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Observed Effects of the PEERS Social Skills Intervention for a Diverse Sample of
Adolescents with ASD

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ABSTRACT OF THE THESIS

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by

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Master of Arts, Graduate Program in Education
University of California, Riverside, March 2020
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Adolescents with autism spectrum disorder (ASD) have difficulty initiating and maintaining conversations with peers, affecting their ability to develop friendships (Reichow & Volkmar, 2010). Social skills interventions targeting conversational skills (e.g., the PEERS intervention) have demonstrated effectiveness (Laugeson et al., 2009, 2012), but few studies have utilized objective behavioral outcome measures. The Contextual Assessment of Social Skills (CASS; Ratto et al., 2011) is the most commonly used observational measure of conversational skills following the PEERS social skills program, but its specificity to the skills targeted has been under-examined. This study evaluates the utility of an adapted version of the CASS in measuring changes in conversational skills following a social skills intervention with a diverse sample of adolescents with ASD. Seven adolescents with ASD and their parents attended concurrent weekly 90-minute PEERS sessions over 16 weeks. Preliminary analyses

revealed consistent improvements in several conversational domains. Observed improvements were associated with parent-reported gains in social responsiveness and increased adolescent social skills knowledge.

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Introduction

Adolescents with autism spectrum disorder (ASD) have challenges with social interaction and communication, affecting their ability to initiate and maintain conversations with peers (Reichow & Volkmar, 2010). Conversations are the primary mechanism by which adolescents interact with their peers. Thus, the conversational difficulties that adolescents with ASD experience impact their ability to develop and maintain friendships. Not surprisingly, adolescents with ASD report poorer quality friendships, greater loneliness, and greater social anxiety than their typically developing peers (Bauminger & Kasari, 2000). Social skills have therefore been a primary target for intervention, especially among adolescents with ASD with average cognitive abilities. With an increase in the prevalence of ASD in the last few decades, there has also been an increase in research evaluating the effectiveness of social skills interventions. However, evidence for the effectiveness of these interventions is limited, often due to methodological issues, including limited outcome measures (Wolstencroft et al., 2018). The use of multiple informant reports on questionnaires in combination with observational measures is considered the gold standard for assessing social skills gains, but few studies have utilized both types of measures (Stratis & Lecavalier, 2015). In addition to a lack of both objective and subjective forms of assessment, there is a lack of reported diversity in social skills interventions that have demonstrated effectiveness.

Latinx families, especially those who are economically disadvantaged, have been consistently underrepresented in ASD intervention research (Bernal & Domenech Rodríguez, 2009; Ratto et al., 2017) in general, and in social skills intervention research

in particular. The Inland Empire region of Southern California, where this research was conducted, represents an ethnically and economically diverse geographic area, with a Latinx population of over 50% (Thorman, Hsieh, & Bohn, 2018) and an average annual wage ranked second to last of all metropolitan areas in the country (Kelly, 2008).

Previous research on adapting ASD treatment for Latinx samples indicates that cultural adaptation is necessary for successful intervention implementation (Huey & Polo, 2008; Ratto et al., 2017). Thus, the goals of the current study are two-fold: 1) to evaluate individual and group level changes in observed conversational skills following an evidence-based social skills intervention known as PEERS, and 2) to examine the effectiveness of PEERS with minor cultural adaptations with a sample of primarily Latinx adolescents in the Inland Empire. A mixed methods approach is used to evaluate individual and group level changes in adolescents' observed conversational skills following treatment.

Social Deficits among Adolescents with ASD

Adolescence is a time of increased emphasis on peer relationships, and decreased reliance on parents. For adolescents with ASD, this may be a particularly difficult period, marked by negative social outcomes, such as fewer friends, lack of social support, increased peer rejection, and limited social engagement (Shattuck, Orsmond, Wagner, & Cooper, 2011). Impairments in social functioning are a defining characteristic in ASD and impact many areas of an adolescent's life (American Psychiatric Association, 2013). Research suggests that social skills deficits are often the most significant challenge for

individuals with ASD, impacting their ability to develop and maintain meaningful friendships (Reichow & Volkmar, 2010; Church, Alisanski, & Amanullah, 2000).

Conversational skills, in particular, are an area of difficulty for adolescents with ASD, due to their deficits in social communication, social awareness, social motivation, and social cognition (Carter, Davis, Klin, & Volkmar, 2005; Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012). For example, adolescents with ASD may have difficulty with topic initiation and may use repetitive themes in conversations. Their conversations tend to lack reciprocity, and they often fail to identify common interests with peers (Laugeson, 2013). Difficulties understanding social cues or picking up on nonverbal communication, as well as difficulties understanding the perspectives of others, may exacerbate these challenges. In addition, adolescents with ASD are less involved in social activities and have less peer entry attempts than typically developing youth, limiting their conversational opportunities (Chevallier et al., 2012; Shattuck et al., 2011). These conversational challenges and limited opportunities for social interaction make developing and maintaining friendships difficult for adolescents with ASD (Laugeson, 2013, 2014; Laugeson & Frankel, 2010).

The social difficulties common to youth with ASD have not been found to improve on their own or as these youth grow into adolescents and adults (Church et al., 2000). Rather, the social difficulties may become even more apparent in adolescence, due to changing social demands and the increasing complexity of social life (White, Keonig & Scahill, 2007; Schall & McDonough, 2010). In addition, cognitive functioning does not appear to lessen the impact of these social deficits. On one hand, adolescents with

ASD who have average to above average cognitive abilities have been found to initiate more social interaction than their lower-functioning peers (Bauminger, Shulman, and Agam, 2003). However, these ‘higher-functioning’ adolescents may also interact with peers in ways that limit their opportunities for social success. They may barge into conversations, make inappropriate comments, perseverate on specific topics, or use humor inappropriately, with little regard for how their conversational partner perceives them. Due to their difficulties with understanding social cues, adolescents with high-functioning ASD have been described as standing out from their peers socially. In addition, the lack of an apparent disability may increase their likelihood of peer rejection (Church et al., 2000) and bullying (Zeedyk, Rodriguez, Blacher, & Baker, 2016; Zeedyk, Rodriguez, Tipton, Baker, & Blacher, 2014).

Consequences of Social Deficits

Despite the social deficits inherent in ASD, the literature suggests that adolescents with ASD have a desire for social involvement and relationships. Unfortunately, accomplishing these goals may be difficult for these adolescents (Chevallier, Grèzes, Molesworth, Berthoz, & Happé, 2012; Locke, Ishijima, Kasari, & London, 2010). For example, in a study by Mazurek and Kanne (2010), only 15% of adolescents with ASD had a clearly reciprocal friendship involving interaction outside of school, and 24% had no peer relationships whatsoever. In another study, 43% of adolescents with ASD never had get-togethers with their friends outside of school, as reported by parents (Shattuck et al., 2011). In a study by Bauminger and Kasari (2000), adolescents with high-functioning ASD reported having friends, but experienced poorer friendship quality and greater social

isolation and loneliness than their typically developing peers. Similarly, Church and colleagues (2000) found that all middle-school age adolescents with high-functioning ASD expressed interest in interacting with their peers to some degree. However, their socially awkward behaviors affected their peer relationship development, with most adolescents reporting concerns over making friends or not having any friends. The high-school age adolescents in this study also had notable social skills difficulties, including not knowing how to start conversations and needing adult support to help facilitate social interactions at school. In addition, their parents reported that these adolescents were more socially isolated than their typically developing siblings (Church et al., 2000).

To summarize, friendships serve as protective factors in adolescence, predicting overall adjustment in life and buffering the impact of stressful life events (Buhrmester, 1990). Having meaningful friendships is associated with increased self-esteem and independence, and decreased loneliness, depression, and anxiety (Bollmer, Milich, Harris, & Maras, 2005; Matson, Smiroldo, & Bamburg, 1998; Miller & Ingham, 1976). On the other hand, peer rejection is associated with the development of mental health problems, juvenile delinquency, early withdrawal from school, substance abuse, and even suicidal ideation and attempts (Buhrmester, 1990; Matson, Smiroldo, & Bamburg, 1998; Miller & Ingham, 1976). Consequently, it is unsurprising that individuals with ASD report greater levels of anxiety and depression as compared to their typically developing peers (Bauminger et al., 2003; Shtayermann, 2007; Sze & Wood, 2007).

Social Skills Interventions for Adolescents with ASD

Unlike typically developing adolescents, adolescents with ASD are unlikely to learn the basic rules of social etiquette (Gralinski & Kopp, 1993; Rubin & Sloman, 1984). For adolescents with ASD with average to above average intellectual functioning, who make up an estimated 44% of those with ASD (Baio et al., 2018), social skills are often the primary treatment priority. In particular, group-based social skills interventions (GSSIs) are widely used for youth with ASD (Gates, Kang, & Lerner, 2017). Despite their popularity, research on the effectiveness of GSSIs has been limited by methodological weaknesses and lack of skill generalization (Wolstencroft et al., 2018). A recent meta-analysis conducted by Gates and colleagues (2017) found a medium overall effect size ($g = 0.51$) for GSSIs for youth with ASD. However, many of these studies were lacking in generalizable effects, and did not include long-term follow-up or replication. Various methods, including parent participation and peer mediation, have been proposed to promote generalization and maintenance of treatment gains (Kasari, Rotheram-Fuller, Locke, & Gulsrud, 2012; DeRosier, Swick, Davis, McMillen, & Matthews, 2011). However, another limitation of GSSI studies is that self-reported gains have generally been reported in social knowledge, but not in social behavior, suggesting that observed treatment gains may not be clinically meaningful (Gates et al., 2017; White et al., 2007).

In addition, most research on social skills interventions has focused on children under the age of 12. A 2012 meta-analysis identified 34 GSSI studies from early childhood through late adolescence, only two of which focused on adolescents (Kasari &

Patterson, 2012). Similarly, a best evidence synthesis of 66 studies on GSSIs found only three studies that included adolescent or adult participants (Reichow & Volkmar, 2010). However, a growing body of literature suggests that this is a promising intervention modality for individuals with ASD across the lifespan (Ellingsen, Bolton, & Laugeson, 2017; Kasari & Patterson, 2012; Laugeson, Frankel, Gantman, Dillon, & Mogil, 2012; Laugeson, Frankel, Mogil, & Dillon, 2009; Leaf et al., 2017; Lerner & Mikami, 2012; Lopata, Thomeer, Volker, Nida, & Lee, 2008; Minihan, Kinsella, & Honan, 2011; Vernon, Miller, Ko, & Wu, 2016; White et al., 2013). The largest and most recent meta-analysis on GSSIs for youth with ASD between the ages of 5 to 21 identified 14 studies using a randomized controlled trial (RCT) design, four of which involved adolescents (Gates et al., 2017). Three out of these four studies examined the *Program for the Education and Enrichment of Relational Skills* (PEERS; Laugeson & Frankel, 2010), a manualized parent-assisted program for adolescents with high-functioning ASD. The fourth study examined the *Multimodal Anxiety and Social Skills Intervention* (MASSI; White et al., 2013) for adolescents with ASD and anxiety. Findings from these four studies are summarized below.

The 20-session MASSI program was conducted with adolescents ages 12 to 17 who met criteria for ASD and an anxiety disorder. The intervention includes both group (7 sessions) and individual therapy (13 sessions) with two weekly sessions, uses a flexible modular approach, and incorporates both parent coaching and peer tutors. Results of the randomized trial were positive, with parents reporting significant improvements in autism symptomatology; however, reductions in anxiety symptoms were not statistically

significant (White et al., 2013). Limitations of this study were the small sample size (only 25 adolescents completed the randomized trial), limited outcome measures (parent-report only), and feasibility concerns (coordination of both group and individual therapy with twice-weekly sessions). Additionally, the MASSI study was conducted by the intervention developer, and no independent research groups have since replicated these findings.

