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ORIGINAL PAPER

A Randomized Controlled Trial of the Social Tools And Rules for Teens (START) Program: An Immersive Socialization Intervention for Adolescents with Autism Spectrum Disorder

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Abstract
Adolescents with ASD face numerous personal and contextual barriers that impede the development of social motivation and core competencies, warranting the need for targeted intervention. A randomized controlled trial was conducted with 40 adolescents to evaluate the merits of a multi-component socialization intervention that places emphasis on experiential learning. This investigation evaluated the impact of the 20-week START program on the social functioning of adolescents with ASD. Significant *Group* × *Time* differences between START and waitlist control groups were found across multiple measures. Secondary analyses of the entire program cohort also yielded significant improvement trends across all measures. These findings may be an important step in identifying optimal strategies to target the complex factors limiting optimal social development in ASD.

Keywords Adolescents with autism spectrum disorder · Social competence · Social motivation · Social readiness · Social skills group · START program

Introduction

Adolescence marks a developmental period in which social expectations greatly increase (Lerner 1985). A heightened desire to fit in with peers coincides with an increasingly complex set of unspoken social expectations dictated by peer culture (Brown and Klute 2003; Englund et al. 2000; Lynch et al. 2013). While parents typically structure, oversee, and facilitate interactions among younger children, adolescents now assume the responsibility of initiating social gatherings, monitoring their own interactions, and maintaining their own relationships. During this time period, social connection plays a critical role in the determination of an adolescent's subjective well-being (Park 2004). Adolescents who are socially engaged and maintain positive peer relationships tend to have better mental health outcomes, with studies highlighting the powerful impact a single friendship can have on psychological health and resilience (Graber et al. 2015).

Interpersonal immersion and social acceptance are essential prerequisites for the acquisition of further social competence, as skill building cannot occur within a peer group that is constantly ignoring or rejecting an individual's efforts to connect. Repeated social rejection can also diminish personal motivation to engage with others. The perception of relative risk versus reward value of socialization is altered as one is repeatedly rejected by peers, which may make these individuals less willing to seek out future social opportunities and cause them to discount the necessity of

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social relationships in general (Lepore et al. 1989). Vulnerable social populations, such as those diagnosed with autism spectrum disorder (ASD), are at particular risk.

Adolescents with ASD make social interaction bids much less frequently and with significantly less success than their typically developing counterparts (Orsmond et al. 2004). These limited social competencies can leave these individuals vulnerable to social rejection or exclusion, ultimately preventing them from accessing the very social context needed to actually improve their social skillset. Because of this catch-22, it is not surprising that many adolescents with ASD appear to experience lower social status and friendship quality while endorsing lower levels of social motivation and greater levels of loneliness than their typically developing peers (Locke et al. 2010; Mazurek 2013; Wagner et al. 2004). Fortunately, targeted social interventions may be able to address these challenges and generate crucial social momentum (Miller et al. 2014).

A supportive social context may be a particularly critical intervention component in socialization efforts. In recognition of this, the use of peer interaction within socialization efforts is growing in popularity (Watkins et al. 2015). Typically developing peer models are recognized for their ability to model, teach, and constructively evaluate social performance while providing an important insider's perspective on socially appropriate behaviors. There is also value in providing this vulnerable population with a positive, corrective social experience. Through these positive interactions, individuals with ASD gain exposure to unconditional social acceptance—exchanges with receptive peers who are open, willing to converse, and forgiving. Having positive experiences with typically developing peers provides individuals with ASD with evidence that they can actually be perceived as desirable social partners and provides a counterpoint to previous experiences of social rejection. Thus, the provision of external peer support can simultaneously address internal motivational barriers, which may also be impeding willingness to socialize.

One approach that has been proposed to improve social competence in adolescents with ASD relies on the use of immersive experiential learning techniques (Vernon et al. 2016), or the process of learning through the exposure to and processing of real-world experiences (Kolb 2014). A socialization intervention that incorporates experiential learning allows participants to experiment with social strategies firsthand, reflect on their interpersonal successes, and learn from their mistakes. Many of the dynamic social variables associated with live interactions are inevitably lost when information is consolidated and summarized into a didactic social lesson. By actively engaging in a naturalistic social setting with typically developing peers, individuals can benefit from the social complexities inherent in real-world interaction. Moreover, these active learning opportunities allow individuals to experience the natural incentives of positive peer interactions, such as discussion of favorite topics, responses to humor, and opportunities to jointly engage in enjoyable activities. By practicing social interactions in a safe, welcoming environment, participants can begin to associate social engagement with rewarding, positive experiences and outcomes.

