PRS and YiPP. Values for the PRS and YiPP were coded independently by three raters. The consensus value (two out of three raters) was used to determine the code for an item. If no agreement was found, the values of all raters were checked for a trend (i.e., did all ratings consistently increase, decreases or stay the same from pre to post). Any change between pre and post was deemed to be of potential clinical interest. On the Y*i*PP, two items, for both Initial and Best Response, scores were not available for any participants, either because the item hadn't been administered or because there were unresolved scoring differences.

CCC-2. Standard deviations for the subscales on the CCC-2 range from 2.5 to 3.5 (Bishop, 2003). Given that standard scores are expressed in whole numbers, a difference of 3

scaled scores was selected to represent a potentially meaningful change between pre and post measures. A change score of 3 was argued to be a balance between an overly liberal value of 2 and an overly stringent value of 4 (i.e., balance the risk of Type 1 vs. Type 2 error).

Thematic Analysis

The parent interviews were analyzed according to the six stages for thematic analysis proposed by Braun and Clark (2006). These six phases included: (1) familiarization of the data, (2) generating codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) reporting findings. This analysis was an iterative process, initially done independently by the lead author, with multiple meetings to discuss emerging findings with the supervisors until everyone agreed that the summary of data accurately and comprehensively captured the data. Thematic analysis was conducted before analysis of quantitative data.

Results

The data are presented for each participant followed by a comparison of data across participants.

Participant 1

CCC-2: Scoring of the CCC-2 contains a check on the consistency or reliability of parent responses. Twenty items are reverse-scores and the values obtained for the original- and reverse-scored items are compared to a criterion. The information provided for Participant 1 did not meet the criterion established for this check. As a result, no data from the CCC-2 are presented for this participant.

Y*i*PP: Table 10 presents a summary of the Y*i*PP results for Participant 1. Percentages indicate the percentage of the maximum total possible score based on the items that contributed to that score (i.e., percentages relate to the points that could have been awarded for items grouped within a domain; a higher percentage is indicative of a more socially appropriate

response). Scores were calculated for the Initial Response and Best Response. If a score of two (indicating an appropriate response) was obtained on the initial trial, that score was considered best score. If a cue was given, then that was considered best score if higher than the initial score (there were no instances where a cue resulted in a lower score). The number of items that contributed to the initial response scores that required a cue is also provided. This number also indicated how many items contributed to that domain. Items that could not be scored or for which we did not reach consensus both pre- and post-PEERS were excluded.

Table 10
Participant 1 – Summary of Scores on the YiPP Pre- and Post PEERS

		Pre			Post		
		Initial Response	Best Response	Cue Given	Initial Response	Best Response	Cue Given
Participant 1							
Discourse Management	(DM)	13%	63%	3/4	88%	88%	1/4
Communicative Functions	(CF)	33%	50%	2/3	0%	33%	3/3
Presupposition	(P)	67%	67%	0/3	33%	67%	1/3
Request Clarification	(CR)	25%	50%	4/4	63%	75%	1/4
Total		32%	57%	64%	50%	68%	43%

For both Initial Response and Best Response, Participant 1 showed improved scores following PEERS in the domains of Discourse Management (DM) and Request Clarification (CR) and decreased performance in Communicative Functions (CF). Performance also decreased for Presupposition (P) for Initial Response, whereas no change was observed for Presupposition for Best Response. Participant 1's Total Score showed an increase performance for both Initial Response and Best Response from pre to post. Participant 1 required less cueing from the pre- to post-measurement in the domains of Discourse Management and Requests Clarification and more cueing pre to-post in the communicative domains of Communicative Functions and Presupposition. Overall, Participant 1 required less cuing post-PEERS.

PRS: Improved scores (reflected by lower post scores/negative change scores) were concentrated in two categories: Paralinguistic Behaviours (3 of 4 items), and Pragmatic Behaviours, and more specifically in two subcategories within Pragmatic Behaviour: Exchange of Information (4 of 6 items) and Conversational Content (2 of 6 items). A score reflecting poorer performance at post-test was only observed for one item (Odd humour). For seven items where no change was observed pre-to-post-PEERS, the participant's scores were at ceiling (score of 0) at both measurement points. Overall, change was most apparent in the subcategory of exchange of information. Four out of the six items within this subcategory showed improvement and the other two either had scores at ceiling, or there was an unresolved scoring difference between raters. Scoring differences for five items were unresolved (See Table 11).

Table 11
Participant 1 – Summary of Change on the PRS Pre- and Post-PEERS

		Pre	Post	Change
Paralinguistic Behaviours [a]				
1	Posture/physical position	2	2	0
2	Gestures	1	0	-1
3	Facial Expression	3	2	-1
4	Gaze	3	2	-1
Speech/Prosody Behaviours				
5	Scripted, stereotyped sentences or discourse	0	UR	UR
6	Awkward expression of ideas	3	3	0
7	Indistinct speech/mispronunciations	1	UR	UR
8	Rate of speech is too rapid	0	0	0
9	Intonation is unusual	2	1	-1
10	Volume is inappropriate (note: too loud/soft)	0	0	0
11	Unusual timing of responses, reformulations	3	UR	UR
12	Unusual rhythm of speech such as stuttering	3	3	0
Pragmatic Behaviours				
Tone				
13	Strikingly candid	0	0	0
14	Overly direct or blunt	0	0	0
15	Inappropriately formal	0	0	0
16	Inappropriately informal	0	0	0
Exchange of Information				
17	Overly talkative	2	1	-1
18	Out of sync content/unannounced topic shifts	UR	UR	UR
19	Topic preoccupation/perseveration	2	0	-2
20	Unresponsive to examiner's cues	2	0	-2
21	Little reciprocal to-and-fro exchange	2	1	-1
22	Terse	0	0	0
Conversational Content				
23	Irrelevant/inappropriate detail	2	1	-1
24	Confusing accounts	UR	UR	UR
25/26	Insufficient background information/Failure to reference pronouns, terminology	1	1	0
27	Inadequate clarification	1	1	0
28	Vague	1	0	-1
29	Odd humour	0	1	1
Total				-11

Note. (blue shading) and UR = scores were unresolved; (green shading) = improvement; (red shading) = decreased performance; and (yellow shading) = improvement.
[a]Paralinguistic Behaviours were reverse scored to remain consistent with scoring on the other categories (i.e., negative scores indicate improvement and positive score indicate decreased performance).

Parent semi-structured interview

The Parent of Participant 1 (Parent 1) described his teen's experience in PEERS as positive. Paralinguistic behaviours such as body language and eye contact were reported to improve, as well as the way Participant 1 exchanged information (See Table 12). Of particular note, this parent made reference to his son's increased interest on others, improved sensitivity to others' emotions, as well as being better able to read emotions and act/make appropriate comments accordingly. For example, Parent 1 stated:

> He seems to be more sensitive and, and knows now if somebody's not having a good day and their not doing good and he's very sympathetic. And, and then he, then he tries to, tries to either uh, encourage, or, or he keeps his distance like he, he just kind of lets that person just veg or relax or, or whatever, get over whatever their, it is that's bothering them.

When asked to rate Participant 1's communication before and after PEERS on a scale of 1 to 10, he rated his teen's communication as 3-4 before the program and a 6-7 after the program.