The three PEERS studies included in the 2017 meta-analysis were conducted by the developer of the intervention and two independent research groups (Laugeson et al., 2009; Schohl et al., 2014; Yoo et al., 2014). In all three of these studies, the manualized PEERS intervention was delivered in a weekly 90-minute format for 12 to 14 weeks, with concurrent but separate adolescent and parent groups. 138 adolescents between the ages of 11-18 participated in the PEERS intervention across the three studies. In the first RCT on PEERS, Laugeson and colleagues (2009) reported significant improvements in adolescent-reported knowledge of social skills, increases in adolescent-reported frequency of social engagement, and improvements in parent-reported social skills. Though teacher data were also collected, no significant improvements were found in teacher-reported social skills, likely due to a poor return rate of questionnaires (Laugeson et al., 2009).

Schohl and colleagues (2014) conducted an independent replication and extension of the PEERS intervention to evaluate its effectiveness in reducing social anxiety. Adolescents in this study not only demonstrated increased social skills knowledge and social engagement, but also showed decreased levels of social anxiety, core autism

symptoms, and problem behaviors following treatment. This study also extended the original findings by demonstrating independently rated treatment gains; teachers who were not directly involved in treatment reported reductions in problem behaviors that were similar to those reported by parents. However, parent- and teacher- reports of overall social skills gains following intervention did not reach statistical significance. Additionally, findings were limited by a lack of diversity in the sample (participants were all Caucasian) (Schohl et al., 2014).

In a Korean cross-cultural validation trial of PEERS, Yoo and colleagues (2014) reported similar improvements in adolescent- and parent- reported social skills. This study further extended previous findings by using direct observation and formal assessment to evaluate improvements, and by including parent outcome data. Questionnaire findings revealed significant improvements in adolescent-reported social skills knowledge and significant reductions in adolescent depressive symptoms and anxiety. Additional improvements were seen on the Korean version of the Vineland Adaptive Behavior Scales, in the subdomain areas of interpersonal relationships and play/leisure time. Positive parent outcomes, including reductions in maternal state anxiety, were also noted following treatment. Additionally, adolescents demonstrated improvements in the communication and social interaction domain scores on the Autism Diagnostic Observation Schedule (ADOS). The treatment gains were maintained three months after treatment, with the exception of the observed gains on the ADOS, since it was not administered at follow-up. Noted limitations in this study were that the ADOS

administration was only partially blinded and third party ratings were not included (Yoo et al., 2014).

In addition to the three PEERS studies included in the meta-analysis by Gates and colleagues, five additional RCTs have been conducted on the PEERS for Adolescents intervention (Laugeson et al., 2012; Matthews et al., 2018; Jagersma et al., 2018; Shum et al., 2018; Rabin et al., 2018). These include replications by several research groups and cross-cultural validation studies conducted in China, the Netherlands, and Israel. Taken together, the findings suggest that the PEERS intervention is efficacious in improving adolescent social functioning, based on parent, teacher, and adolescent self-report. Notably, a follow-up study conducted by (Mandelberg et al., 2014) suggests that improvements in social responsiveness, social skills, frequency of peer interactions, and social skills knowledge were maintained 1-5 years following treatment. Though the PEERS intervention has a strong literature base relative to other social skills interventions for adolescents with ASD, most of the reported treatment gains have come from the participants themselves. As parents and adolescents are directly involved in treatment and are therefore highly motivated to see improvements, their reports are inarguably biased. Therefore, valid and reliable measurements of treatment outcome following PEERS requires greater attention.

Measuring Social Skills Treatment Outcome

Although the social deficits associated with ASD are well-documented, the assessment of these deficits and an individual's response to treatment targeting these deficits is largely dependent upon informant perceptions. In particular, assessing social

functioning in adolescents with high-functioning ASD is complicated by conflicting reports by the adolescents themselves, their parents, and other important informants in the adolescents' lives, including teachers, clinicians, and service-providers (Stratis & Lecavalier, 2015). Research has demonstrated widely heterogeneous concordance rates between informant reports in assessing psychiatric symptoms in adolescents with ASD. These discrepancies are dependent upon the instrument used, the disorders under investigation, and the informant characteristics (Mazefsky, Kao, & Oswald, 2011). Informants have their own biases, attributions, and expectations that clearly influence their report (Stratis & Lecavalier, 2015). Moreover, informants may also be influenced by the amount of time they spend with the adolescent they are reporting about, and in turn the adolescent's behavior may be impacted by the presence of the informant (De Los Reyes, 2011; Hoyt, 2000). Self-report measures are also commonly used in the assessment of youth with social challenges, but numerous research studies have suggested that self-report of adolescents with ASD should be interpreted with caution (Stratis & Lecavalier, 2015). One such study found that children and adolescents with ASD reported greater levels of social skills and social competence, compared to parent-reports of the same constructs (Knott, Dunlop, & Mackay, 2006).

Another limitation of relying solely on informant reports to assess treatment outcome is that certain symptoms of a disorder may not appear across contexts, limiting the ability of a single informant to accurately report on these behaviors (Achenbach, McConaughy, & Howell, 1987; De Los Reyes, 2011). The use of multiple informants in the assessment of psychological functioning is considered a "gold standard" in the

assessment of psychopathology in children and adolescents (e.g., Mash & Hunsley, 2005). However, due to their inherent bias, questionnaire measures should be combined with other more objective measures of treatment outcomes, such as behavioral observations, cognitive or neuropsychological measures, and sociometric tasks (Gates et al., 2017; Kaat & Lecavalier, 2014). Observations of behavioral change by blind raters may be one of the most objective measures of treatment outcome, but they have not been used as frequently as questionnaire measures (Kaat & Lecavalier, 2014).

Only two of the RCTs conducted on the PEERS for Adolescents intervention have utilized observational measures. Yoo and colleagues (2014) used the ADOS, and though improvements were demonstrated, the use of this tool to measure treatment outcome is problematic due to concerns over its sensitivity to change and practice effects (Lord et al., 2005). More recent studies on the PEERS intervention have utilized the Contextual Assessment of Social Skills (CASS; Ratto, Turner-Brown, Rupp, Mesibov, & Penn, 2011). This measure and its use in evaluating PEERS treatment outcome are described below.

The CASS as an Outcome Measure for PEERS

The CASS is a semi-structured live role-play measure of conversational skills, designed for use with adolescents and young adults with ASD with average cognitive abilities. The measure consists of a 3-minute filmed conversation between the adolescent and an unfamiliar peer (i.e., a research confederate). The original CASS paradigm has two conditions; in the first, the confederate shows interest and engagement in the conversation, and in the second, the confederate acts bored and uninterested. Blind and

independent raters code these conversations for nine items related to conversational skills; two items are frequency counts (asking questions and topic changes), and the other seven are on a 1-7 Likert scale (e.g., overall involvement in the conversation, quality of rapport, etc.). The CASS may be a promising treatment outcome measure for PEERS for several reasons: 1) it reflects the common social errors made by adolescents and adults with ASD; 2) it is a direct assessment of an individual's social interactions with similar-age peers, which typically constitutes the greatest challenge for individuals with high-functioning ASD; 3) it is brief, practical, and cost-effective; and 4) confederates can be quickly trained, and raters are quickly able to become reliable in coding filmed interactions (White et al., 2015).

To date, three published studies have used the CASS to evaluate the effects of PEERS (White et al., 2015; Dolan et al., 2016; Rabin et al., 2018). In a preliminary study on the utility and sensitivity of the CASS as a treatment outcome measure for PEERS, White, Scarpa, Conner, Maddox, and Bonete (2015) used the CASS with five adults ages 19 to 27 at pre- and post- intervention, with opposite-gender confederates, as in the Ratto et al. (2011) study. Confederates in this study were undergraduate and graduate students. Findings were promising, with four participants demonstrating significant improvements in conversational involvement, two initiating significantly more topic changes, and one asking significantly more questions. Although all five participants obtained higher scores for most of the "interested" conversation domains following intervention, change was not seen for all participants, and change was not consistent across all rated items on the CASS. Despite the variability in the statistical significance of improvements in these

participants, the researchers concluded that the CASS may be a sensitive treatment outcome measure with respect to specific social behaviors, particularly conversational involvement.

Dolan and colleagues (2016) adapted the CASS paradigm and used it with a subset of 53 adolescents from the Schohl and colleagues' RCT. In this study, the peer interactions were extended to 10 minutes, and were with gender-matched peers who were typically developing high school students. Also in contrast to the original CASS paradigm, adolescents and confederates were told that they could play the interlocking tower puzzle Jenga, work on a traditional puzzle, and/or chat and hang out. Further, only the "interested" condition was used in this study, as it was thought to be a better representation of typical social interactions (White et al., 2015). Following treatment, participants demonstrated significant improvements in vocal expressiveness, as well as improvements in quality of rapport, although the latter did not reach significance. Additionally, improvements in adolescent-reported social skills knowledge correlated with improvements in quality of rapport on the CASS, suggesting that adolescents who gain a better understanding of social skills are able to implement them more appropriately in vivo. The authors noted that the lack of significant improvements across all domains on the CASS may be explained by the fact that many of the CASS items do not directly relate to the skills taught in PEERS. Moreover, although adolescents may understand the concepts from PEERS following intervention, it may take more time for them to develop and implement the skills in vivo; thus, the authors suggest that future research should use

the CASS paradigm at a 6-12 month follow-up period, after adolescents have had more time to practice the newly learned skills (Dolan et al., 2016).

Correspondingly, Rabin and colleagues (2018) were the first to use the CASS to evaluate the maintenance of intervention effects at a 4-month follow-up in 37 adolescents ages 12-17. Similarly to Dolan and colleagues, only the “interested” condition was used. Confederates were opposite-gender peers, whose ages were not reported. Intervention effects were seen for quality of rapport; however, the RCT results did not demonstrate a significant difference in this domain between the intervention and control group, likely due to insufficient power. Rabin and colleagues extended previous findings by demonstrating significant improvements in overall involvement in the conversation, question asking, and reduced kinesic arousal (e.g., fidgeting/moving about) at post-treatment; these gains were maintained at follow-up assessment. Additionally, unlike the White and colleagues study, the CASS total score was shown to significantly improve, suggesting meaningful changes in adolescents’ conversational skills. Finally, the researchers found that improvements in conversational involvement predicted parent-reported social skills improvement, suggesting that this item may represent the most salient domain on the CASS (Rabin et al., 2018).

Overall, studies suggest that the CASS may be a promising behavioral observational tool for measuring generalization of the skills learned in PEERS. Various paradigms have been employed, including using opposite-gender versus matched-gender confederates, 3-minute versus 10-minute interactions, and “interested” only versus both conditions. Outcomes have been measured on both an individual and group level, and

some studies utilized the CASS total score, while others only analyzed individual items on the CASS. Although these studies have been inconsistent in demonstrating statistically significant improvements, they have provided validation for the changes perceived by parents, teachers, and adolescents following treatment. Taken together, the research suggests that the most salient items on the CASS for measuring PEERS treatment outcome are conversational involvement, quality of rapport, and vocal expressiveness. Still, many of the findings were only marginal, likely due to the lack of a direct relationship between the PEERS skills and items rated on the CASS. As the CASS was not developed as a treatment outcome measure for PEERS, the addition of new items specifically tied to the skills taught in treatment may enhance the tool's sensitivity and specificity as an outcome measure.

Objective

The purpose of this study is to examine the effectiveness of an observational measure used to assess the impact of an evidence-based social skills intervention with a predominantly Latinx sample of adolescents with ASD. Since this study is somewhat underpowered, it should be considered exploratory. It is a replication and extension of the previous PEERS intervention studies and aims to address limitations of previous studies in the following ways. First, the study extends previous research on the CASS paradigm as a treatment outcome measure for PEERS by adding new items that directly relate to the particular skills taught in PEERS. Second, the study participants were largely bilingual Latinx adolescents and their parents. Thus, the observational measure was added to overcome possible language or cultural differences that might render the paper-

and-pencil measures less valid. Third, the study uses gold standard methods of diagnostic screening for ASD in the selection of participants, resulting in a well-characterized sample – something that isn't universal in studies using PEERS.