Despite the potential importance of experiential learning, this approach is underutilized in the current literature on social skills intervention for adolescents with ASD (Miller et al. 2014). Many existing programs focus primarily on didactic lessons to address the social vulnerabilities associated with an autism diagnosis (e.g., Ozonoff and Miller 1995; Webb et al. 2004; White et al. 2010). Although these programs typically include a controlled opportunity to practice a skill of interest (e.g. conversation skills, humor, perspective-taking, empathy), such programming might be further enhanced with the addition of free socialization periods with typically developing peers to facilitate experiential learning opportunities. Without an embedded experiential component, participating adolescents may not have an identifiable group of receptive peers to engage and may face difficulties with internal social motivation and external peer acceptance. Consequently, these setbacks may limit the generalized use and mastery of their newly acquired social concepts and skills at school and in other social settings.

The Social Tools And Rules for Teens (START) socialization program for adolescents with ASD combines a traditional didactic social cognition curriculum with experiential learning opportunities (Vernon et al. 2016). Structured and unstructured socialization periods are embedded within each group session to provide a supportive, natural context for social experimentation and skill building. These opportunities are paired with 20 interactive didactic social lessons. This study builds upon the initial pilot investigation of the START program by presenting the results of a randomized controlled trial (RCT) of the model.

Methods

Participants

A total of 44 potential participants were originally recruited for the START RCT. The participants of the project were adolescents (ages 12–17 at the start of the study) with a confirmed diagnosis of ASD. Individuals were required to have a verbal IQ over 70 and communicate using fluent, full sentence phrases. Four recruited individuals were excluded for either (a) not having an ASD diagnosis (3 individuals) or (b) not meeting language and verbal IQ requirements (1 individual), resulting in 40 program participants. Participant demographic information is described in Table 1. Twenty

Table 1 Participant demographic information

Variable	Group				*p*
	START	n = 16	Waitlist	n = 19	
	Mean	(SD)	Mean	(SD)	
Age (years)	13.25	1.48	13.64	1.47	ns
Grade	7.75	1.57	8.27	1.35	ns
Female	25%		36.4%		ns
White	62.5%		63.6%		ns
Latino/a	25.0%		22.7%		ns
Overall IQ	99.1	16.6	97.5	20.2	ns
Verbal IQ	98.5	15.6	96.2	22.1	ns
SSIS parent	75.4	11.8	80.6	14.7	ns
SRS parent	74.6	9.3	76.6	11.2	ns
SCMS parent	71.2	10.6	73.8	11.3	ns
SSIS teen	85.6	19.2	100.7	20.9	.034*
SCMS teen	95.6	14.4	94.7	18.3	ns

*$p < .05$

adolescents were randomly assigned to the START treatment group, while the remaining 20 were assigned to the waitlist control group.

One parent per adolescent also participated in the program. They took part in the weekly checkout session (i.e. the last 5–10 min of each session) and also completed measures of social progress at pre- and post-intervention.

Recruitment occurred in two separate yearly cycles using targeted online research advertisements, correspondence with local junior high and high school staff, university autism center website listings, and email notifications. Approximately half of the total project participants were recruited during Year One and were randomized into immediate and delayed treatment conditions. Those in the immediate treatment cohort were then further divided into two smaller groups operating on separate days of the week (based on participant schedules and age), resulting in individual groups with 3–6 participants each. The delayed treatment group began the START program after the immediate treatment group concluded (after 20 weeks time) and was also divided into separate groups in an identical manner. During Year Two, the remaining participants were recruited and randomized using the same procedures.

Of the 20 participants ultimately assigned to the START treatment condition, 4 withdrew from the study prior to the completion of the group. Reasons provided for withdrawing from the group included: joining an extracurricular social activity that conflicted with the scheduled group time (2 participants), excessive driving distance to the project location (1 participant), and expressed dissatisfaction with the assigned group's demographic make-up (1 participant). Specifically, two participants joined highly desired