Table 12
Parent 1 – Summary of Responses in Semi-Structured Parent Interview Post-PEERS

	Questions	Responses
1.	Tell me about your teen's experience in PEERS?	Positive/enjoy
2.	What changes do you notice in the way your teen communicates with you (parent)?	Reads facial expression
3.	What changes do you notice in the way that your teen communicate with other teens?	Improvement
4.	Do you find any difference in the way your teen initiates or ends conversations?	Improved/Unsure
5.	Do you find any difference in the way your teen exchanges information?	Improvement
6.	Do you find any differences in how he shares the conversations with others?	Improvement
7.	Do they listen to others talk and make comments or ask questions that further the conversation?	Improvement + topic maintenance
8.	Do you find your teen's body language any different after taking part in PEERS?	Improvement
9.	Does your teen more readily maintain eye contact and maintain the appropriate distance from their conversation partner?	Improvement
10.	Has your teen changed how they feel or feel about others after taking peers?	More sensitive to others emotions
11.	Has your child changed or made any comments about how they view communicating?	No
12.	How does your teen use the concepts taught in PEERS?	Yes
13.	What other changes have you noticed in your teen since they participated in PEERS? How about in terms of get-togethers, or extra curricular?	Will actively pursue
14	Do you think the skills that your teen learned in PEERS have helped him to have stronger relationships with peers or siblings (if relevant)? How so?	Yes
15.	On a scale of one to ten what would you rate your teen's communication before peers? How about after?	3-4 →6-7

Overall, Parent 1 reported improvement in all areas he was able to observe. Sensitivity and increased understanding of others appeared to be at the centre of improvements in paralinguistic behaviour and pragmatic behaviours such as exchange of information (e.g., topic maintenance, sharing the conversation, making/asking appropriate comments/questions, etc.).

Participant 2

CCC-2: Using the established criterion of +/- 3 scale points, change was observed on two subscales: Nonverbal Communication (Scale I, +4 scaled score points) and Interests (+3 scaled score points). Although the Initiation subscale (E) did not meet our criteria for meaningful change, a difference of +2 in the scaled score was observed. The Global Communication Composite (GCC) is the sum of the scaled scores of scales (A) to (I) and excludes subscales (J) (Social Relations) and (K) (interests), the two scales designed to represent autistic behaviours. An improvement in GCC standard score of +7 was observed (GCC standard score pre = 76 with a 90% confidence interval of 72-82, and GCC standard score post = 83 with a 90% confidence interval of 79-89). The Social Interaction Difference Index (SIDI) identifies language impairment and further suggests the potential of specific language impairment, and autism spectrum disorder (ASD). A value of -11 or less indicates the possibility of ASD, 11 or greater specific language impairment, and between -10 and 10 corresponds with typical scores. Pre-PEERS, Participant 2 obtained a SIDI score of -27 and post-PEERS he obtained a score of -20. His profile for both pre- and post-PEERS indicated the possibility of ASD; however, the participant's SIDI score became less negative (from -27 to -20) which indicated a potential decrease in the discrepancy between challenges with pragmatic language versus other aspects of language (See Table 13).

Table 13
Participant 2 – Summary of Change on the CCC-2 Pre- and Post-PEERS

Subscale		Pre	Post	Change
(A)	Speech	12	12	0
(B)	Syntax	9	9	0
(C)	Semantics	9	10	1
(D)	Coherence	3	4	1
(E)	Initiation	1	3	2[a]
(F)	Scripted Language	1	1	0
(G)	Context	8	7	-1
(H)	Nonverbal Communication	3	7	4
(I)	Social Relations	1	1	0
(J)	Interests	1	4	3
GCC Standard Score		76	83	7
SIDI		-27	-20	7
GCC Confidence Interval		72 - 82	79 - 89	---

Note. ■ (green shading) = potential meaningful improvement
[a]Initiation did not meet the criteria set for meaningful change; however, the improvement of +2 pre-to-post might be an indicator of potential positive change.

Y*i*PP: On Initial Response Participant 2 showed decreased scores overall with no change in the domains of Discourse Management (DM) and Communicative Functions (CF). Furthermore, his performance was observed to decrease in the domains of Presupposition (P) and Requests Clarification (CR). However, for Best Response, Participant 2 showed improved scores in the domains of Discourse Management (DM) and Communicative Functions (CF) with no change observed in Presupposition (P) and decreased performance in Requests Clarification (CR). Total Scores indicate that his performance decreased for Initial Response, but increased for Best Response pre-to-post-PEERS. No trend was observed for the percentage of cues given. The percentage of cues increased from pre-to-post-PEERS in the communicative domains Discourse Management (DM) and Presupposition (P), and overall. Table 14 summarizes Participant 2's Y*i*PP scores.

Table 14
Participant 2 – Summary of Scores on the YiPP Pre- and Post-PEERS

		Pre			Post		
		Initial Response	Best Response	Cue Given	Initial Response	Best Response	Cue Given
Participant 2							
Discourse Management	(DM)	80%	80%	1/5	80%	100%	2/5
Communicative Functions	(CF)	50%	50%	1/2	50%	100%	1/2
Presupposition	(P)	90%	100%	1/5	60%	100%	2/5
Request Clarification	(CR)	75%	100%	2/4	63%	88%	2/4
Total		78%	88%	31%	66%	97%	44%

PRS: Participant 2 showed improved scores in the category Pragmatic Behaviours, and more specifically within the subcategories Tone (1of 4 items), Exchange of Information of Information (2 of 6 items) and conversational Content (1 of 6 items). On 11 of 14 items where no change was observed, Participant 2 had reached ceiling at both pre- and post-PEERS measurement. Scoring differences on eight items were not resolved (See Table 15). Notably, in addition to the two of the six items in the Exchange of Information subcategory that showed improvement, the remaining four items showed no change, of which three had reached ceiling.

Table 15
Participant 2 – Summary of Change on the PRS Pre- and Post-PEERS

		Pre	Post	Change
Paralinguistic Behaviours[a]				
1	Posture/physical position	0	0	0
2	Gestures	UR	3	UR
3	Facial Expression	2	UR	UR
4	Gaze	1	CNR	UR
Speech/Prosody Behaviours				
5	Scripted, stereotyped sentences or discourse	0	0	0
6	Awkward expression of ideas	1	1	0
7	Indistinct speech/mispronunciations	1	1	0
8	Rate of speech is too rapid	UR	UR	UR
9	Intonation is unusual	UR	2	UR
10	Volume is inappropriate (note: too loud/soft)	0	0	0
11	Unusual timing of responses, reformulations	0	0	0
12	Unusual rhythm of speech such as stuttering	0	0	0
Pragmatic Behaviours				
Tone				
13	Strikingly candid	2	1	-1
14	Overly direct or blunt	3	3	0
15	Inappropriately formal	UR	UR	UR
16	Inappropriately informal	0	0	0
Exchange of Information				
17	Overly talkative	2	1	-1
18	Out of sync content/unannounced topic shifts	UR	1	UR
19	Topic preoccupation/perseveration	0	0	0
20	Unresponsive to examiner's cues	0	0	0
21	Little reciprocal to-and-fro exchange	1	0	-1
22	Terse	0	0	0
Conversational Content				
23	Irrelevant/inappropriate detail	1	0	-1
24	Confusing accounts	UR	UR	UR
25/26	Insufficient background information/Failure to reference pronouns, terminology	1	0	-1
27	Inadequate clarification	0	0	0
28	Vague	0	0	0
29	Odd humour	0	1	1
Total				-4

Note. (blue shading) and UR = scores were unresolved; (green shading) = improvement; (red shading) = decreased performance; (yellow shading) = improvement; CNR = Could not rate

[a]Paralinguistic Behaviours were reverse scored to remain consistent with scoring on the other categories (i.e., negative scores indicate improvement and positive score indicate decreased performance).