The following research questions were addressed: 1) Do Latinx adolescents show improvements in conversational skills on the original CASS items following treatment? 2) Do the newly added items to the CASS paradigm demonstrate sensitivity to change following treatment? 3) How do improvements in CASS scores relate to improvements on rating scales of social competence (i.e., parent-reported social skills and autism symptoms, and adolescent-reported social skills knowledge)? It was hypothesized that adolescents would demonstrate the greatest improvements on the original CASS items that are most related to the skills taught in PEERS (i.e., overall conversational involvement, quality of rapport, vocal expressiveness), as well as on the newly added items to the CASS rating system (e.g., asking more follow-up questions on the same topic, making fewer socially inappropriate remarks). It was secondarily hypothesized that improvements in CASS scores would correlate with improvements in parent- and self-reported social functioning.

Methods

Recruitment and Eligibility

In an effort to increase the accessibility and feasibility of the intervention for Latinx families in the Inland Empire region of Southern California, focus groups were conducted with parents to determine the applicability of the PEERS program. Overall, parents endorsed the feasibility of the PEERS intervention and had a desire to participate.

Several families who attended the focus groups were recruited for participation. Additional families were recruited from local school districts, community organizations, parent advocacy groups, and flyers posted in the community. To be eligible for the study, there were several recruitment criteria for youth participants: 1) age range from 11 to 18 years and currently in middle school or high school; 2) previous diagnosis of ASD, as confirmed by the Autism Diagnostic Observation Schedule, 2nd edition (ADOS-2; Lord et al., 2012); 3) IQ above 70, as confirmed by the Wechsler Abbreviated Scale of Intelligence, 2nd edition (WASI-II; Wechsler, 2011); 4) ability to speak and understand English; and 5) indicated willingness to participate. Criteria for parent participants included a) ability to understand and speak either English or Spanish, and b) commitment to attend consistently as a social coach. Exclusionary criteria for youth included a) a history of major mental illness (e.g., psychosis), b) hearing, visual, or physical disabilities that would prevent participation in outdoor activities, c) current problems with severely aggressive or oppositional behaviors, d) history of seizure disorder, and e) other physical or neurological illnesses that would inhibit participation in treatment. This study was approved by the Institutional Review Board at the University of California, Riverside. In addition to the standard consent, this study required consent by both youth and parents to be filmed for training purposes, and to release their phone number to the other group members for the purpose of completing homework assignments.

Participants

Participants in the current study were seven adolescents (six males and one female) ages 11-16 ($M=13.3$, $SD=1.9$) with ASD. Five participants were in middle

school, and two were in high school. Four participants were Latinx, one was biracial (Latinx and Black), and two were Caucasian. Four participants attended sessions with their mothers, two attended with their fathers, and one attended with both his mother and father. Parent participants spoke English, with the exception of one exclusively Spanish-speaking mother. Several parents were bilingual in English and Spanish. ASD diagnoses were confirmed using the ADOS-2 Module 3 for five of the participants, and Module 4 for the other two participants, based on age appropriateness; all participants met criteria for autism or autism spectrum disorder. All participants had an IQ above 70 as confirmed by the WASI, but there was wide variability in IQ scores, ranging from 77 to 129 ($M=104.1$, $SD=17.4$). Four participants had parent-reported comorbid diagnoses; three participants had ADHD, two of whom had an additional diagnosis of depression or anxiety. The fourth participant had a speech-language impairment. All teen participants were currently receiving one or more services in school or in the community, including speech therapy, occupational therapy, ABA, and/or counseling. No participants were presently receiving social skills training outside of the study. One participant was taking medication. Table 1 presents demographic information for each participant.

Table 1. Participant Demographic Information

Participant	Age (years)	Grade	Ethnicity	Parent	ADOS total	FSIQ	Comorbid diagnosis?
Kate	13	8	Caucasian	Father	10	92	ADHD, depression
Dan	11	6	Caucasian	Father	7	129	None
Adrian	13	8	Biracial - Latinx/Black	Mother	20	107	ADHD, anxiety
Eduardo	12	7	Latinx	Mother	10	77	ADHD
Alejandro	16	11	Latinx	Both	15*	102	SLI
Fabian	12	6	Latinx	Mother	15	101	None
Jose	16	11	Latinx	Mother	12*	121	None

Note. ADOS = *Autism Diagnostic Observation Schedule*, 2nd edition; ADOS total = ADOS-2 total score; * = ADOS-2 module 4 administered; FSIQ = full scale intelligence quotient estimated by the *Wechsler Abbreviated Scale of Intelligence*, 2nd edition; ADHD = attention deficit hyperactivity disorder; SLI = speech-language impairment.

Procedure

Adolescent eligibility was initially assessed during a phone screening interview with the parent using the Phone Screening Script from the PEERS Treatment Manual (Laugeson & Frankel, 2010). Adolescent motivation to participate was assessed during a brief phone call with the adolescent, and again during an intake appointment using the Teen Mental Status Checklist from the manual. Prior to participating in treatment, all families came in individually for two separate appointments at the UCR Eady Center.

During the first appointment, informed consent and child assent were obtained; the WASI was administered to confirm an IQ above 70, and the ADOS-2 was administered to confirm an ASD diagnosis. Adolescents and parents completed various questionnaires, including a demographic questionnaire, measures of adolescent social functioning, measures assessing parent acculturation and language, and measures assessing parent and family impact. Adolescents and parents returned to the Eady Center within a 2-month period for a second appointment, consisting of a 3-minute

conversational interaction with an unfamiliar peer (CASS). Within two weeks following the 16-week treatment, adolescents and parents came in for a post-appointment and completed all the same measures from both the first and second pre-appointments, excluding the diagnostic and cognitive assessments, demographic questionnaire, and Teen Mental Status Checklist. Four months later, families came in for a follow-up appointment, which was identical to the post-appointment, in order to assess maintenance of treatment gains. To increase retention rates, families were each compensated \$110, spread out throughout the pre, post, and follow-up appointments.

Treatment

The PEERS Curriculum for School-Based Professionals (Laugeson, 2014) comprised the intervention. It was administered in a 16-week format, and it was used concurrently with the original PEERS Treatment Manual (Laugeson & Frankel, 2010) for the parent portion of the intervention. Adolescents and parents attended 90-minute concurrent but separate sessions. Treatment was conducted by two PEERS Certified Providers, and all procedures were overseen by a licensed psychologist. Behavioral coaches who were undergraduate or graduate students assisted with role-play demonstrations, behavior management, attendance and homework tracking, and tracking treatment fidelity.

Treatment sessions focused on teaching ecologically valid social skills specific to making and keeping friends and handling peer conflict and rejection. Skills were taught using didactic instruction in a small group format, which included role-play demonstrations, behavioral rehearsal activities with reinforcement and corrective

feedback, and weekly homework assignments related to social engagement (Ellingsen et al., 2017). To promote generalization of the skills outside of the clinic setting, parents were taught how to become social coaches for their teens by using key words taught by the program when providing feedback or practicing skills at home, and identifying appropriate extracurricular activities that can serve as a source of friends for their teens. Weekly parent handouts and homework assignment sheets were provided to parents to assist in social coaching (Ellingsen et al., 2017; Laugeson et al., 2009, 2012).

Topics of instruction included using appropriate conversational skills; choosing appropriate friends, using electronic communication appropriately and safely; using humor appropriately; initiating, joining, and exiting conversations with peers; organizing successful get-togethers; being a good sport when playing games/sports with peers; handling arguments and disagreements; handling rejection, teasing, bullying, rumors/gossip and cyber bullying; and changing a bad reputation (Laugeson, 2014). Treatment fidelity was assessed using a checklist. Behavioral coaches were responsible for ensuring that the group leader covered each component of the intervention in the treatment manual. If the group leader skipped any section or skill covered in the manual, behavioral coaches were instructed to raise their hands during the group and ask a question about this section/skill, indirectly reminding the group leader to cover it. This resulted in 100% treatment fidelity in both the adolescent and parent groups.

Spanish translation and adaptation. In an effort to adapt the PEERS intervention for Latinx families, several materials were translated into Spanish prior to the start of the program, including the parent handouts and homework assignment sheets, the program

welcome letter, the planned absence sheet, and the graduation flyer. The adolescent groups were conducted in English, and the parent groups were conducted simultaneously in English and Spanish by a bilingual group leader. As many of the parents recruited for this study were bilingual, a combination of English and Spanish in the parent group was determined to be the most culturally sensitive and inclusive format. For this preliminary study, minor cultural adaptations were made throughout the program. For example, many Latinx parents reported feeling overwhelmed with the homework assignments that required their teens to have get-togethers with peers, rather than family members. In response to this feedback, Latinx families were allowed to practice homework assignments with extended family members, as well as with non-related adolescent peers.

Measures

The following measures were administered prior to starting the PEERS intervention, and immediately following treatment.

Contextual Assessment of Social Skills (CASS; Ratto et al., 2011). The CASS is an observational measure of conversational skills designed primarily for adolescents and young adults with high-functioning ASD. Adolescent participants are asked to have a 3-minute conversation with an unfamiliar peer (i.e., a research confederate), who was not involved in the current intervention. The participant and confederate are told to “act as if you have recently joined a new club or social group”; the examiner then leaves the two in the room together to talk. The filmed interaction is then coded for nine items, including two frequency counts (number of questions asked, number of initiated topic changes), and seven 1-7 Likert scale items (vocal expressiveness, gestures, positive affect, kinesic

arousal, social anxiety, involvement in the conversation, and quality of rapport). The last two Likert scale items (conversational involvement and rapport) represent global ratings of conversational skills, and can be considered the most salient representation of social competence of the nine items. For the Likert scale items, a specific qualitative description accompanies each score, allowing raters to assign a score that best describes how the adolescent with ASD performed on a particular domain (for specific codes, see Ratto et al., 2011). Scores below a 6 indicate some level of social skill deficit, according to the CASS rating manual (Ratto et al., 2011). The CASS has high internal consistency on all nine items (standardized alpha = .83; Ratto et al., 2011), and previous research has supported the tool as a valid, reliable, and sensitive measure (White et al., 2015; Dolan et al., 2016; Rabin et al., 2018).

The original CASS paradigm included an “interested” and a “bored” condition, in order to measure an individual’s ability to adapt their social behavior to the social context (Ratto et al., 2011). The current study uses only the “interested” condition, as previous research on the CASS suggests that this condition would be the most likely to reflect changes following PEERS (White et al., 2015; Dolan et al., 2016; Rabin et al., 2018). The original CASS also recommends using opposite-gender confederates but the current study used gender-matched confederates, as PEERS is focused on developing friendships, and adolescents may be expected to develop friendships with same-gender peers (Dolan et al., 2016; Leonczyk, 2017). Three females and five males served as CASS confederates; five were undergraduate students, and two were graduate students. Confederates received approximately one hour of training, using the CASS script developed by Ratto and

colleagues (2011). Specifically, they were taught to demonstrate interest in the conversation by appearing warm and friendly, facing the participant, maintaining natural eye contact, smiling, leaning forward slightly, and using natural gestures and head nodding. Confederates were also taught to appropriately time pauses and to use prompts to maintain the conversation, while minimizing social initiation, to allow the participants ample opportunities to initiate. The confederates then practiced the role-play with the lead author before completing a CASS session. Following each CASS session, confederates watched their filmed interaction, and received feedback on their performance from the lead author in order to improve standardization for future sessions.

In addition to the original nine items coded on the CASS, seven new items were added to reflect the specific skills taught in PEERS. This includes four frequency items of open-ended questions, follow-up questions, appropriate questions, and inappropriate questions asked by the participants. These items reflect the quality and appropriateness of question asking, whereas the original CASS item on question asking only provides a frequency count. In PEERS, adolescents are taught to ask questions of their peers, but not to be an “interviewer” (e.g., ask too many questions) or ask “personal questions.” Thus, an increase in question asking may not be representative of improved conversational skills for participants who previously asked too many questions. In addition, three binary yes/no items were added, including inappropriateness of questions/comments, introductions (did the participant introduce themselves), and conversation hogging. Examples of inappropriate questions/comments were talking about politics, religion, sex, bodily functions, or other personal topics; conversation hogging or interviewing; saying,

“I’m bored/this is boring,” or asking if the time is up; and/or bragging, arguing, teasing, or correcting the confederate’s mistakes. These social errors were taken directly from the skills taught in PEERS. Conversation hogging was defined as “taking over” the conversation (e.g., talking for a long period of time about the same topic without asking the confederate questions or pausing for the confederate’s response, or clearly showing little regard for the confederate’s response). These new items were expected to better represent the adolescents’ implementation of the skills taught in PEERS.