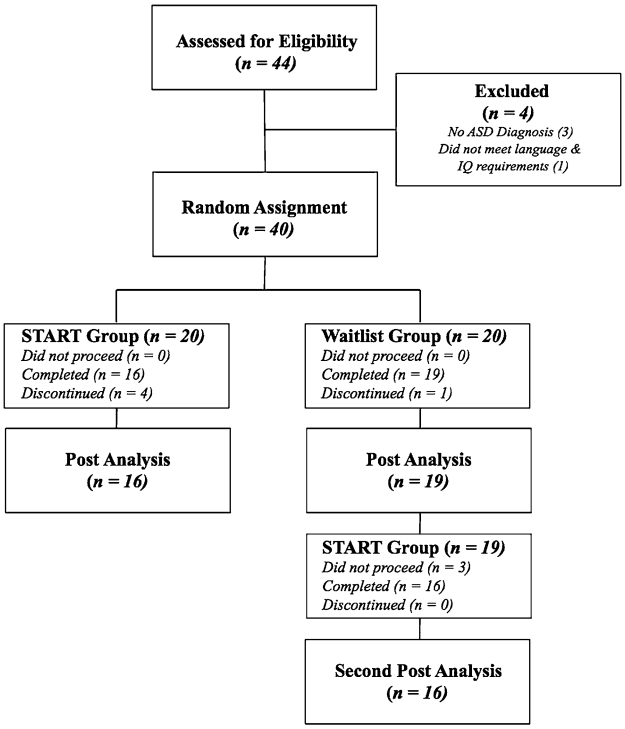

Fig. 1 START RCT consort diagram

extracurricular activities (a robotics club and the school volleyball team, respectively) after completing the first 6–10 sessions of the START program. Another participant's weekly 2 h round-trip commute was too difficult to sustain. The final participant reported dissatisfaction with the relatively younger age range of the remaining participants in her assigned group. One individual from the waitlist also failed to return for his 20-week post-waitlist assessments, resulting in a total of 19 final waitlist group participants. After the waitlist period ended, 16 of these 19 controls went on to then complete the 20-week START program (Three could no longer accommodate the START group in their weekly schedule and thus did not enroll). The total project cohort of adolescents that ultimately participated in the START program consisted of 32 participants (16 from the immediate treatment group and 16 in the delayed treatment group who received the intervention after being on the waitlist). Figure 1 depicts the project consort diagram.

Research Design

An RCT was used to evaluate the impact of the START model on social performance. All participants were randomly assigned to a treatment group or waitlist control group. Those assigned to the START treatment group immediately received 20 weeks of the START program. Those assigned to the waitlist control group were permitted

to continue any pre-existing therapy efforts but were not exposed to the experimental socialization treatment package. Both groups were re-evaluated after a 20-week time period. Following the completion of all measures, the waitlist group entered treatment and was re-evaluated a third time after the 20-week program concluded.

Procedures

Social Facilitator and High School Peer Training

Undergraduate research assistants served as social facilitators for the START program. High school volunteers were recruited from local schools through recruitment flyers and notifications provided to school counselors/teaching staff. All facilitators received an initial 4-h training on basic group facilitation techniques, covering basic group facilitation skills, methods for fostering rapport, and exposure to practice group sessions. The social facilitators also participated in weekly 1-h supervision meetings for ongoing clinical training purposes. One undergraduate was assigned as the designated primary social facilitator for each participant and was responsible for all check-in and check-out sessions (described below), along with all progress meetings with that individual. Advanced clinical psychology doctoral students and/or a licensed clinical psychologist jointly conducted all training and supervision sessions.

Pre-intervention Sessions

All participants completed an initial 90-min intake session, which consisted of obtaining consent/assent from parents and adolescents, obtaining basic demographic information, and completing all required intake measures. Trained research assistants conducted all intakes and subsequent progress meetings.

Target Skill Selection and Self-Management

During the pre-intervention session, an assessment of individual social vulnerabilities was conducted. Participants and parents were provided with a list of common social skill difficulties/vulnerabilities and also had the option to write in additional concerns that were not listed (this list is described in Vernon et al. 2016). Based on a rank order of specific social skill difficulties completed separately by each adolescent, a parent, and an intake clinician, consensus was reached on an individual social skill to serve as the initial focus of self-management. The primary objective was to directly target the social skill deficit that was identified as having the largest negative impact on each adolescent's level of social success. For example, for an adolescent with challenges related to maintaining a conversation, the skill of question asking as a means of initiating and sustaining a discussion might be selected as an initial self-management target.