Parent semi-structured interview

The parent of Participant 2 (Parent 2) reported that Participant 2 had an overall positive experience in the PEERS program. Some of the changes perceived were in the areas of communicating with other teens, an increased understanding of others, and improvement in the area of Exchange of Information. More specifically, Parent 2 reported that after PEERS, Participant 2, "… *listens more. Listens more for what we intend to say and instead of barreling on with his own thought process he'll actually take time to understand and actually gains a better understanding of what we are talking about"*.

Parent 2 did not observe any changes in paralinguistic behaviors such as body language, eye gaze or distance from conversational partner. Parent 2 struggled to answer whether after PEERS Participant's 2's ability to form relationships with other teens had changed. Parent 2 explained that no change was observed because his teen had already developed a reputation and that his classmates had already formed a view of him: *"I think that people that know him have, well they have a view of who he is and how he communicates and maybe he doesn't get the same opportunity that he would with a new relationship"*.

When asked to rate Participant 2's communication before and after PEERS on a scale of 1 to 10, Parent 2 gave a subjective rating of 4-5 before the program and 5-6 after the program. Table 16 provides a brief summary of the responses recorded during the semi-structured parent interview.

Table 16
Parent 2 – Summary of Responses in Semi-Structured Parent Interview Post-PEERS

	Questions	Responses
1.	Tell me about your teen's experience in PEERS?	Positive/enjoy
2.	What changes do you notice in the way your teen communicates with you (parent)?	Listens/takes more time to understand others
3.	What changes do you notice in the way that your teen communicate with other teens?	None observed/ teen said better able to relate to other teens
4.	Do you find any difference in the way your teen initiates or ends conversations?	Improved
5.	Do you find any difference in the way your teen exchanges information?	---
6.	Do you find any differences in how he shares the conversations with others?	Improvement
7.	Do they listen to others talk and make comments or ask questions that further the conversation?	Improvement
8.	Do you find your teen's body language any different after taking part in PEERS?	Same
9.	Does your teen more readily maintain eye contact and maintain the appropriate distance from their conversation partner?	Same
10.	Has your teen changed how they feel or feel about others after taking peers?	Better able to understand, less confrontational
11.	Has your child changed or made any comments about how they view communicating?	Yes
12.	How does your teen use the concepts taught in PEERS?	Not actively
13.	What other changes have you noticed in your teen since they participated in PEERS? How about in terms of get-togethers, or extracurricular?	No
14	Do you think the skills that your teen learned in PEERS have helped him to have stronger relationships with peers or siblings (if relevant)? How so?	No (reputation)
15.	On a scale of one to ten what would you rate your teen's communication before peers? How about after?	4-5 → 5-6

Overall, Parent 2 reported improvements, no change or unable to observe for all questions. No aspects of communication were reported to have worsened. Comments of particular note were that Participant 2 had a greater willingness to listen to others, and was also better able to understand others.

Participant 3

CCC-2: Potentially meaningful change was observed on the subscales of Coherence (+4 scaled score points), Initiation (+4 scaled score points), Scripted Language (+3 scaled score points), and Interests (+6 scaled score points). An improvement in GCC standard score of +16 was observed (GCC standard score pre = 83 with a 90% confidence interval of 79-89, and GCC standard score post = 98 with a 90% confidence interval of 93-103). The confidence interval pre- and post-PEERS did not overlap suggesting a true difference in scores pre- to post-PEERS. Pre PEERS, Participant 3 obtained a SIDI score of -12 pre-PEERS and -7 post-PEERS (an improvement of 5 scaled score points). This increase from -12 to -7 shifted the participant's SIDI scores from a score suggestive of ASD into the expected range of typical scores (-10 to +10) and suggested a potential decrease in the discrepancy between problems with pragmatic language versus other language aspects (see Table 17).

Table 17
Participant 3 – Summary of Change on the CCC-2 Pre- and Post-PEERS

Subscale	Pre	Post	Change
(A) Speech	8	9	1
(B) Syntax	9	9	0
(C) Semantics	9	9	0
(D) Coherence	4	8	4
(E) Initiation	4	7	3
(F) Scripted Language	3	6	3
(G) Context	8	9	1
(H) Nonverbal Communication	4	4	0
(I) Social Relations	7	8	1
(J) Interests	3	9	6
GCC Sum of Scaled Scores	59	78	19
GCC Standard Score	83	98	16
SIDI	-12	-7	5
GCC Confidence Interval	79 - 89	93 - 103	---

Note. ■ (green shading) = potential meaningful improvement

YiPP: For Initial Response, Participant 3 showed improved scores in Presupposition (P), and Requests Clarification (CR), no change in Communicative Functions (CF) and decreased performance in Discourse Management (DM). For Best Response, Participant 3 only showed improved scores in Requests Clarification (CR) with no change observed in the other domains. Overall, Participant 3's total score suggests that performance improved for both Initial Response and Best Response. On three of four domains (Communicative Functions, Presupposition and Requests Clarification), the percentage of cues given decreased from pre-to-post-PEERS and did not change for Discourse Management (DM). Overall, the percentage of cueing decreased post-PEERS. Ceiling values had been reached for the four instances where no change was observed for Initial and Best Response (domains: Communicative Functions, Discourse Management and Presupposition). See Table 18 for details.

Table 18
Participant 3 – Summary of Scores on the YiPP Pre- and Post-PEERS

		Pre			Post		
		Initial Response	Best Response	Cue Given	Initial Response	Best Response	Cue Given
Participant 3							
Discourse Management	(DM)	100%	100%	1/4	88%	100%	1/4
Communicative Functions	(CF)	100%	100%	3/3	100%	100%	2/3
Presupposition	(P)	50%	100%	2/3	100%	100%	0/3
Request Clarification	(CR)	63%	88%	1/4	100%	100%	0/4
Total		77%	97%	50%	97%	100%	21%

PRS. Participant 3 demonstrated positive score changes concentrated in the category Pragmatic Behaviours, and more specifically, within the subcategories Exchange of Information (3 of 6 items) and Conversational Content (3 of 7 items). Additionally, positive change in Speech/Prosody Behaviour was found for one item (Volume is inappropriate). Of the 18 items where no change was observed, 14 items were at ceiling pre- and post-PEERS, including all but

one item (which had an unresolved scoring difference) within the Exchange of Information and Conversational Content subcategories. Four items had an unresolved scoring difference and were therefore uninterpretable (see Table 19).