Prior to the start of the study, the developer of the CASS conducted an off-site training with the author and research team on the measure’s development, administration, and scoring. Two undergraduate coders were then trained to reliability, by rating training videos provided by the authors (Ratto et al., 2011). The coders were required to achieve 80% agreement with Ratto et al.’s “gold” codes for the original items and the current author’s “gold” codes for the new items in order to become reliable. The coders rated four training videos to obtain reliability; inter-rater agreement occurred when raters were in full agreement on the binary yes/no items, and were within one point of each other on the Likert-scale and frequency count item ratings. Inter-rater reliability was calculated separately for the original and new codes, as well as for all 16 codes combined, by dividing the number of agreements by the total number of codes, and multiplying by 100 ($[(\text{number of agreements} / \text{total number of codes}) \times 100]$). Coders had high reliability with the authors’ “gold” codes on the training videos for both the original and new codes (.86 and .86-.89, respectively) as well as the 16 combined codes (.86-.88). For the current study, inter-rater reliability was established by double coding 100% of the videos. Coders

were blind to treatment status (pre, post, or follow-up). Reliability coefficients for the current study's videos were .74 for the original nine items, .80 for the seven new items, and .76 for the combined items.

Test of Adolescent Social Skills Knowledge—Revised (TASSK-R; Laugeson & Frankel, 2010). The TASSK-R is a 30-item criterion-referenced self-report measure that assesses an adolescent's knowledge of the social skills taught in the PEERS intervention. Items include sentence stems in which adolescents choose the best option from two possible choices, based on the PEERS didactic lessons. Previous PEERS studies found the TASSK to have high internal consistency and to be sensitive to intervention related change (Schohl et al., 2014; Yoo et al., 2014).

Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998). The SIAS is a 20-item self-report measure that assesses an adolescent's fears around social interaction (e.g., being boring, sounding stupid, being ignored). All items are rated on a 5-point scale based on the degree to which respondents feel that the given statement is characteristic of them; higher total scores indicate greater levels of social interaction anxiety. The SIAS has demonstrated good internal consistency, test-retest reliability, convergent and discriminant validity, and has shown sensitivity to post-treatment change (Mattick & Clarke, 1998; Osman, Gutierrez, Barrios, Kopper, & Chiro, 1998; McEvoy, Nathan, Rapee, & Campbell, 2012).

Social Skills Improvement System (SSIS; Gresham & Elliott, 2007). The SSIS is a standardized 79-item parent-report measure of social and behavioral functioning for children ages 3 to 18. The measure is designed to assess treatment-related changes in

social skills and problem behaviors. Parents are asked to indicate how often their child displays a particular behavior (e.g., “introduces him/herself to others”), by rating items on a 4-point Likert scale as “never”, “seldom”, “often”, or “almost always”. The SSIS has been found to have high internal consistency, and has been used extensively with youth with ASD (e.g., Gresham & Elliot, 2007; Gillis, Callahan, & Romanczyk, 2011).

Social Responsiveness Scale, 2nd Edition (SRS-2; Constantino & Gruber, 2012).

The SRS-2 is a standardized 65-item parent-report rating scale used to assess the severity of autism symptoms as they occur in natural settings for children ages 4 to 18. Previous research has demonstrated the measure to have high internal consistency and to be sensitive in detecting intervention-related changes in social functioning in children with ASD (e.g., Constantino & Gruber, 2012; Laugeson et al., 2012; Wood et al., 2009).

Data Analytic Plan

To assess the primary aim of examining changes in conversational skills on the CASS from pre- to post- treatment, descriptive statistics were analyzed to assess changes in means on the original and newly added items on the CASS. Similar to the White and Rabin et al. studies (2015 and 2018, respectively), the CASS total score was computed by adding each participant’s scores for question asking, topic changes, conversational involvement, and quality of rapport. In addition, a new CASS total score was computed by adding the scores for the CASS Likert scale items that had improved average scores at post-treatment in the current sample.

For the CASS items that either had improved average ratings or a 1-point change in either direction at post-treatment, paired samples t-tests were used to evaluate whether

these differences were significant on a group level. The expectation was that the global CASS items (i.e., conversational involvement and quality of rapport) and newly added items (e.g., improved quality of question asking, fewer inappropriate statements/questions) would demonstrate significant group-level changes. Next, mean difference scores were computed for the two global CASS items and new CASS total score to represent improvement following treatment. In addition to group-level analyses, pre and post CASS scores were graphed individually for each participant to visually examine individual changes in each conversational domain.

To assess the secondary hypothesis of whether improvements in CASS scores related to improvements on rating scales of social competence, paired samples t-tests were first conducted with questionnaire composite and total scores (i.e., TASSK-R, SIAS, SSIS, and SRS-2) to examine parent- and self-reported change from pre- to post-intervention. Bivariate Pearson correlations were then conducted between the mean difference scores of the global CASS items and new CASS total score and questionnaire total/composite scores. It was expected that improvements in CASS scores would correlate with improvements in parent-reported social skills and autism symptoms, and adolescent-reported social skills knowledge. With the exception of the individual case data that is graphed to display visually, the group-level analyses and examination of relationships to other measures of social competence are exploratory only.

Results

Group-Level Analyses of CASS Outcomes

A descriptive analysis of the original CASS items at pre- and post- intervention revealed higher average ratings in vocal expressiveness, gestures, positive affect, overall involvement, and overall rapport following treatment (see Table 2 and Figure 1 for descriptive statistics of original CASS items). Mean social anxiety scores were equal at pre- and post- intervention, and the average kinesic arousal score was lower (indicating increased fidgeting) post-treatment. Although overall involvement and rapport generally improved following treatment, participants in the current sample asked fewer questions and initiated fewer topics post-intervention. Consequently, no differences emerged on the CASS total score (comprised of question asking, topic changes, conversational involvement, and quality of rapport) from pre- to post- intervention. The original total score should therefore be interpreted with caution in the current sample, as it may not be an accurate representation of conversational competence.

To more accurately represent changes in conversational skills following PEERS, a new CASS total score was calculated by summing the five Likert scale CASS items that showed improved average scores in the current sample (vocal expressiveness, gestures, positive affect, conversational involvement, quality of rapport). Several of these items have demonstrated consistent improvements on previous studies using the CASS to evaluate PEERS (e.g., Dolan et al., 2016; Rabin et al., 2018). The frequency of question asking and topic changing were left out of the newly derived total score, as they were not

believed to be reflective of treatment gains. At a group level, the new CASS total score showed improvement following treatment (see Table 2).

The newly added CASS items of open-ended questions, follow-up questions, and appropriate questions did not increase in frequency as expected, as participants asked fewer questions at post-treatment on average. However, the number of inappropriate questions asked decreased from an average of .29 at pre-treatment (2 total inappropriate questions) to 0 at post-treatment (see Table 2 and Figure 2 for descriptive statistics of the newly added CASS frequency items). No changes were observed in the percentage of participants who asked inappropriate questions/made inappropriate statements or hogged the conversation from pre- to post- treatment. However, a higher percentage of participants introduced themselves at post-treatment (86% vs. 57%) (see Table 2 and Figure 3 for the newly added CASS binary items).

Table 2. Descriptive Statistics [Mean (SD) or Majority] for CASS Codes Pre- and Post-Intervention ($n=7$)

	Pre-Intervention	Post-Intervention
<i>Original Codes</i>		
# of Questions	5.43 (2.37)	3.86 (2.34)
# of Topic Changes	3.57 (1.71)	3.14 (.90)
Vocal Expressiveness (1-7)	4.29 (1.25)	4.86 (1.68)
Gestures (1-7)	2.86 (2.12)	4.29 (2.06)
Positive Affect (1-7)	4.71 (1.25)	4.86 (1.35)
Kinesic Arousal* (1-7)	4.57 (1.62)	3.71 (.95)
Social Anxiety* (1-7)	4.86 (1.68)	4.86 (1.35)
Overall Involvement (1-7)	5.43 (1.13)	5.86 (.90)
Overall Rapport (1-7)	5.00 (.82)	5.29 (1.11)
<i>New Codes</i>		
# of Open-Ended Questions	2.71 (1.11)	1.86 (1.35)
# of Follow-Up Questions	1.57 (1.27)	1.14 (1.35)
# of Appropriate Questions	5.00 (1.53)	3.86 (2.34)
# of Inappropriate Questions	.29 (.76)	.00 (.00)
Inappropriate Question/Statement (yes/no)	71.4% no	71.4% no
Introductions (yes/no)	57.1% yes	85.7% yes
Conversation Hogging (yes/no)	71.4% no	71.4% no
<i>Total Scores</i>		
CASS Total Score-Original	19.43 (4.79)	18.14 (3.67)
CASS Total Score-New	22.29 (4.57)	25.14 (6.23)

Note. Raw scores reported as means and standard deviations. Asking questions, topic changes, open-ended questions, follow up questions, appropriate questions, and inappropriate questions scored as behavior frequency counts. Inappropriate question/statement, introductions, and conversation hogging scored as binary yes/no items. All other variables scored on 1 to 7 scale, 1 = low to 7 = high. *Higher scores indicate reductions kinesic arousal and social anxiety. CASS Total Score-Original = sum of # of questions, # of topic changes, overall involvement, and overall rapport. CASS Total Score-New = sum of vocal expressiveness, gestures, positive affect, overall involvement, and overall rapport.

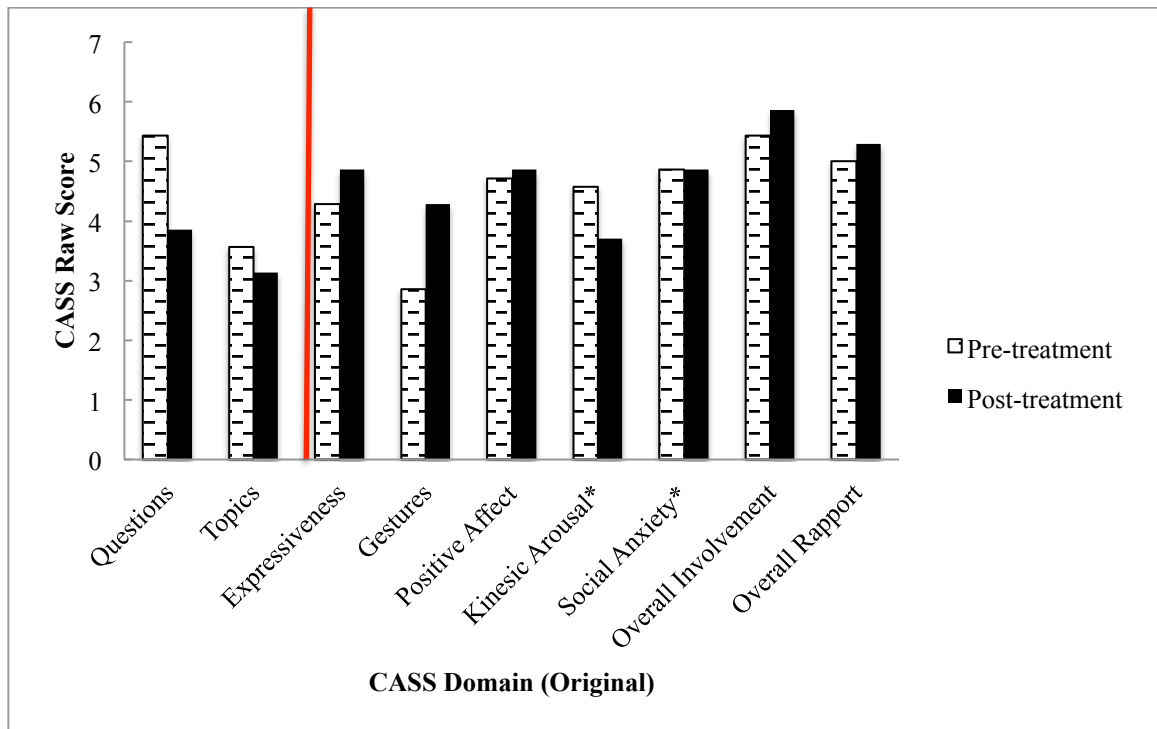


Figure 1. CASS original domains mean raw scores at pre-treatment and post-treatment ($n=7$). Items to the left of the red line are frequency counts. Items to the right are on a 1-7 Likert scale. Higher scores on Likert scale items indicate greater social competence. *Higher scores indicate reductions in Kinesic Arousal and Social Anxiety.