The primary facilitator discussed the target skill with adolescent and they jointly practiced self-management procedures (monitoring and tracking one's use of a particular social skill). Specifically, the skill was operationally defined for the participant, modeled by the social facilitator, and then practiced in a brief conversational exchange while the participant tracked their skill use using a small digital tally counter. After the participant could verbally describe the target social skill and successfully demonstrate accurate self-management in conversation, they were encouraged to continue self-managing use of this skill during each START group session. Individual goals were reexamined every 5 weeks and a new primary skill was introduced as participants either (a) demonstrated adequate mastery of a previous target skill or (b) exhibited a more significant challenge in another skill domain that was identified as a more notable source of social difficulty.

START Program Sessions

All of the adolescents began participation in the START program within 2 weeks of completing all pre-intervention measures. The 90-min weekly program consisted of the following phases: an individual therapeutic check-in session, a group unstructured socialization time, a group discussion and practice of a social skill topic, a structured group activity, and an individual checkout session with parent involvement. Participants, 2–4 college-aged social facilitators, and 1–2 high school peers attended each group.

Individual Check-in Session Adolescents first completed an individual check-in session with a college-aged social facilitator. This time period was allotted to provide a private forum to discuss the previous week's social challenges and successes, review social homework, practice self-management of the current individualized target behavior, and become oriented to the activities of the upcoming session. Facilitators used this time to prime individuals of session content and answer questions.

Free Socialization Phase All participants joined the group free socialization time with the facilitators and high school peers. This time was allowed to unfold without a predetermined agenda and was intended to create a natural, comfortable social environment. Topics were brought up organically by the participants and often included video games, favorite foods and places to eat, school and current events, vacation and weekend plans, and memorable personal experiences. Food and refreshments were provided during each group to aid in the creation of a casual, club-like atmosphere. While

conversing with one another, the participants and social facilitators discretely tracked their use of individual target skills using self-management. The high school peer models and the college-aged facilitators also participated in this self-management process to ensure that every group member was held to the same expectations and to minimize perceived differences between session attendees.

Social Topic Discussion and Practice After the free socialization phase, the social facilitators then introduced the week's social skill topic, which was explored for the next 40 min. After a brief introduction of the target skill, the topic was then modeled by the social facilitators in a series of two brief role-plays—one "bad" example demonstrating poor implementation of the skill and a follow-up "good" example depicting proper use of that particular skill. Popular television and movie clips were also used to highlight good and bad examples of the skill in question. Social facilitators discussed the main points of the topic and recalled relevant personal experiences. The adolescent participants were also encouraged to contribute to the topic—discussing their experiences related to that topic and providing their own suggestions regarding the successful use of a particular social skill. Finally, for the last 5 min of the group, all participants practiced the related skill with a partner.

A manualized curriculum of key points and sample stories and scripts were used to structure and guide these discussions. This portion of the group was intended to increase understanding of a social skills topic and provide opportunities to both observe and practice the skill. Social skills topics covered included: making introductions, maintaining a conversation, respectfully disagreeing, and group interactions. A complete list of weekly topics and a description of the curriculum are provided in Table 2.

Social Activity Phase For the final 20 min, the group transitioned into a structured social activity. These activities varied each week, but generally resembled commonly used team-building activities and party games. Activities were also selected to be highly enjoyable and motivating to increase the engagement of the group participants. This phase was intended to foster sharing of personal information, encourage learning about peer interests, increase comfort in the group, and promote cooperation and teamwork. Other benefits included opportunities to work on effective communication, compromise, and good sportsmanship skills.

Checkout Session At the end of each group session, individual checkout sessions were conducted with each participant, a parent, and their assigned social facilitator. The participants discussed their experiences in the group, reviewed the group socialization topic with their parent, and set 2 weekly homework assignments—one based on their individual self-management target and the other based on the weekly group curriculum. Finally, a written summary of the current topic was provided to the family as a visual reference.

Fidelity of Implementation

In order to assure that all described components were consistently implemented each group, a weekly fidelity checklist was completed during each session (see Online Appendix A for a sample checklist). Phases and content were checked off as they were covered and any deviations from the specified timeframe were noted. An analysis of these fidelity checklists indicated that procedures were correctly implemented 97.7% of the time.

Attendance

Attendance was documented for each participant to ensure that any observable social gains could be accurately attributed to adequate exposure to the 20 week START program. Participants in the immediate treatment condition attended an average of 18.56 of the 20 sessions (92.8%). The entire project cohort attended an average of 18.59 of the 20 sessions (92.9%).