Table 19
Participant 3 – Summary of Change on the PRS Pre- and Post-PEERS

		Pre	Post	Change
Paralinguistic Behaviours[a]				
1	Posture/physical position	1	1	0
2	Gestures	1	UR	UR
3	Facial Expression	1	1	0
4	Gaze	2	2	0
Speech/Prosody Behaviours				
5	Scripted, stereotyped sentences or discourse	0	0	0
6	Awkward expression of ideas	UR	0	UR
7	Indistinct speech/mispronunciations	0	0	0
8	Rate of speech is too rapid	0	0	0
9	Intonation is unusual	1	1	0
10	Volume is inappropriate (note: too loud/soft)	1	0	-1
11	Unusual timing of responses, reformulations	0	0	0
12	Unusual rhythm of speech such as stuttering	0	0	0
Pragmatic Behaviours				
Tone				
13	Strikingly candid	0	0	0
14	Overly direct or blunt	0	0	0
15	Inappropriately formal	3	UR	UR
16	Inappropriately informal	0	0	0
Exchange of Information				
17	Overly talkative	1	0	-1
18	Out of sync content/unannounced topic shifts	0	0	0
19	Topic preoccupation/perseveration	0	0	0
20	Unresponsive to examiner's cues	1	0	-1
21	Little reciprocal to-and-fro exchange	1	0	-1
22	Terse	0	0	0
Conversational Content				
23	Irrelevant/inappropriate detail	1	0	-1
24	Confusing accounts	0	0	0
25/26	Insufficient background information/Failure to reference pronouns, terminology	1	0	-1
27	Inadequate clarification	0	N/O	UR
28	Vague	0	0	0
29	Odd humour	0	0	0
Total				-6

Note. (blue shading) and UR = scores were unresolved; (green shading) = improvement; (red shading) = decreased performance; (yellow shading) = improvement; N/O = No opportunity to rate.
[a]Paralinguistic Behaviours were reverse scored to remain consistent with scoring on the other categories (i.e., negative scores indicate improvement and positive score indicate decreased performance).

Parent semi-structured conversational interview

Parent 3 reported that Participant 3 had an overall positive experience in the PEERS program. After having taken PEERS, Participant 3 was said to be more skilled in social communication with other teens. Paralinguistic aspects of eye contact and body language were reported to have improved (see Table 20). The concept of greater awareness was raised multiple times by Parent 3. When asked if Participant 3 listens more, makes more comments or asks more questions to further a conversation? Parent 3 responded that Participant 3 is better able to do so because, "[*PEERS] build[s] social awareness of what is expected*". Parent 3 also expressed the idea that Participant 3 has acquired a new set of skills that he is able to use if he so desires. However, Parent 3 believed that the drive to cultivate deeper relationships may not be able to be taught and, despite communicating better than most with older teens and adults, he is not interested in "typical" things that other teens are interested in. When asked to rate Participant 3's communication ability before and after PEERs on a scale of 1 to 10, Parent 3 responded a 3 before PEERS and a 5 after PEERS.

Table 20
Parent 3 – Summary of Responses in Semi-Structured Parent Interview Post-PEERS

	Questions	Responses
1.	Tell me about your teen's experience in PEERS?	Positive/enjoy
2.	What changes do you notice in the way your teen communicates with you (parent)?	---
3.	What changes do you notice in the way that your teen communicate with other teens?	More skilled
4.	Do you find any difference in the way your teen initiates or ends conversations?	Improvement
5.	Do you find any difference in the way your teen exchanges information?	---
6.	Do you find any differences in how he shares the conversations with others?	---
7.	Do they listen to others talk and make comments or ask questions that further the conversation?	Improvement (social awareness)
8.	Do you find your teen's body language any different after taking part in PEERS?	Improvement (awareness)
9.	Does your teen more readily maintain eye contact and maintain the appropriate distance from their conversation partner?	Improvement
10.	Has your teen changed how they feel or feel about others after taking peers?	No, an issue of finding common interests
11.	Has your child changed or made any comments about how they view communicating?	No
12.	How does your teen use the concepts taught in PEERS?	When he chooses to
13.	What other changes have you noticed in your teen since they participated in PEERS? How about in terms of get-togethers, or extra curricular?	Will actively Pursue
14	Do you think the skills that your teen learned in PEERS have helped him to have stronger relationships with peers or siblings (if relevant)? How so?	Yes
15.	On a scale of one to ten what would you rate your teen's communication before peers? How about after?	3→5

Participant 3 was reported to show general improvement across multiple communicative domains such as paralinguistic behaviours (e.g., body language and eye contact) and pragmatic behaviours, such as initiating and ending conversations and asking questions or making comments to further the conversation. Parent 3 reported that while still not natural, Participant 3 had acquired a skill set that he could use if he chose to apply it.

Comparison Across Participants

Table 21 presents an overall and abbreviated summary of participant outcomes after taking part in the PEERS program. To make the interpretation of overall scores easier and standardize outcomes across different measures, Table 21 presents positive (↑) and negative (↓) direction change relative to pre-intervention results, rather than the numerical difference in scores. Positive and negative change corresponded to the net response score for a given category/measure as well as for subcategory/subscale (i.e., for the CCC-2 if the sum values for categories or subcategories was greater than or equal to ± 3 and for the PRS and YiPP if the sum values for categories or subcategories was greater than or equal to ± 0). Table 21 further differentiates among the categories that did not show change (≙), by indicating if categories reached ceiling (‾) or floor (_) values.

Table 21
Comparison of Pre-Post Change for All Participants Across CCC-2, YiPP and PRS

	Participant 1	Participant 2	Participant 3
CCC-2 Total		↑	↑
Speech	---	≙	≙
Syntax	---	≙	≙
Semantics	---	≙	≙
Coherence	---	≙	↑
Initiation	---	≙[a]	↑
Scripted Language	---	≙	↑
Context	---	≙	≙
Nonverbal communication	---	↑	≙
Social Relations	---	≙	≙
Interests	---	↑	↑
*Yi*PP Total	↑	↑	↑
Discourse management	↑	↑	≍
Communicative function	↓	↑	≍
Presupposition	≙	≍	≍
Request clarification	↑	↓	↑
PRS Total	↑	↑	↑
Paralinguistic behaviours	↑	≙	≙
Speech/Prosody behaviours	↑	≙	↑
Pragmatic behaviours	↑	↑	↑
Tone	≍	↑	≍
Exchange of information	↑	↑	↑
Conversational content	↑	↑	↑

Note. ■ (green shading) and ↑ = improvement; ■ (red shading) and ↓ = decreased performance; ■ (yellow shading) and ≙ = no change; ≍ = ceiling; --- = No score available.
[a]Although a level of potential meaningful change was not reached, the participant displayed a trajectory of improvement.

CCC-2

The CCC-2 data were limited to Participants 2 and 3. Table 22 presents the data for both participants, for all subscales of the CCC-2. Where both participants experienced the same direction of change on a subscale/composite it was defined as a trend. A positive trend was observed for the Interests subscale and both composite measures, the GCC and the SIDI. No trend of decreased performance was observed for either participant on the CCC-2.

Table 22

Comparison of Pre-Post Change Across Participants on the CCC-2

	Subscale	Participant 2	Participant 3	Trend
A)	Speech	0	1	≙
B)	Syntax	0	0	≙
C)	Semantics	1	0	≙
D)	Coherence	1	4	≙
E)	Initiation	2 [a]	3	≙ [a]
F)	Scripted Language	0	3	≙
G)	Context	-1	1	≙
H)	Nonverbal Communication	4	0	≙
I)	Social Relations	0	1	≙
J)	Interests	3	6	↑
	GCC Standard Score	7	19	↑
	SIDI	7	16	↑

Note. ■ (green shading) and ↑ = improvement; ■ (yellow shading) and ≙ = no change.
[a]Although a level of potential meaningful change was not reached, the participant displayed a trajectory of improvement.

Y*i*PP

On the Y*i*PP, trends were defined as a minimum of two out of the three participants experiencing change in the same direction, with no evidence of change in the opposite direction for the third participant. For Initial Response, when considering patterns at the item level, only two items showed a trend across participants. One of these items was within the domain of Presupposition in the negative direction and the other was in the domain of Requests Clarification in the positive direction. For Best Response, when considering patterns at the item level, only one item showed a trend across participants which was in the domain of Discourse Management in the positive direction.