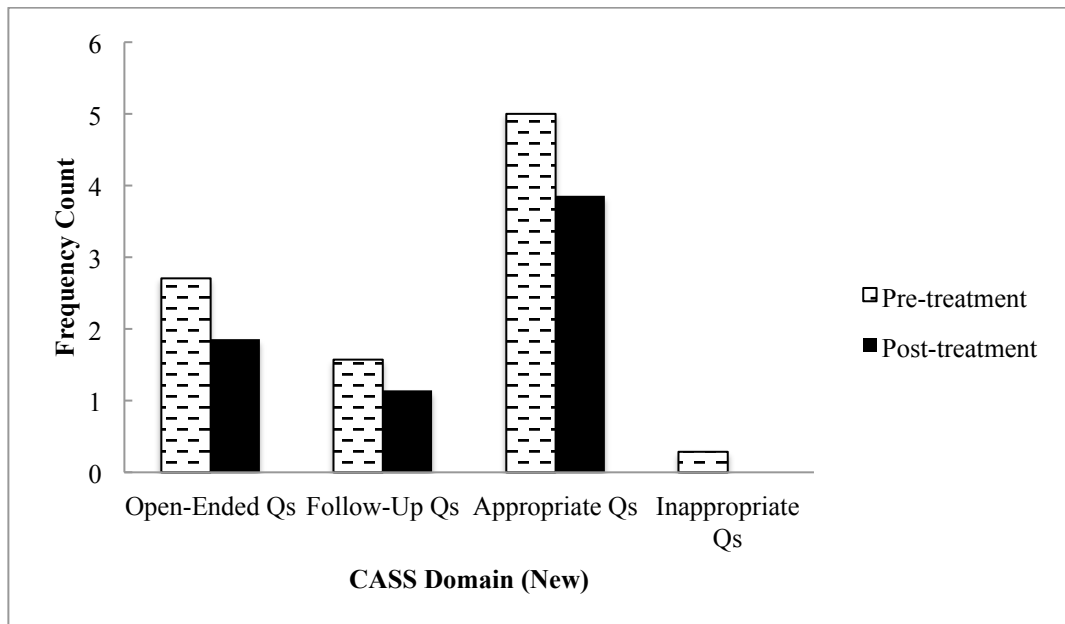


Figure 2. CASS new domains (frequency count items) mean raw scores at pre-treatment and post-treatment ($n=7$).

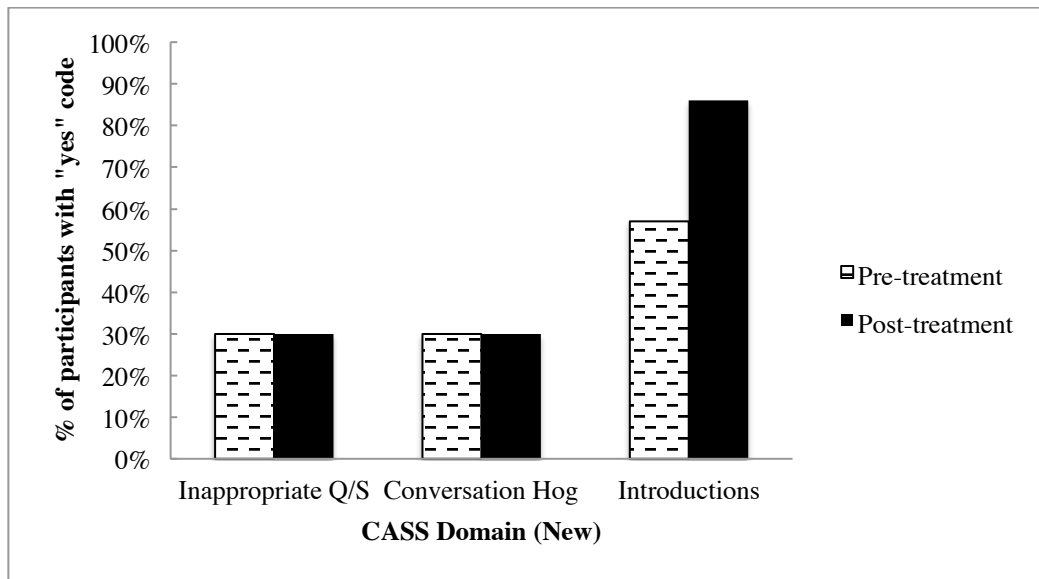


Figure 3. CASS new domains (binary items) – percentage of participants for whom item was coded “yes” at pre-treatment and post-treatment ($n=7$). Inappropriate Q/S = did the participant say anything inappropriate or bring up inappropriate topics? Conversation Hog = did the participant “take over” the conversation? Introductions = did the participant introduce him/herself?

Paired samples *t*-tests conducted with the CASS items that had improved average ratings or a 1-point change in either direction at post- intervention did not reveal statistically significant differences in scores from pre- to post- intervention (see Table 3 for *t*-test statistics and mean difference scores for selected CASS items). This was likely due to limited statistical power in analyses. However, the new CASS total score demonstrated a statistically significant improvement from pre- to post- intervention ($t = 2.65, p < .05$) (see Table 3). Further research must evaluate the validity and reliability of this new total score in measuring the construct of conversational skills.

Table 3. Comparisons of Selected CASS Codes at Pre- and Post- Intervention (n=7)

	Pre-intervention	Post-intervention			
	Mean (SD)	Mean (SD)	<i>T</i>	<i>p</i>	Difference M (SD)
Vocal Expressiveness	4.29 (1.25)	4.86 (1.68)	1.19	.28	.57 (1.27)
Gestures	2.86 (2.12)	4.29 (2.06)	1.99	.09	1.43 (1.9)
Positive Affect	4.71 (1.25)	4.86 (1.35)	.55	.60	.14 (.69)
Overall Involvement	5.43 (1.13)	5.86 (.90)	1.16	.29	.43 (.98)
Overall Rapport	5.00 (.82)	5.29 (1.11)	.68	.52	.29 (1.11)
CASS Total Score – New	22.29 (4.57)	25.14 (6.23)	2.65	.04*	2.86 (2.85)
# of Questions	5.43 (2.37)	3.86 (2.34)	2.01	.09	1.57 (2.07)
# of Inappropriate Questions	.29 (.76)	.00 (.00)	-1.0	.36	-.29 (.76)
% Teens Who Introduced Self _a	.57 (.54)	.86 (.38)	1.56	.21	

Note. Paired samples *t*-test, **p* < .05. Difference = mean difference score (measures changes in scores from pre- to post-treatment). _a = for % of teens who introduced self, a χ^2 analysis was conducted.

Individual-Level Analyses of CASS Outcomes

Figures 4 to 10 represent individual outcomes on the CASS frequency and Likert-scale items. Items to the left of the red line are frequency counts (including original and newly added items); items to the right are on a 1-7 Likert scale. On the frequency count items, six out of seven participants asked the same number or fewer total questions and initiated the same number or fewer topics following intervention. However, two participants asked more open-ended questions and/or more follow-up questions post-treatment. Six participants did not ask any inappropriate questions at pre- or post-intervention, while one participant asked two at pre and none at post.

On the Likert-scale items, four participants had higher scores in Gestures, while three had the same score after treatment. Three participants had higher scores in Vocal Expressiveness, three had the same scores, and one had a lower score following treatment. The same was true for the global domain of Overall Conversational Involvement. On the global domain of Overall Rapport, three participants had higher

scores following intervention, two had the same scores, and two had lower scores. Additionally, two participants had higher scores in Positive Affect, four had the same score, and one had a lower score. Two participants had higher Social Anxiety scores (indicating reduced anxiety) post-treatment, two had the same scores, and three had lower scores. Finally, one participant had a higher score in Kinesic Arousal (indicating reduced fidgeting), three had the same scores, and three had lower scores after treatment. No clear pattern emerged in terms of the relationships between improved scores on each item. For some participants, higher scores in gestures and vocal expressiveness were accompanied by improved overall rapport or overall involvement, but this pattern was not consistent across participants. Finally, the newly derived CASS total score improved for 5 out of 7 participants (see Figure 11).

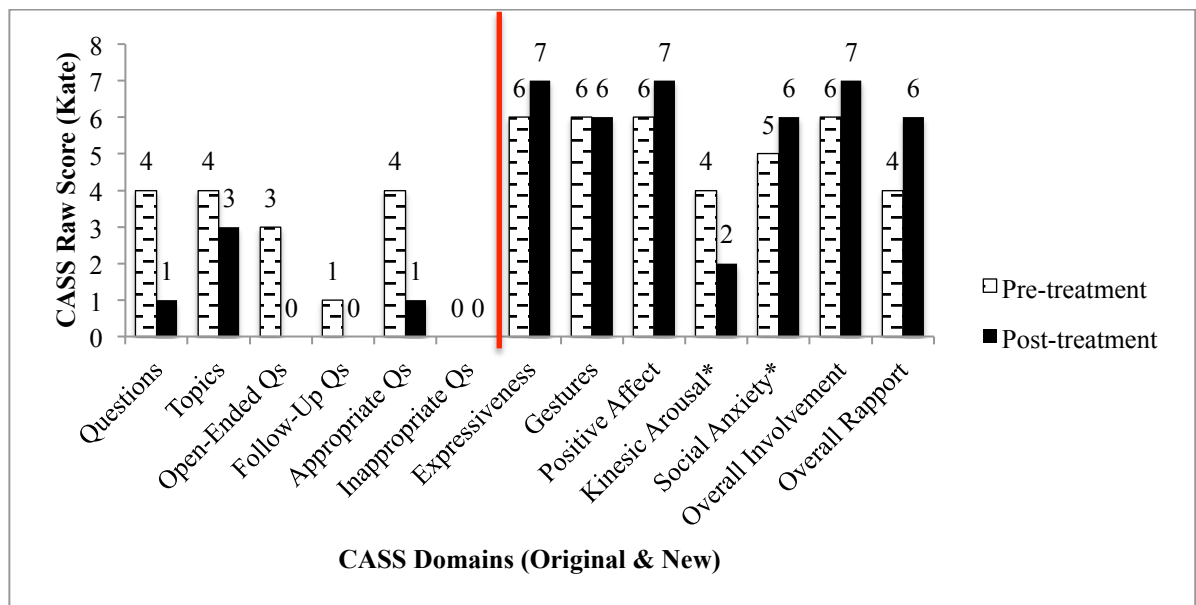


Figure 4. CASS domain raw scores at pre- and post-treatment for Kate. Kate had higher scores in vocal expressiveness, positive affect, social anxiety (*indicating reduced anxiety), overall involvement, and overall rapport following treatment. Kate had the same score on gestures and did not ask inappropriate questions at pre- and post-treatment. Kate asked fewer questions (including open-ended, follow-up, and appropriate questions), initiated fewer topics, and had a lower kinesic arousal score (*indicating increased fidgeting) post-intervention.