Dependent Measures

A number of assessment measures were used to assess baseline functioning and improvement. These instruments were administered prior to starting the START program and after every 5 weeks. These measures included both commonly used, well-established tools in the field of autism research [the Social Skills Improvement System-Rating Scales (SSIS-RS) and the Social Responsiveness Scale, Second Edition (SRS-2)] and an internally developed instrument (The Social Motivation and Competencies Scale).

Social Skills Improvement System-Rating Scales (SSIS)

The SSIS is a 75–83 item revised version of a widely-used rating scale measuring measures several aspects of social skills, including Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, and Self-Control (Gresham and Elliott 2008). Internal consistency alpha reliability coefficients for the parent and self-report forms are reported to be in the mid to upper 0.90s, with moderate to high correlations to other social and behavioral scales.

Social Responsiveness Scale, Second Edition (SRS-2)

The SRS-2 is a 65-item rating scale that covers various dimensions of interpersonal behavior, communication, and stereotypic behavior associated with ASD (Constantino and

Table 2 START weekly group discussion topics and description

Week	Topic	Description
1	Making a good first impression/greeting others/making initial introductions	Making first contact with peers and successfully entering into a social interaction with others
2	Using questions in conversation	Keeping a conversation going and demonstrating interest by making social inquiries that are thematically related to the topic of conversation
3	Using comments in conversation	Keeping a conversation going and sharing experiences and perspectives that are thematically related to the current topic of conversation
4	Showing interest—attention, eye contact, facial expressions	Using appropriate nonverbal behaviors, such as eye contact, directed facial expressions, body posture, and gestures to convey focus on a conversational partner
5	Choosing appropriate topics for conversations	Identifying topics that are likely to be mutually appealing to both social partners and avoiding controversial/inappropriate topics (e.g. gossip, politics, religion, sensitive personal information)
6	Making and keeping friends	Laying out a step-by-step plan for identifying peer groups, focusing on available group activities, and using previously discussed conversational strategies
7	Changing topics/ending conversations/saying goodbye	Reading nonverbal signs of interest, changing topics of conversation, and saying goodbye appropriately when it is time to end an interaction
8	Reducing anxiety/being comfortable during social exchanges	Discussing how social anxiety can impact socializing efforts and using strategies to increase one's comfort with peers
9	Expressing empathy	Showing others that you care by listening, demonstrating concern/interest, validating, and offering support when they are going through both negative and positive experiences
10	Complimenting others	Using specialized positive comments to praise someone's accomplishments, appearance, possessions, or traits
11	Giving social feedback	Delivering constructive criticism to someone to help improve their social success
12	Receiving social feedback	Receiving constructive criticism and taking action to improve how others perceive you
13	Respectfully disagreeing with others	Handling conflict and compromising in a way that prioritizes social relationships over the need to be correct
14	Demonstrating good sportsmanship/being a good winner and loser	Discussing the role of games and competitive activities in social interaction and the need to maintain a good attitude when both winning and losing events
15	Working in a group/being a good team member/leader	Interacting as a positive leader or team member of a group
16	Understanding/using appropriate humor and sarcasm	Using and understanding many forms of humor, including amusing personal anecdotes, jokes, puns, and sarcasm
17	Having social courage/joining a new group of peers	Persisting in daily social interaction and remaining open to new social experiences as a crucial means to build social momentum
18	Using cellphones and social media	Using phone calls, text messages, and social media to contact with peers, plan get-togethers, and build relationships
19	Hosting others at your home/being a good guest at someone's home	Preparing to successfully host someone at your home and demonstrating proper behavior and etiquette when being a guest at someone else's home
20	Summary of group topics and conclusion	Reviewing the START curriculum and highlighting observed social gains in participants

Gruber 2005). Internal consistency alpha reliability coefficients for the parent forms were reported to be above 0.90 and strong correlations (r = 0.52–0.74) with subscales of the ADI-R. This measure was used as an indicator of ASD symptom severity, with score reductions associated with a decrease in observable symptoms.

Social Motivation and Competencies Scale (SMCS)

The SMCS is an unpublished rating scale that was developed by the current researchers for use in this study. It was designed to have corresponding parent and adolescent self-report versions. Items pertaining to comfort in social

interaction, conversation skill use, empathy, friendships, appropriate behavior, social contact, and social interest are rated on 1–5 Likert scales. See Online Appendix B for a complete list of scale items. This measure was used as an indicator of social motivational factors and concrete skill competencies.