When items were collapsed into their respective domains, for Initial Response a positive trend of improvement was observed for Requests Clarification (RC) and a negative trend of decreased performance was observed on Communicative Function (CF). However, for Best

Response at the domain level, only one trend was observed, a positive trend in Discourse Management. No item or domain consistently changed across all three participants. However, a positive trend for Total Score showed pre-to-post improvement overall for all three participants.

PRS

On the PRS, three items showed positive score changes across all three participants: Overly talkative, Little reciprocal to-and-fro exchange and Irrelevant/inappropriate detail. These items were all in the category of Pragmatic Behaviours. For further examination of the data, trends were defined as a minimum of two out of the three participants experiencing change in the same direction with the third participant experiencing no change. In addition to the items (listed above) that showed a consistent pattern across all three participants, three additional items met the two-of-three criterion (see Table 23): These items "Unresponsive to examiner's cues" and "Insufficient background information/Failure to reference pronouns, terminology" showed positive change, and "Odd humour" showed negative change. All items that showed a trend of positive change were in the category of Pragmatic Behaviours and were predominantly concentrated in the Exchange of Information subcategory.

Table 23
Comparison of Pre-Post Change Across Participants on the PRS

		Participant			
		P1	P2	P3	Trend
Paralinguistic Behaviours [a]					
1	Posture/physical position	0	↗	0	→
2	Gestures	-1	UR	UR	→
3	Facial Expression	-1	UR	0	→
4	Gaze	-1	UR	0	→
Speech/Prosody Behaviours					
5	Scripted, stereotyped sentences or discourse	UR	↗	↗	↗
6	Awkward expression of ideas	0	0	UR	→
7	Indistinct speech/mispronunciations	UR	0	↗	→
8	Rate of speech is too rapid	↗	UR	↗	↗
9	Intonation is unusual	-1	UR	0	→
10	Volume is inappropriate (note: too loud/soft)	↗	↗	-1	→
11	Unusual timing of responses, reformulations	UR	↗	↗	↗
12	Unusual rhythm of speech such as stuttering	0	↗	↗	→
Pragmatic Behaviours					
<u>Tone</u>					
13	Strikingly candid	↗	-1	↗	→
14	Overly direct or blunt	↗	0	↗	→
15	Inappropriately formal	↗	UR	UR	↗
16	Inappropriately informal	↗	↗	↗	↗
<u>Exchange of information</u>					
17	Overly talkative	-1	-1	-1	↑
18	Out of sync content/unannounced topic shifts	UR	UR	↗	→
19	Topic preoccupation/perseveration	-2	↗	↗	→
20	Unresponsive to examiner's cues	-2	↗	-1	↑
21	Little reciprocal to-and-fro exchange	-1	-1	-1	↑
22	Terse	↗	↗	↗	↗
<u>Conversational Content</u>					
23	Irrelevant/inappropriate detail	-1	-1	-1	↑
24	Confusing accounts	UR	UR	↗	→
25/26	Insufficient background information/Failure to reference pronouns, terminology	0	-1	-1	↑
27	Inadequate clarification	0	↗	UR	→
28	Vague	-1	↗	↗	→
29	Odd humour	1	1	↗	↓
Total		-11	-4	-6	↑

Note. ■ (blue shading) and UR = Scores were unresolved; ■ (green shading) and ↑ = improvement; ■ (red shading) and ↓ = decreased performance; ■ (yellow shading) and ⧋ = no change; ⩛ = ceiling.
[a]Paralinguistic Behaviours were reverse-scored to remain consistent with the scoring of other categories (i.e., negative scores indicate improvement and positive scores indicate decreased performance).

Parent semi-structured interview

For an easier comparison between participants, interview questions are presented in two tables. Table 24 summarizes questions directly related to aspects of communication and Table 25 summarizes general impressions and all other questions that are not explicit about communication.

Table 24
Comparison of Responses Given During Semi-Structured Parent Interview Across Participants

	Question/Topic	Parent 1	Parent 2	Parent 3
2.	Communication with caregiver	Reads facial expression	Listens/takes more time to understand others	---
3.	Communicating with other teens	Improved/Unsure	None observed/teen told better able to related to others	More skilled/still not natural
4.	Initiating/ending	Improvement	Improvement	Improvement
6.	Exchanges information	Improvement	---	---
7.	Shares conversation	Improvement	Improvement	---
8.	Contingent comment/question	Improvement + topic maintenance	Improvement	Improvement (social awareness)
9.	Body language	Improvement	Same	Improvement (awareness)
10.	Eye contact	Improvement	Same	Improvement
16.	Rating	3-4 →6-7	4-5 → 5-6	3→5

Note. --- = Question was unanswered or unasked.

All parents reported that that their teen improved at initiating and ending conversations, making/asking contingent comments/questions, and increased their overall subjective rating of their teen's communication ability. When asked if there were any changes in the way that their teen communicated with other teens (Question 3), all parents gave at least one indication of positive change even if they were unsure because they had not directly witnessed their teens interact with same age peers.

Table 25
Comparison of Parent General Impressions and Impact of PEERS Across Participants

	Question/Topic	Participant 1	Participant 2	Participant 3
1.	Experience	Positive/enjoy	Positive/enjoy	Positive/enjoy
11.	Change feel about others	More sensitive to others emotions	Better able to understand, less confrontational	No, an issue of finding common interests
12.	Comments on communication	No	Yes	No
13.	Uses Peers concepts	Yes	Not actively	When he chooses to
14.	Get-togethers/ Extracurricular	Will actively pursue	No	Will actively Pursue
15.	Better relationships	Yes	No (reputation)	Yes

All participants were reported to have a positive experience taking part in PEERS. Each participant was reported to use the concepts taught in PEERS to a different degree. Participant 1 was said to actively think about and use the concepts, Participant 2 was said to use PEERS concepts when he chose to, and Participant 3 was said not to use the concepts actively. Two of the three parents expressed a desire to continue working on teen get-togethers and two of three

parents believed that PEERS would help develop better relationships. Participant 2 was reported to neither change in get-togethers or in ability to develop relationships.

Discussion

The purpose of this research was to conduct a preliminary investigation into changes in SPC that may occur after teens participate in the PEERS program. Furthermore, we aimed to address a gap in the PEERS literature with respect to the lack of observable measures, as noted by Dolan et al. (2016). The Y*i*PP (Simmons et al., 2014) and PRS (Landa et al., 1992) were selected to provide observational data and to provide a detailed analysis of SPC changes experienced by participants of the PEERS program. Overall, the results suggest that SPC improved after teens participated in the PEERS program. Analysis across measures (CCC-2, Y*i*PP, PRS and semi-structured parent interview) suggest an improvement in the teens' ability to manage the back-and-forth demands of conversational exchanges. Salient findings, implications, limitations and directions for future research are discussed below. The findings will be discussed between and within participants and important results will be evaluated in the context of other measures. Patterns that emerged in the data will also will be explored in greater depth.

Summary of salient findings

Across Participants

Preliminary findings suggest that SPC skills improved across measures (CCC-2, YiPP, PRS and semi-structured parent interview) following PEERS. All participants showed improvements, but the degree and specific area(s) of improvement observed across and within measures varied between participants.

The CCC-2 showed increased performance for both Participant 2 and Participant 3; However, the magnitude of change observed for Participant 3 was greater. Participant 2 showed

improved scores on two subscales (with the indication of improvement on a third) whereas Participant 3 showed improved scores on four subscales. Neither participant showed subscales with potentially meaningful lower scores at post-test on the CCC-2.