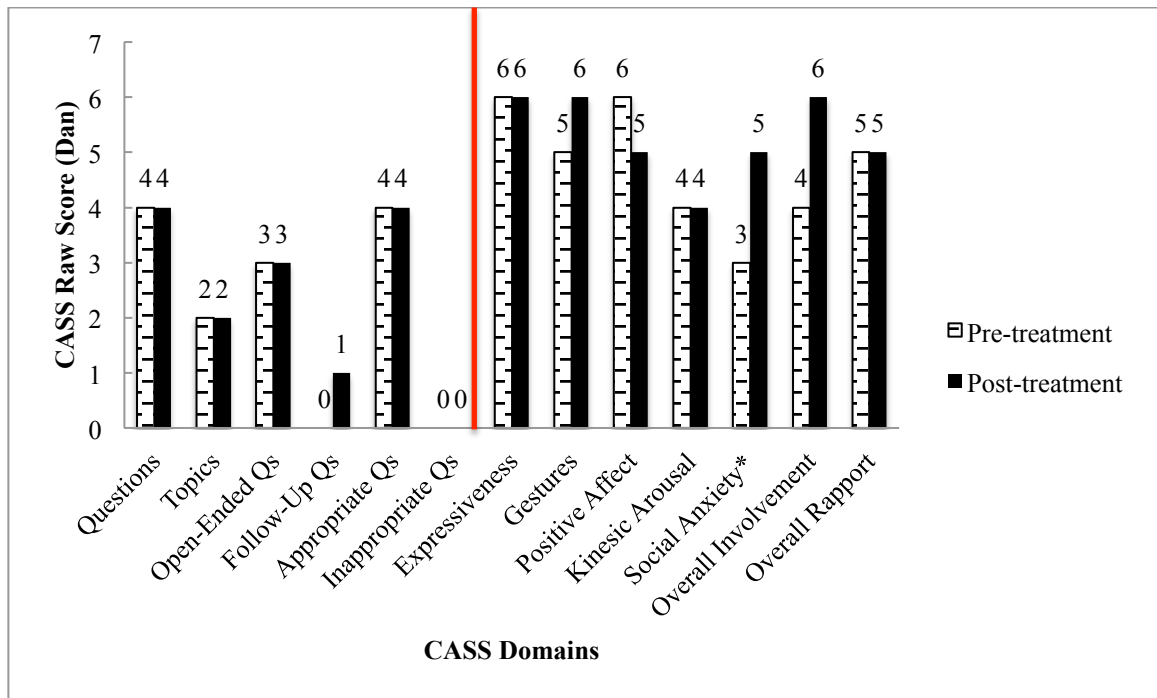


Figure 5. CASS domain raw scores at pre- and post-treatment for Dan. Dan had higher scores in gestures, social anxiety (*indicating reduced anxiety), and overall involvement, and asked more follow-up questions following treatment. Dan asked an equal number of questions (including open-ended and appropriate questions), initiated an equal number of topics, had the same scores for vocal expressiveness, kinesic arousal, and overall rapport, and did not ask inappropriate questions at pre- and post-intervention. Dan's positive affect score was lower following intervention.

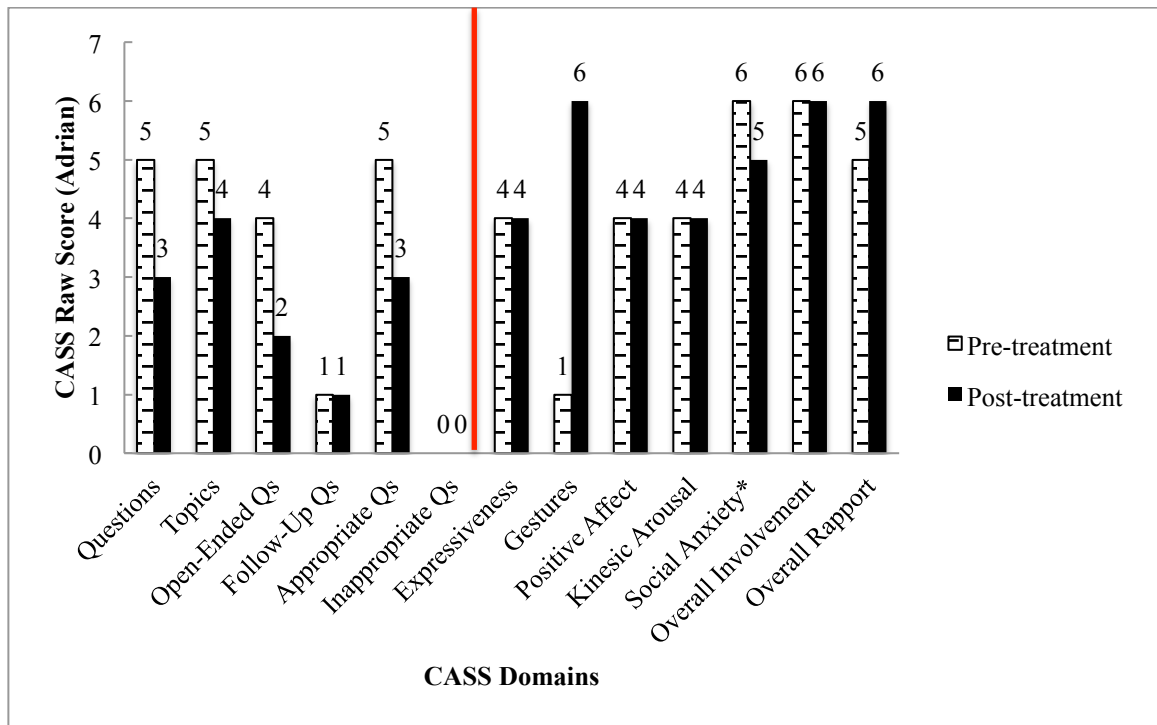


Figure 6. CASS domain raw scores at pre- and post-treatment for Adrian. Adrian had higher scores in gestures and overall rapport following treatment. Adrian had the same scores in vocal expressiveness, positive affect, kinesic arousal, and overall involvement, asked an equal number of follow-up questions, and did not ask inappropriate questions at pre- and post- intervention. Adrian asked fewer questions (including open-ended and appropriate questions), initiated fewer topic changes, and had a lower score for social anxiety (*indicating increased anxiety) following treatment.

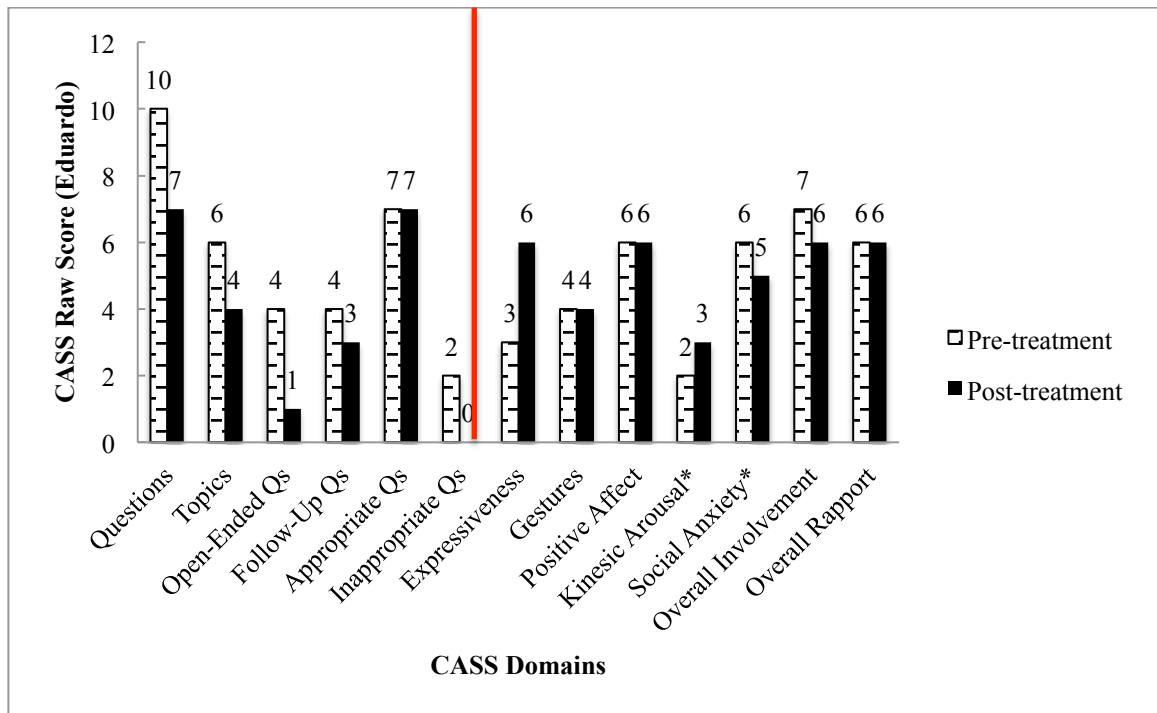


Figure 7. CASS domain raw scores at pre- and post-treatment for Eduardo. Eduardo had higher scores in vocal expressiveness and kinesic arousal (*indicating reduced fidgeting), and asked fewer inappropriate questions following treatment. Eduardo had the same scores in gestures, positive affect, and overall rapport, and asked the same number of appropriate questions at pre- and post- intervention. Eduardo asked fewer questions (including open-ended and follow-up questions), initiated fewer topic changes, and had lower overall involvement and social anxiety scores (*indicating increased anxiety) post-treatment.

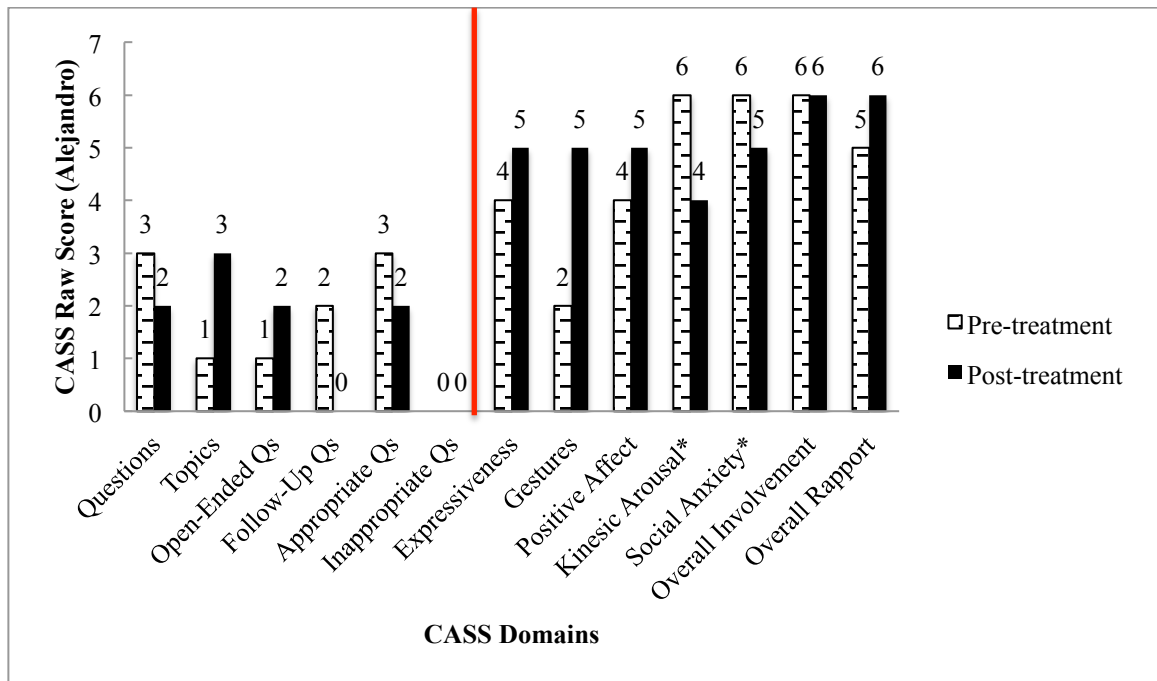


Figure 8. CASS domain raw scores at pre- and post-treatment for Alejandro. Alejandro initiated more topic changes, asked more open-ended questions, and had higher scores in vocal expressiveness, gestures, positive affect, and overall rapport following treatment. Alejandro had the same score in conversational involvement, and did not ask any inappropriate questions at pre- and post- intervention. Alejandro asked fewer overall questions (including appropriate questions and follow-up questions), and had lower kinesic arousal and social anxiety scores (*indicating increased fidgeting and anxiety) post-treatment.