Social Validity Ratings

Parents and participants were both asked to provide ratings to provide information about the acceptability of the START program. Specifically, they were asked to provide separate ratings on a 0–10 Likert scale on both (a) enjoyment of the adolescent's time in the group and (b) the extent to which the adolescent's social skills/competence improved as a result of participation. The specific questions provided to participant and parent were as follows:

> On a scale from 0 to 10, how much did you enjoy (for parents: do you think your child enjoyed) being a part of the social club?
> On a scale from 0 to 10, how much did your (for parents: your child's) social skills/competence improve through participation in the club?

Data Analysis

Treatment and waitlist groups were initially compared for equivalency across demographic and intake assessment variables. Next, two separate analyses were conducted to evaluate START program outcomes. To assess group differences between treatment and waitlist groups, a *Group* × *Time* mixed MANOVA was conducted, followed by individual post-hoc ANOVAs for each dependent variable. Due to the significant difference between groups on pre Adolescent SSIS total scores, an ANCOVA was conducted for post measure scores using pre scores as a covariate.

In addition to the main between group comparisons, a separate, secondary set of analyses were conducted on the entire project cohort of 32 adolescents who ultimately received the START intervention to examine the results of a larger clinical sample. This secondary analysis was observational, not experimental, in nature and was not an analysis of the RCT. Again, this cohort consisted of the original 16 adolescents in the immediate treatment group who completed the START program and the 16 of the 19 participants in waitlist group who opted to complete the START program after the waitlist period and who re-completed all outcome measures. For the waitlist group participants, post-waitlist measures were used as their pre-intervention (baseline) data and the third administration of the measures served as their post-START program data. All dependent measures were examined using a series of paired sample t tests to examine pre-post data trends.

Results

Primary Analysis: RCT Outcome Measures

Treatment and Waitlist groups were compared for equivalency across demographic and intake assessment variables. Table 2 depicts the data for both groups. T tests failed to reach significance for age, grade, KBIT-2 Verbal IQ, parent SSIS, parent SRS-2, and parent/participant SMCS intake scores. There was a significant difference in adolescent participant SSIS total standard scores. Despite randomization procedures, the treatment group was found to endorse significantly lower adolescent reported SSIS scores at the pre-intervention time point.

Results of the mixed MANOVA analyses revealed the presence of significant *Group* × *Time* effects for the outcome variables (Wilks' Lambda = 0.53; $F(5,29) = 5.22$, $p = .002$). Results from the ANOVAs performed on individual parent and self-report social survey measures are presented in Table 3.

The assumption of homogeneity of slopes for the Adolescent SSIS ANCOVA was tested and met, as the interaction term was not statistically significant, $F(1,31) = 1.969$, $p = 1.70$. Additionally, no significant correlations were found

Table 3 Pre and post outcome measures: START versus waitlist groups

Measure	START treatment group				Waitlist control group				*p*	Partial η^2
	Pre		Post		Pre		Post			
	M	SD	M	SD	M	SD	M	SD		
Parent SSIS	75.4	(11.8)	82.2	(12.5)	80.6	(14.7)	80.8	(14.3)	.121	0.071
Parent SRS-2	74.6	(9.3)	68.2	(10.5)	76.6	(11.2)	77.5	(11.2)	.009	0.189
Parent SMCS	71.2	(10.6)	86.9	(14.7)	73.8	(11.3)	74.9	(12.4)	.001	0.287
Teen SSIS[a]	85.6	(19.2)	100.5	(17.4)	100.7	(20.9)	100.0	(21.0)	.007	0.207
Teen SMCS	95.6	(14.4)	102.0	(15.5)	94.7	(18.3)	94.2	(23.6)	.119	0.072

[a]ANCOVA used to control for significant pre score differences. Data presented are unadjusted scores. See text for adjusted scores

between pre-intervention SSIS scores and other measures at post intervention (*ps* > .5). ANCOVA results for the Adolescent SSIS scores are reported in Table 3 as unadjusted data. The adjusted data are as follows: Mean adolescent report SSIS total scores were greater in the START group (106.1 ± 4.1) compared to the waitlist group (96.1 ± 3.8), using a pre covariate SSIS value of 93.9.