All participants showed improved scores overall for Best Response on the Y*i*PP. However, change on the individual Y*i*PP domains was variable. The only pattern that emerged across participants was improved Discourse Management (two of the participants showed improvements and the third reached ceiling). This pattern was in line with expectations because the SPC skills that are taught in PEERS most closely relate to Discourse Management. It is important to note that Best Response scores were better than Initial Response Scores. This suggests that, in addition to potential remediation in SPC pre-to-post PEERS, the introduction of cueing gave participants added supports to better overcome SPC challenges.

Findings were the most consistent across participants on the PRS with all participants showing improved scores overall. While there was slight variation on the items that improved, increased performance clustered in the subcategory of Exchange of Information with SPC skills related to being overly talkative, attentive to the cues given by the examiner and the degree to which there was back-and-forth in the conversation. Additionally, all three participants showed improvement in their ability to share the necessary amount of detail (i.e., avoid giving too much or irrelevant detail).

When comparing relative improvement on all measures between participants, the magnitude of improvement appeared to follow a pattern. Participant 1 had the most room for growth (as indicated by his relatively lower score on the CCC-2) and showed the greatest improvement post-PEERS. This was reflected in the greatest improvement on the Y*i*PP, PRS and in the reported subjective rating of communication (semi-structured parent interview).

Participant 3 showed the most gains on the CCC-2, and second most gains on the PRS and the reported subjective rating of communication (semi-structured parent interview). Lastly Participant 3 showed the most modest gains on all measures except for the Y*i*PP.

Although there was a considerable amount of variability among the participants' outcomes, several consistent areas of potential change did emerge. In particular, observed improvements on the Interests subscale (CCC-2), Discourse Management domain (Y*i*PP), Exchange of Information subcategory (PRS) and, a recurring theme of increased social awareness, mindfulness, and understanding of others became evident after thematic analysis (parent semi-structured conversational interview). The observed concentration of improvement in Exchange of Information appears to coincides with or overlaps the improvement observed in Discourse Management (Y*i*PP). Both of these areas tap skills involved in the management of the back-and-forth exchange in conversation: when to starting talking, when to stop talking, how much to talk and how to sustain a conversation. It is also important to note that the only negative change observed on the PRS across participants was the use of unusual humour. A possible explanation is that participants felt greater comfort with the experimenter and, as such, acted more naturally around him.

Within Participants

Participant 1 demonstrated improved scores on the Y*i*PP and the PRS, and his parent reported positive changes in the semi-structured parent interview (the CCC-2 was excluded as a forth measures for Participant 1). Thus, all available indices pointed to positive change for this participant. Improvements in paralinguistic behaviours such as body language and eye contact reported in the semi-structured parent interview were consistent with improved paralinguistic behaviours observed on the PRS such as eye contact and appropriate use of gestures.

Additionally, improved scores concentrated in Exchange of Information (PRS) corresponded with improved scores in Discourse Management (Y*i*PP). In the semi-structured parent interview, Parent 1 reported that it was easier to have a conversation with Participant 1 after taking PEERS. This parent comment, related to conversations in natural contexts, corresponds with the improved ratings observed on the Y*i*PP in the domains of Discourse Management (DM) and Request Clarification (CR) and the improved ratings in the subcategories of Exchange of Information and Conversational Content on the PRS. Participant 1 showed a particularly notable concentration of change in the subcategory of Exchange of Information on the PRS. This finding appears to be consistent with information reported by Parent 1 during the semi-structured conversational interview post-PEERS. Parent 1 reported that pre-PEERS, it was difficulty to have a conversation with Participant 1 because he would often use single words. However, post-PEERS Parent 1 relayed that it was noticeably easier to have a conversation with Participant 1.

Participant 2's performance showed improvements across all measures. His scores improved on the CCC-2, Y*i*PP, PRS and his parents reported some positive changes in communication. Consistent improvement was observed in Initiation, and Interests (as reflected by decreased disproportionate challenges in pragmatics as indicated by the SIDI), which coincided with the pattern of improved Discourse Management (Y*i*PP) and Exchange of Information (PRS). Thus, all available indices pointed to positive change in SPC for this participant. Notably, although this participant showed improved scores in nonverbal communication on the CCC-2, his scores for Paralinguistic Behaviours on the PRS were unchanged, and skills such as body language and eye contact were reported to remain the same during the semi-structured parent interview. Participant 2 was reported to be "less confrontational" in the semi-structured parent interview and "more willing to listen to others for

what they intend to say". These comments are consistent with his improved scores showing Participant 2 to be less overly candid with the examiner (PRS) and rated to react more positively to new unfamiliar activities and unexpected occurrences that do not go his way (CCC-2).

Participant 3's performance consistently improved across all four measures (the CCC-2, Y*i*PP, PRS and the semi-structured parent interview). Thus, all available indices pointed to positive change for this participant. The positive change observed on the CCC-2 was more noticeable than the change on any of the other measures because of the number of improved subscales and the degree to which his SIDI appeared to reflect a decreased discrepancy of challenges between pragmatics and other aspects of language. Participant 3's parent reported that post-PEERS, Participant 3 is more skilled in his discussion with others which will help him make better relationships. This comment appeared to be reflected in the concentration of Participant 2's improved scores on the PRS related to his ability to respond to cues in an interaction and the degree to which the conversation was back-and-forth in nature. PRS improvement also appeared to be consistent with improved scores in Discourse Management (Y*i*PP) as well as Initiation and Interests on the CCC-2.

Potential Links to Specific and General Aspects of the PEERS Curriculum

Improvements in communication as observed by the CCC-2, YiPP, PRS and semi-structured parent interview are consistent overall with the existing literature, in which teens have been found to have improved social skills after taking part in PEERS (Laugeson et al., 2009, 2012, 2014; Frankel et al., 2010; Gantman et al., 2012; Schohl et al., 2013; Yoo et al., 2014; Madelberg 2014; Marchino & D'Amico, 2016). The following section will consider how observed changes in SPC might relate to the curriculum taught in PEERS.

The Social Relations and Interests subscales of the CCC-2 were developed to measure autistic behaviours (Bishop, 2003). Improvement for both Participant 2 and 3 on the Interests subscale and the SIDI are in line with the decreased autistic symptoms observed in the PEERS literature (Laugeson et al., 2015; Schohl et al., 2013; Van Hecke et al., 2013). This positive change could be linked to the concepts taught in PEERS. In Week 1 (Lesson: Introduction and conversational skills I - Trading information) and Week 2 (Lesson: Conversation skills II – two-way conversations) teens practice being a good conversationalist by learning to ask questions and make comments on topics that they might not necessarily be interested in. During Week 8 (Lesson: Get-togethers), teens are taught to offer guests to choose what game they want to play. They are told that even if they want to play something different, being a good host requires them to prioritize their guest's desires over their own. It is quite possible that improvement on the Interests subscale is reflected in a greater willingness to partake in activities outside the teens' normal interests practiced throughout PEERS. In other words, these skills targeted in the PEERS program may have generalized to contexts within daily life.

The subcategory Exchange of Information on the PRS and Discourse Management domain on the Y*i*PP appeared to show potential meaningful change across all three participants. The PEERS program specifically teaches concepts that directly relate to Exchange of Information. Week 1 (Lesson: Introduction and conversational skills I - Trading information) introduces the idea of trading information where teens are taught to ask questions about others, find common interests and share the conversation. Week 2 (Lesson: Conversation skills II – two-way conversations) they are taught how to have back-and-forth conversations where they learn how to ask open-ended questions and follow-up questions, to listen and not to tease or criticize, not to monopolize the conversation, not to be an interviewer (i.e., ask too many questions), and

not to be repetitive. These aspects are all involved in the exchange of information. Throughout the entire program, teens practice these skills and watch role plays. Potential meaningful improvement captured on the PRS and Y*i*PP could be explained by this portion of the program.