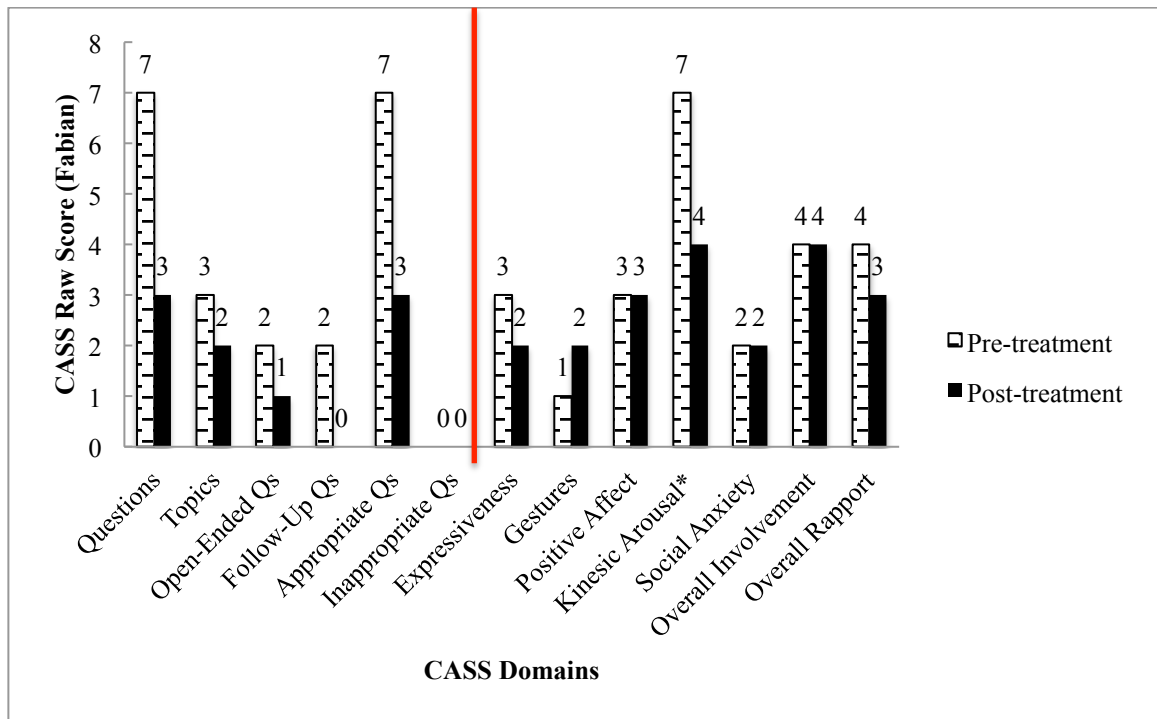


Figure 9. CASS domain raw scores at pre- and post-treatment for Fabian. Fabian had a higher score in gestures following treatment. Fabian had the same scores in positive affect, social anxiety, and overall involvement, and did not ask inappropriate questions at pre- and post-intervention. Fabian asked fewer overall questions (including open-ended, follow-up, and appropriate questions), initiated fewer topic changes, and had lower vocal expressiveness, overall rapport, and kinesic arousal scores (*indicating increased fidgeting) at post-treatment.

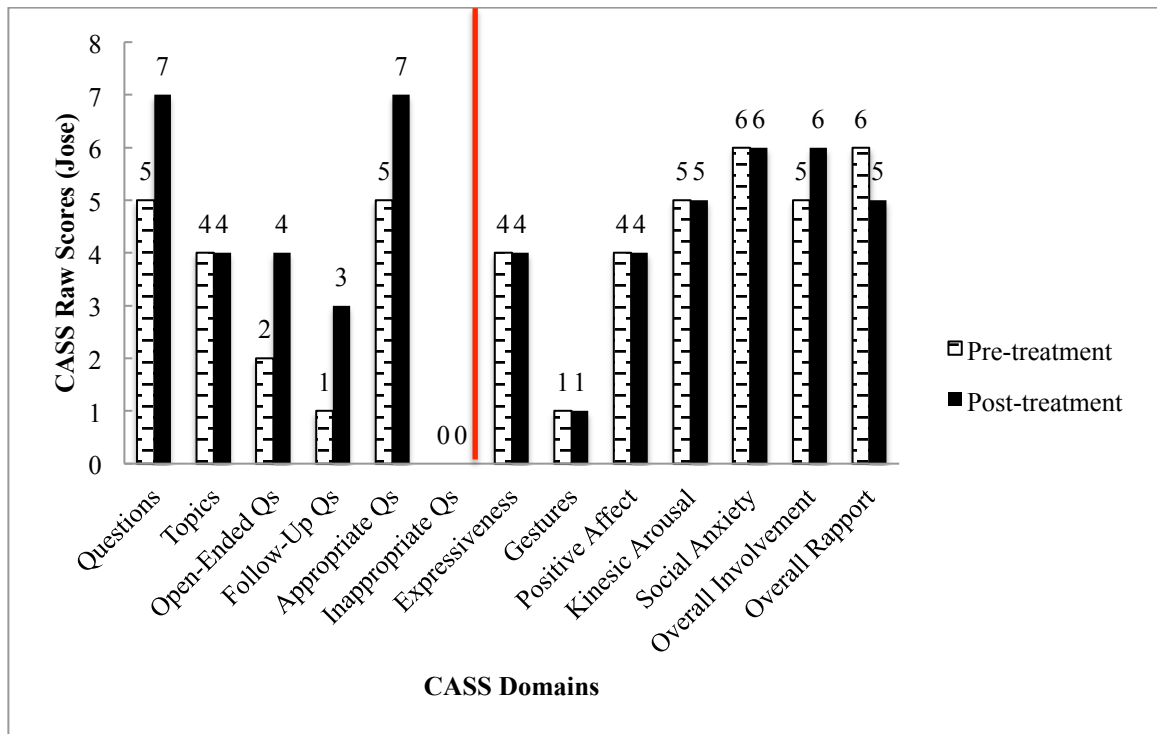


Figure 10. CASS domain raw scores at pre- and post-treatment for Jose. Jose asked more questions (including open-ended, follow-up, and appropriate questions), and had a higher score in overall involvement following treatment. Jose initiated the same number of topic changes, had the same scores in vocal expressiveness, gestures, positive affect, kinesic arousal, and social anxiety, and did not ask inappropriate questions at pre- and post- intervention. Jose had a lower score in overall rapport post-treatment.

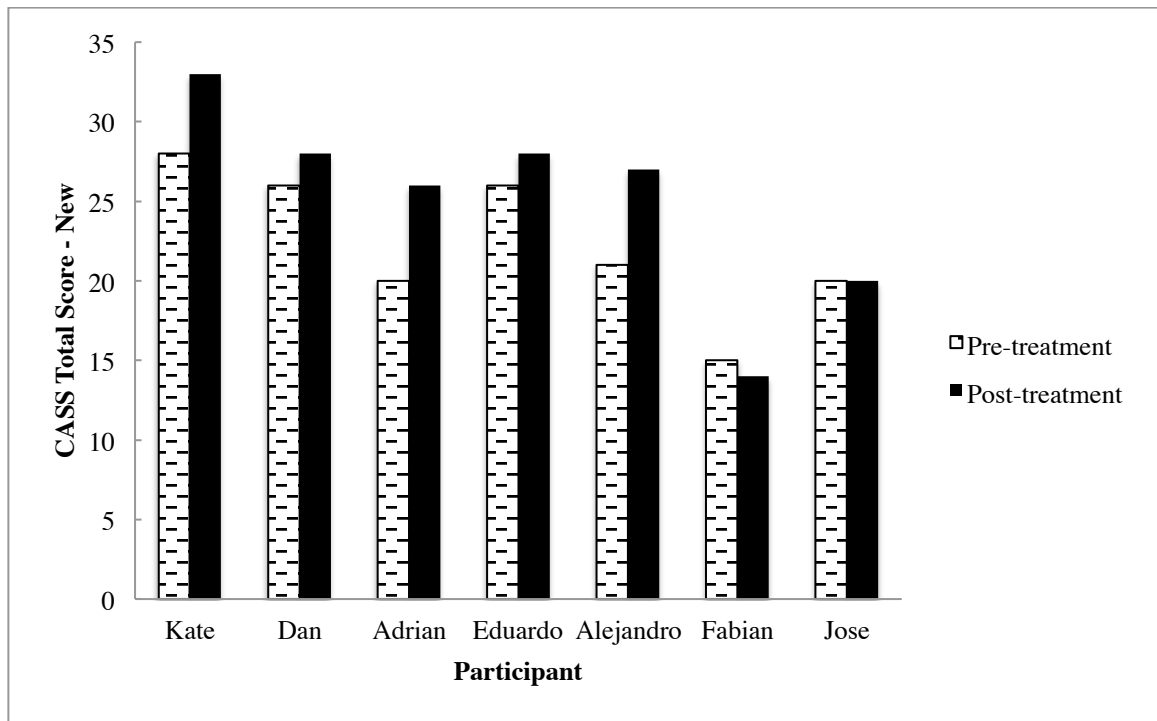


Figure 11. Newly derived CASS total score for each participant. The new CASS total score is comprised of overall involvement, overall rapport, vocal expressiveness, gestures, and positive affect. Higher scores may indicate higher conversational competence.

Comparison to Questionnaire-Based Outcomes

Paired samples t-tests revealed significant improvements in parent-reported overall social responsiveness (i.e., the SRS-2 total score; $p = .02$) and on the Social Communication and Interaction (SCI) composite on the SRS-2 ($p = .01$). Parent-reported Social Skills on the SSIS also improved significantly from pre- to post- intervention ($p < .001$). Though changes were in the expected direction on the Restricted and Repetitive Behaviors (RRB) composite on the SRS-2, and on the Problem Behaviors and Autism Spectrum composites on the SSIS, these changes did not reach significance ($p = .13$, $p = .15$, and $p = .08$, respectively). Adolescent social skills knowledge improved significantly from pre- to post- treatment on the TASSK-R ($p < .001$), while self-reported social

anxiety on the SIAS did not decrease significantly ($p = .5$) (see Table 4 for a comparison of questionnaire measures at pre- and post- intervention).

Table 4. Comparisons of Questionnaire Measures at Pre- and Post- Intervention ($n=7$)

	Pre-intervention		Post-intervention		<i>T</i>	<i>p</i>
	Mean	SD	Mean	SD		
<i>Parent-Report Measures</i>						
SRS Total T-Score	69.14	14.18	61.43	14.89	-3.13	.02*
SRS RRB T-Score	68.29	13.67	64.57	13.51	-1.75	.13
SRS SCI T-Score	69.57	15.04	60.14	14.65	-3.74	.01*
SSIS Social Skills (standard)	85.86	25.13	93.57	22.78	4.65	.00**
SSIS Problem Behaviors (standard)	117.71	21.77	112.29	22.54	-1.67	.15
SSIS Autism Spectrum (raw)	16.71	9.76	14.29	10.37	-2.15	.08
<i>Adolescent Self-Report Measures</i>						
TASSK-R Total Score	14.29	3.09	24.29	4.60	11.83	.00**
SIAS Total Score	32.71	15.84	28.29	9.69	-.72	.50

Note. Paired samples *t*-test, * $p < .05$; ** $p < .01$. SRS = Social Responsiveness Scale, 2nd Edition; RRB = Restricted & Repetitive Behaviors; SCI = Social Communication & Interaction; SRS higher scores indicate greater autism symptomatology. SSIS = Social Skills Improvement System; higher scores on the SSIS Social Skills composite indicate better social functioning; lower scores on the SSIS Problem Behaviors and Autism Spectrum composites indicate better behavioral functioning and fewer autism symptoms. TASSK-R = Test of Adolescent Social Skills Knowledge-Revised; TASSK higher scores signify greater social skills knowledge. SIAS = Social Interaction Anxiety Scale; SIAS higher scores indicate greater social anxiety.

Bivariate Pearson correlations revealed that changes in the CASS global domains (Overall Conversational Involvement and Overall Quality of Rapport) and the new CASS total score were related to changes on questionnaire measures in the expected direction. A significant correlation emerged between mean change in SRS-2 total score and mean change in Overall Quality of Rapport on the CASS ($r = .81, p < .03$). Change in Overall Quality of Rapport was also associated with change in the Social Communication and Interaction (SCI) composite on the SRS-2, but this correlation did not reach significance ($r = .69, p < .1$). Change on the SRS-2 RRB composite was negatively correlated with change in CASS involvement ($r = -.85, p < .01$), but as improvements on the RRB composite were not significant, this association should be interpreted with caution.