The *Group* × *Time* interaction reached statistical significance for several outcome measures: Parent SRS-2, $F(1,33) = 7.68$, $p = .009$, partial $\eta^2 = 0.189$; Parent SMCS $F(1,33) = 13.29$, $p = .001$, partial $\eta^2 = 0.287$. After adjusting for pre-intervention Adolescent SSIS scores, there was also a statistically significant difference in post-intervention Adolescent SSIS scores between the groups, $F(1,32) = 8.39$, $p = .007$, partial $\eta^2 = 0.207$. *Group* × *Time* interaction did *not* reach statistical significance for the Parent SSIS, $F(1,33) = 2.53$, $p = .121$, partial $\eta^2 = 0.071$; and the Adolescent SMCS, $F(1,33) = 2.56$, $p = .119$, partial $\eta^2 = 0.072$. The outcome measures are depicted in Figs. 2, 3, 4, 5 and 6.

Secondary Analysis: Entire Project Cohort Outcomes

Results of the paired sample t tests for each outcome measure are presented in Table 4. Significant differences were found between all pre-post measures (Parent SSIS, Parent SRS-2, Parent SMCS, Teen SSIS, and Teen SMCS; $p < .01$) and these data are also depicted in Fig. 2-6.

Social Validity Ratings

All parents endorsed ratings indicating that their adolescent highly enjoyed being a part of the social skills group (mean rating of 8.14 out of 10, SD = 0.97). Additionally, they endorsed that their child's social skills and competence improved through participation in the group (mean of 7.50 out of 10, SD = 0.82).

The adolescent participants also indicated that they enjoyed their time in the groups (mean rating of 8.41 out of 10, SD = 1.83). Likewise, they endorsed that their social skills and competence improved through participation in the group (mean of 8.34 out of 10, SD = 1.43).

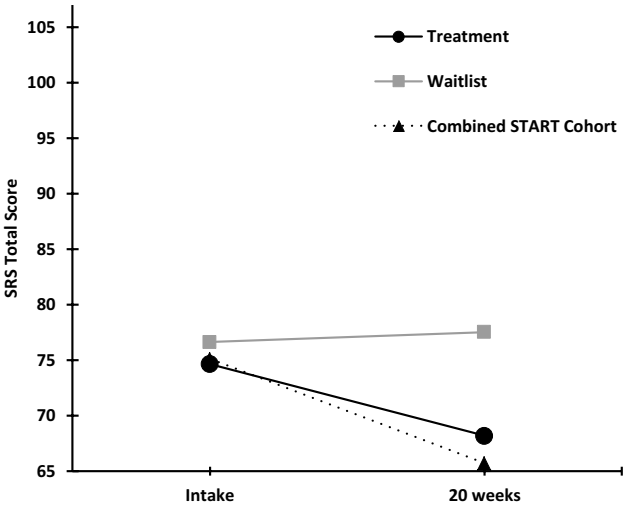

Fig. 3 SRS-2 total standard score for RCT groups and combined START cohort at pre and post. Note: lower scores indicate improvement

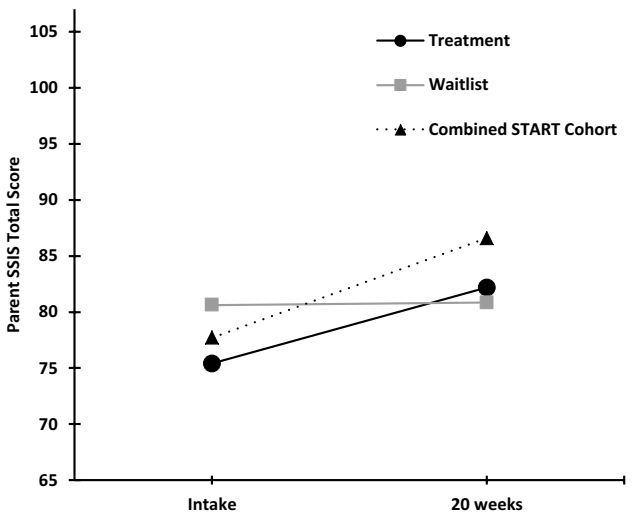

Fig. 2 Parent SSIS total standard score for RCT groups and combined START cohort at pre and post