Providing examples or specific details of what aspects of their teen's communication had improved appeared challenging for parents. However, a theme that emerged from the semi-structured parent interviews was the perception that teens had developed greater social awareness. This awareness could be a realization of social norms (i.e., an expectation of how one should behave in social settings), an awareness of why others behave the way they do in conversation and relationships, an awareness of what is expected of them (e.g., in a conversation you should ask appropriate questions and listen to others even if the topic doesn't interest you) and an awareness of how to behave if they (the teen) wants to develop a friendship. While parents used different language to describe the improvement experienced by their teens, the idea of social-communicative mindfulness was repeated – a better understanding of others, increased awareness of social norms, a willingness to understand and listen to others and a greater sensitivity to others' emotions.

Prior studies on PEERS have reported that teens have more get-togethers and increased social contacts following participation in PEERS (Gantman et al., 2012; Laugeson et al., 2009, 2012, 2014, 2015; Madelberg 2014; Schohl et al., 2013; Yoo et al., 2014; Van Hecke et al., 2012). The link between these PEERS outcomes and the importance of social awareness may be illustrated by Bauminger et al. (2008)'s description of the requirements for developing friendships:

> friendships are reciprocal in nature, and thus require a set of complex and comprehensive reciprocal capabilities such as consideration for and awareness of the other child's

emotions, desires, intentions, and thoughts—Theory of mind capabilities (p. 1213)

Therefore, because social awareness is a necessary component of "reciprocal capabilities", it is possible that the changes observed by parents and the documented success in the PEERS literature may be related to PEERS teaching teens "reciprocal capabilities" (Bauminger et al., 2008, p. 1213).

Reciprocal capabilities are embedded in communication and potentially affect skills that moderate an interaction like Exchange of Information. Strikingly, the most consistent pattern observed pre-to-post PEERS was the concentrated improvement in Exchange of Information, specifically related to the items, Overly talkative, Unresponsive to examiner's cues, and Little reciprocal to-and-fro exchange on the PRS. It is plausible that improved reciprocal capabilities, a consideration of and awareness for a conversational partner, reflected why participant performance appeared to have improved. Further evidence for this explanation might be strengthened by the findings that teens are observed to have increased empathy after taking part in PEERS – empathy being the ability to understand and relate to another's lived experience (Gantman et al., 2012; McVey et al., 2016). Consideration and awareness of others is necessary for empathy.

An alternative but peripherally related explanation for observed improved SPC could be explained by greater participant confidence. PEERS is a safe environment in which teens can practice their SPC skills. With practice comes more confidence in the use of SPC skills required to make and maintain relationships. This might best be exemplified by the evidence that shows participants have decreased anxiety after taking part in PEERS (Lordo et al., 2016; McVey et al., 2016; Schohl et al., 2014). It is plausible to hypothesize that decreased anxiety could be related to increase confidence in social skills and the subsequent improvements in SPC.

Limitations

Limitations of Experimental Design

It is important to note that this was a pilot study, and as such experimental considerations such as randomization to groups, controls groups (e.g., treatment versus no treatment), or replication across more participants were not feasible. Additionally, to ensure participant anonymity from PEERS facilitators, fidelity measures were not collected. The results of this study therefore can not be interpreted to indicate causation. Moreover, because any change on the YiPP and PRS were taken as potential indicators of change for current purposes, the results need to be interpreted cautiously as we did not have set criteria for what might constitute clinically meaningful change on these measures. The findings in the research should be interpreted cautiously and only taken as positive indicators of potential changes in SPC for the PEERS program.

Despite these limitations there were internal controls that allow for greater confidence in the results. First, coders were blind to the pre-post nature of the experiment and all identifying information was removed from videos. Second, administration of measures was uniform across participants (i.e., participants were all treated the same). Third, the make-up of the CCC-2 allowed for some prediction of which subscales would remain static. PEERS is a social skills training program and does not target formal aspects of language for intervention. Therefore, Speech, Syntax and Semantics subscales arguably should not change from pre- to post-PEERS. In fact, none of these three subscales showed any potentially meaningful change for our participants, but subscales like Interests and Initiation did show meaningful change in line with our hypothesis.

Limitations in Administration

The were several factors in the administration of the experiment that may limit the validity of this research. In the process of data collection there were instances where the camera was positioned in a way that did not frame the participant's body below the shoulders. In future research, video recordings should have a participant's full body in the frame to see how participants orient their body with respect to the examiner. Additionally, two cameras should be used so that the Y*i*PP examiner is also recorded allowing for eye contact to be more accurately assessed by raters.

Second, as previously explained, Participant 1's CCC-2 scores were usable because they did not pass the consistency check. For this reason, it was not possible to generalize CCC-2 findings across all three participants or compare the CCC-2 results with other measures such as the Y*i*PP or the PRS for Participant 1. Although scoring the CCC-2 immediately after administration would have have permitted the experimenter to address the problem that arose with the consistency check, scoring the CCC-2 was deliberately left until after the semi-structured parent interview was conducted. This was to avoid biasing the experimenter during the semi-structured parent interview which occurred post-PEERS. In future, a second experimenter should be used to ensure that all participants pass the consistency check.

Limitations of Participant Information

There were several limitations with regard to the lack of information and variability in participant profiles. First, all three participants who took part in this research had very different communication profiles, with CELF-5 composite scores ranging from the 79 (Borderline/Marginal/At risk) range to the 125 (Above average) range. This made generalization of findings challenging. That being said, it can also be viewed as positive because there is great

diversity of profiles in ASD. Apart from CELF-5 scores and age, no descriptive information about participants was collected such as comorbidities, educational history and history of intervention.

Second, there was a high frequency of items that reached ceiling values on the Y*i*PP and the PRS. Therefore, there is a possibility that some items on the Y*i*PP or PRS may have actually shown an increase or decrease in performance but the rating scale was not sensitive enough to capture these changes. As previously mentioned in the method section of this paper, scoring for Cue Given on the Y*i*PP was changed for clarity. This decision may need to be revisited in future research.

Third, the principal investigator administered the Y*i*PP instead of a teen confederate or another experimenter. This may have influenced outcomes if participants were more comfortable with the principal investigator during post-assessment. This may also explain the increase in odd humour pre-to-post PEERS observed on the PRS. However, we decided that having the same interviewer posed fewer confounds than a novel interviewer, whose interviewing skills, personal characteristics, or other factors could influence teen performance. Additionally, use of a teen confederate was not feasible due to time and resource constraints.

Fourth, to compare results pre- and post-PEERS, the Y*i*PP was administered before and after PEERS. However, two of the three participants made comments during administration of the Y*i*PP that the conversation was similar pre- and post-PEERS (i.e., they remembered the questions and presses that are part of the Y*i*PP). This may have confused or distracted teens which may have resulted in performance on the Y*i*PP and the PRS not truly reflecting participant SPC abilities. However, the participant that showed the greatest gains did not make any comments about the YiPP script sounding familiar.