Additionally, improvement on the TASSK-R total score was correlated with improvement in Overall Conversational Involvement on the CASS ($r = .84, p < .02$). Improvement on the new CASS total score was highly correlated with improvement in Overall Quality of Rapport on the CASS ($r = .91, p < .01$). In addition, change on the new CASS total score was associated with change on the SRS-2 total score ($r = .89, p < .01$) and the SRS-2 SCI composite ($r = .75, p < .1$), though the latter did not reach significance. No significant correlations were found between the SSIS social skills score and the CASS global items/total mean difference scores (see Table 5 for correlations between CASS items and questionnaire measures).

Table 5. Correlations between Mean Difference Scores on CASS items and Questionnaires

Variables	1	2	3	4	5	6	7	8
1. CASS Involvement	-							
2. CASS Rapport	.02	-						
3. CASS Total Score-New	-.09	.91**	-					
4. SRS-2 Total T-Score	-.15	.81*	.89**	-				
5. SRS-2 SCI T-Score	.06	.69	.75	.936**	-			
6. SRS-2 RRB T-Score	-.85**	.41	.47	.62	.44	-		
7. SSIS Social Skills	.58	-.22	-.39	-.51	-.51	-.68*	-	
8. TASSK-R	.84*	-.34	-.26	-.21	.05	-.80*	.43	-

Note. Bivariate Pearson correlations, * $p < .05$; ** $p < .01$; CASS = Contextual Assessment of Social Skills; CASS Total Score-New = involvement + rapport + gestures + vocal expressiveness + positive affect. SRS-2 = Social Responsiveness Scale, 2nd edition; SCI = Social Communication and Interaction; RRB = Restricted and Repetitive Behaviors. SSIS = Social Skills Improvement System. TASSK-R = Test of Adolescent Social Skills Knowledge-Revised.

Discussion

Changes on the Original CASS Items

The purpose of this study was to examine observed changes in conversational skills following an evidence-based social skills intervention, using an adapted version of a previously validated observational measure (CASS; Ratto et al., 2011). The first

research question in this study was whether adolescents showed improvements in conversational skills on the original nine CASS items following treatment. Though exploratory group-level analyses with an n of 7 participants did not demonstrate statistically significant changes on the original nine items, individual analyses revealed that participants had higher average ratings in several of the original CASS domains following treatment. The most consistent improvements were seen in Gestures, Vocal Expressiveness, Overall Involvement, and Overall Rapport; three to four of the seven participants showed improved ratings in these domains from pre- to post- treatment. In contrast to previous studies, participants (on average) asked fewer questions and initiated fewer topic changes following treatment. One explanation for this finding is that these items do not capture the specific skills that would be expected to change following PEERS. For example, an increase in the number of questions asked may reflect an improvement for some, while a decrease may reflect a positive change for others, as their baseline levels of question asking may have been inappropriately high.

With the exception of Gestures, the improvements seen in the original CASS domains are consistent with previous research using the CASS as an outcome measure for PEERS. For example, White and Rabin and colleagues (2015 and 2018, respectively) found the greatest improvements in Overall Involvement, while Dolan and colleagues (2016) found the greatest improvements in Vocal Expressiveness and Overall Rapport. These domains may therefore be particularly sensitive to change following PEERS. Overall Involvement and Overall Rapport, for example, are global measures of the participant's ability to demonstrate interest and reciprocity in the conversation, both

verbally and nonverbally. According to the CASS rating manual, “participants who ask questions, lean forward, maintain eye contact, and build on the conversation should receive higher ratings” in Overall Involvement (Ratto et al., 2011). These are concrete skills that are taught, demonstrated, and practiced at length in the PEERS intervention. Similarly, Overall Rapport reflects the “overall smoothness of the conversation and the degree to which the participant and the confederate established rapport and reciprocity” (Ratto et al., 2011). In PEERS, participants practice “trading information” and maintaining two-way conversations in session for the first seven weeks, as well as during weekly homework assignments in which they are assigned to call another group member or a peer outside of the group. Though improvements in these global domains did not reach statistical significance, all but two participants had higher ratings in at least one of these domains after treatment, suggesting a clinically meaningful improvement in overall conversational skills.

In contrast, Gestures and Vocal Expressiveness are not specifically targeted in PEERS and may not be expected to change following social skills intervention. Gestures are rated based on the frequency and quality of descriptive and emphatic gestures; for a rating of 5 or higher, the participant must use emphatic gestures. Four participants demonstrated improvements in this domain, with two demonstrating 1-point improvements, a third moving from a rating of 2 to 5, and a fourth moving from a rating of 1 to 6 following treatment. Vocal Expressiveness reflects participants’ ability to vary vocal qualities (e.g., pitch, tone, volume) in order to appropriately express themselves. Two participants had a 1-point increase, and one had a 3-point increase in this domain.

Though these domains are not specifically targeted in PEERS, participants watch role-play demonstrations throughout the intervention in which appropriate gestures and variation of vocal tone are demonstrated. Additionally, homework assignments to practice starting and joining conversations in their daily life may increase participants' frequency of positive social interactions, thereby increasing their opportunities to observe socially appropriate nonverbal behaviors. It may be that this combination of increased practice and observing exemplars both inside and outside of the clinic setting result in more comfortable peer interactions, thus increasing participants' appropriate use of nonverbal behaviors. These findings suggest that participation in PEERS can result in skill generalization to untrained social skills domains on the CASS.

The original average CASS total score (comprised of question asking, topic changes, conversational involvement, and overall rapport) did not change from pre- to post- intervention, unlike in the study by Rabin and colleagues (2018), who found a significant increase in the average CASS total score. The original CASS total score should be interpreted with caution, as the appropriate frequency of question asking and topic changes varies depending on the individual, as noted above. In an effort to better reflect treatment-related improvements in conversational skills, a new CASS total score was derived by summing the two global domains (overall rapport and involvement), and three additional items that demonstrated consistent improvements (vocal expressiveness, gestures, and positive affect). This new total score demonstrated significant improvements from pre- to post- intervention at a group level; on an individual level, 5 out of 7 participants had a higher score following treatment.

Sensitivity of Newly Added CASS Items

A secondary aim of this study was to assess whether the newly added items to the CASS paradigm were sensitive to change following treatment. Seven items were added to the CASS to better reflect the specific skills taught in intervention. In contrast to the author's hypothesis, no changes emerged in the average frequency of open-ended questions, follow-up questions, or appropriate questions from pre- to post- treatment, or in the percentage of participants who made inappropriate statements or hogged the conversation. These findings may be attributed to the fewer number of total questions asked by participants as a group, as well as the small sample size in this preliminary study. Additionally, group level analyses may not reflect meaningful change in a heterogeneous group. Due to the tremendous variability in the characteristics and ability levels in individuals with ASD, evaluating baseline social needs and treatment effects at an individual level is critical for assessing the effectiveness of an intervention (Lord et al., 2005). Correspondingly, individual analyses were conducted to examine unique treatment gains for each participant. Based on these analyses, one participant (Eduardo) asked fewer inappropriate questions, and another (Alejandro) made fewer inappropriate statements following treatment. Prior to treatment, Eduardo dominated the conversation, talked only about his perseverative interest (Minecraft), and appeared to be testing the confederate, asking him to explain what the video game was about twice. After treatment, Eduardo was still a "conversation hog", but he did not ask any inappropriate questions of the participant. Another participant (Alejandro) stated, "This club is boring," prior to intervention, but he did not make any inappropriate statements following intervention.

Additionally, a higher percentage of participants introduced themselves following treatment (six versus four). These preliminary results suggest that the newly added items to the CASS paradigm may detect change following intervention; a larger sample size is necessary to further evaluate the utility of the newly added items.

Relationships to Other Measures of Social Competence

The third aim of this study was to assess the relationship between observed improvements in conversational skills and parent and self-reported improvements in social competence. As expected, results revealed parent-perceived improvements in social skills and social responsiveness and improvements in adolescent social skills knowledge following treatment. Improvements in the CASS global domains of Overall Rapport and Overall Involvement were related to improvements in parent-reported social responsiveness and adolescent social skills knowledge. Improved Overall Rapport was associated with improved social responsiveness on the SRS-2, while improved Overall Involvement was associated with improved social skills knowledge on the TASSK-R. While Dolan and colleagues (2016) found associations between improvements in Overall Rapport and social skills knowledge, the associations in the current study were between Overall Involvement and social skills knowledge. Similar to Dolan et al., these findings reflect positive relationships between greater knowledge of PEERS concepts and the implementation of the newly acquired skills. The lack of a significant relationship between improvement on the SSIS social skills domain and the CASS global items was surprising, as parent-reported social skills gains would be expected to relate to observed conversational improvements.

Limitations and Future Directions

Beyond the small sample size, the current study has a few notable limitations. First, participants in this study were not randomized to a treatment or waitlist control group. Rather, this study used a convenience sample to assess the preliminary effectiveness of the PEERS social skills intervention with primarily Latinx families, which may have led to a potential selection bias (i.e., only highly motivated families enrolled, many of whom were recruited from the focus groups). Future research should incorporate a randomized approach to validate the PEERS intervention with a Latinx population. Second, for the purpose of ease and efficiency, the research confederates used in this study were college students, who were an average of five to ten years older than the participants, and were therefore not same-age peers. They may have been perceived as “adults” rather than as peers. Future research should recruit high-school students to act as research confederates to truly evaluate how adolescents interact with same-age peers. Third, potential differences in the behavior of research confederates were not measured. Dolan and colleagues (2016) found significant differences in female confederates’ interaction styles; female participants were therefore excluded from their analyses. Future studies should evaluate confederate behavior, in terms of confederates’ overall involvement and rapport in the conversation, as confederate differences may contribute to differences in participant behavior. Fourth, the concepts taught in PEERS go above and beyond conversational skills, including skills for handling arguments with friends, responding to teasing and bullying, and planning and organizing get-togethers with friends. Future studies should attempt to measure additional observed treatment gains

beyond conversational skills (e.g., using a conflict resolution task). Fifth, this study only includes pre- and post- data. Anecdotally, it has been observed that some adolescents take longer than others to develop and implement the skills they learned in PEERS. Future studies should include follow-up data to evaluate the maintenance of treatment gains after adolescents have had several months to practice the newly learned skills. Finally, the current study evaluates participants' interactions with unfamiliar peers, though the purpose of PEERS is to develop close meaningful friendships with same-age peers. Observing how participants interact with familiar peers at school or at their extracurricular activities may reflect a more accurate representation of treatment gains. Thus, future studies should attempt to measure conversational skill improvements with real friends, such as the friends that adolescents developed while participating in PEERS. Conducting observations of the participants in the school setting may also provide meaningful data.

Conclusions

Informant reports of social skills gains after intervention are prone to bias, and may differ from actual performance (McDonald, 2008). Integrating observational measures with parent- and self-report provides the best evidence of treatment effectiveness, as observational assessments may be more valid and reliable than questionnaires. Furthermore, observational assessments can be individualized to examine specific skills that are targeted in treatment (Cunningham, 2011). Nevertheless, meaningful behavioral measurement following group-based social skills intervention is challenging, due to the heterogeneity of social errors among participants.

Although the small sample size in this preliminary study limits conclusions, this study extends previous findings on the observed effects of the PEERS intervention. Preliminary findings suggest that adolescents who participated in PEERS experienced positive changes in global conversational skill domains, as well as generalized improvements in social behaviors, most commonly in gestures and vocal expressiveness. This exploratory study suggests that the adapted CASS may be a promising measure for assessing the observed effects of the PEERS social skills intervention. Furthermore, the sample was primarily Latinx from the Inland Empire region of Southern California, which suggests that the program is effective across cultural and socioeconomic groups. With follow-up data and a larger sample size, observed conversational improvements will be analyzed in the context of individual social needs.

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