Limitations of Measures

As previously discussed, assessment in the area of SPC is challenging because introduction of natural context makes standardization difficult, while removal of a natural context makes it artificial and decreases the complexity of an interaction (Adams, 2002). We tried to strike a balance between standardization and naturalness by choosing the YiPP as a framework for a conversation with the additional use of the PRS as a coding schema. Upon administration of the Y*i*PP it became clear that the protocol is exceedingly unnatural. The dialogue feels odd (e.g., Telling the examinee that "our Tigers are really good" with respect to "the local high school band") and verbal cues are awkward (e.g., interrupting an examinee on purpose and if they do not stop talking, prompting them "Listening to me talk about [fill in blank] would be the polite thing to do"). It is important to acknowledge the low inter-rater reliability on some PRS items for two raters. The principal investigator acted as the third rater. Therefore, he was not blind to pre-post conditions of the videos. However, all videos were rated independently (the PI had not seen the other raters scores before he rated) and were not rated in the context of previous videos (i.e., allowing for comparison between pre and post videos).

Directions for future research

Assessment of social-pragmatic communication: Despite these challenges indicated with use of the Y*i*PP, this tool does address the necessity for standardization and simulates various aspects of conversation breakdown where an individual would need to ask for clarification. It is important to note that participants were observed to have the best communication during the portions of the Y*i*PP that were most conversational. Therefore, a promising future direction for PEERS research is the development of a general *in vivo*

observational measure that captures the concepts taught in PEERS. This measure would occur in the context of natural conversation for a five-to-ten-minute stretch. The conversational topics would be kept general, like favourite past-times or current events, to simulate a typical interaction. In addition to being a conversational partner, the examiner would have a set amount of presses to administer to the examinee throughout the conversation. These presses would address different communicative domains, but, unlike the Y*i*PP, the presses would not be scripted and would be naturally introduced into the conversational exchange by the examiner. Presses could include comments about sharing an examinees interest, cues to change topics, or purposefully not supplying enough information to see if an examinee asks for clarification.

Relating Awareness to SPC and PEERS Outcomes: One of the areas that was consistently brought up by parents in the semi-structured interview was the concept that their teens had an increased "awareness", "understanding" and "mindfulness" of others and of social norms. Laugeson and Park (2014) describe the elements that make PEERS a successful social skills training program. However, the mechanism of change experienced by teens that successfully improves their ability to make and maintain friendships is not well understood. An interesting avenue for future research would be to examine the relationships between social awareness and SPC with PEERS outcome measures such as social skills knowledge, frequency of get-togethers/social contacts, social skills, autistic symptomology, anxiety and empathy.

Larger scale research: Our research was a pilot study and as such was exploratory in nature. Based on sample size we were are unable to generalize out findings to future participants of the PEERS program. While aspects of the PRS appeared to show improvements in specific areas, such as Exchange of Information, a larger scale study is necessary to more conclusively investigate what areas of SPC are changing as a result of the program.

Summary and Conclusions

PEERS is a manualized social skills program for adolescents with ASD. Challenges in SPC and the social outcomes of individuals with ASD are related; thus, targeting improved social skills may lead to improvements in SPC, and subsequent improved social outcomes. Indeed, this research provides preliminary evidence, supported by consistent improvement across measures that target SPC (CCC-2, YiPP, PRS and semi-structured parent interview) and across participants, for improved SPC following participation in the PEERS program. Our preliminary positive findings also suggest that further investigation into SPC changes with respect to PEERS is warranted, and potentially with a focus on Exchange of Information. However, evaluation of SPC in the future should carefully consider balancing the need for standardization and the complexity and naturalness present in a conversational interaction.

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Date:			**Video Name:**			**Coder's initials:**
Error score: 2 = Correct/appropriate 1 = Mildly inappropriate, unusual response 0 = Incorrect/no response N/O = No opportunity given			**Cue Score**: 1 = Cue given 0 = No cue given N/O = No opportunity given		**Response Score**: 2 = Correct/appropriate 1 = Mildly inappropriate, unusual response 0 = Incorrect/no response N/O = No opportunity given	
	Behaviour	**Pragmatic Domain**	**Description**		**Initial Response**	**Cue Given**	**Cued Response**
1.	Initiation	DM	Appropriately starts talking when adult does not.				
2.	Request Information	DM	Asks examiner for additional information.				
3.	Hypothesizing	CF	Offer help or give a reason why tape recorder is not working.				
4.	Request Clarification: muffled speech	CR	Appropriately asks for repetition or indicate misinterpretation verbally.				
5.	Background information	DM	Provides relevant background information to assist examiner's understanding.				
6.	Comment contingently	P	Provides comments relevant to the topic.				
7.	Request Clarification: decreased volume	CR	Appropriately ask for repetition or indicate misinterpretation verbally.				
8.	Request Clarification: unfamiliar acronym	CR	Appropriately indicate misunderstanding verbally.				
9.	Presupposition (statement with incorrect article)	P	Indicates confusion because the information (article) contained in the sentence is not known and, therefore, the sentence does not make sense to the subject.				
10.	Presupposition (need additional information)	P	Indicates confusion because the information (noun) contained in the sentence is not known and, therefore, the sentence does not make sense to the subject.				
11.	Presupposition (statement with ambiguous pronoun)	P	Indicates confusion because the information (pronoun) contained in the sentence is not known and, therefore, the sentence does not make sense to the subject.				
12.	Request clarification	CR	Appropriately indicate misunderstanding verbally				
13.	Termination	DM	End conversation appropriately when indicated.				
14.	Response to cues to change speakers	DM	Stop talking when the conversational partner attempts to take the floor.				
15.	Topic Maintenance	DM	Ability to respond to the conversational partner's bids and add to the topic (for three turns)				
16.	Comment/Notice	CF	A look, or comment that acknowledges the even (event marked by bell or falling block sound).				
17.	Request Object	CF	Appropriately requests an object needed to				

			complete the task.			
18.	Express Denial/Comment on Object	CF	Comment or deny wrong object than one requested			
19.	Insufficient Information	P	Appropriately asks for clarification of missing information on the questionnaire			

Appendix A1

YiPP Coding Form

Appendix A2

PRS Coding Form

Instructions: Rate each video using the scale below on how often each item occurs.

Rating scale:

0 = Never
1 = Rarely
2 = Sometimes
3 = Often
4 = Always

CNR = could not rate
N/O = no opportunity to rate

Pragmatic Rating Scale (PRS)		
	Code	**Notes**
Paralinguistic Behaviours (**positive behaviours**)		
1. Posture/Physical position		
2. Gestures		
3. Facial expressions		
4. Gaze		
Speech/Prosody Behavior		
5. Scripted, stereotyped sentences or discourse		
6. Awkward expression of ideas		
7. Indistinct speech/mispronunciations		
8. Rate of speech is too rapid		
9. Intonation is unusual		
10. Volume is inappropriate (note too loud/soft)		
11. Unusual timing of responses, reformulations		
12. Unusual rhythm of speech such as stuttering		
Pragmatic Behaviours		
Tone		
13. Strikingly candid		
14. Overly direct or blunt		
15. Inappropriately formal		
16. Inappropriately informal		
Exchange of Information		
17. Overly talkative		
18. Out of sync content/unannounced topic shifts		
19. Topic preoccupation/perseveration		
20. Unresponsive to examiner's cues		
21. Little reciprocal to-and-fro exchange		
22. Terse		
Conversational Content		
23. Irrelevant/inappropriate detail		
24. Confusing accounts		
25. Insufficient background information		

26. Failure to reference pronouns, terminology		
27. Inadequate clarification		
28. Vague		
29. Odd humour		