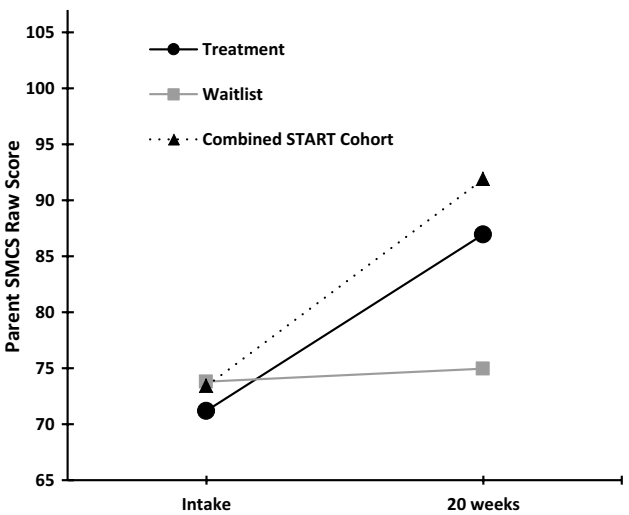

Fig. 4 Parent SMCS raw score for RCT groups and combined START cohort at pre and post

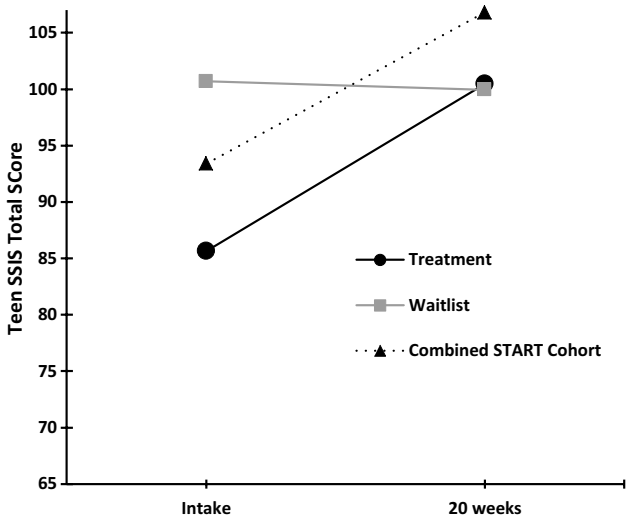

Fig. 5 Teen SSIS total standard score for RCT groups and combined START cohort at pre and post

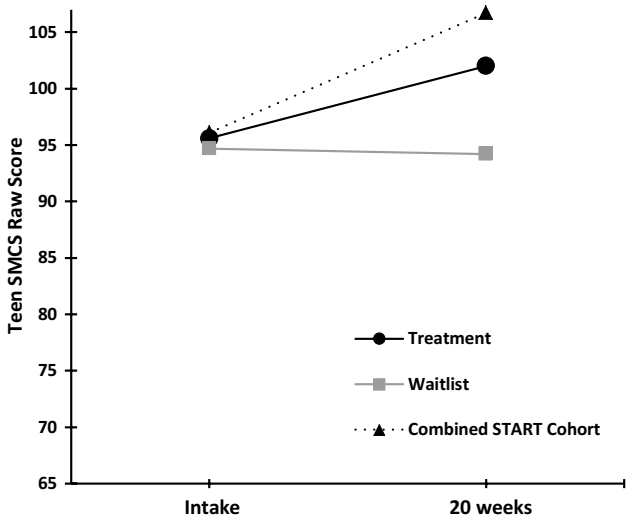

Fig. 6 Teen SMCS raw score for RCT groups and combined START cohort at pre and post

Discussion

The participating adolescents and their parents provided outcome measure endorsements that suggest that the START program was perceived as effective in increasing social competencies and reducing autism-related symptomology. Specifically, there were significant *Group* × *Time* differences between START and waitlist groups treatment group on the Parent SRS-2 total standard score, Parent SMCS raw scores, and Adolescent SSIS total standard scores (all with medium-to-large effect sizes). This evidence suggests that participating adolescents and their parents observed improvements in global social functioning and a reduction in the social vulnerabilities associated with ASD. Although there were promising improvement trends on the Parent SSIS and Adolescent SMCS scores for the START group, analyses did not yield significant *Group* × *Time* effects across these measures.

When the entire cohort analyses were conducted after all project participants had completed the START intervention program, significant pre-to-post changes with medium-to-large effect sizes were observed across all five outcome measures. While these observed trends may be indicative of perceived clinical improvements after participation in the 20 week START program, changes in these variables cannot be used as definitive evidence of treatment effectiveness (see the Limitations and Future Directions section for more information).

The social validity questionnaire responses provide evidence that the participating adolescents seemed to derive both enjoyment and therapeutic benefit from the experiential intervention. Parents appeared to share in this perspective. It was of utmost importance that adolescents be inclined to participate voluntarily in the program during the design of the curriculum. Any observed reluctance or reliance on parental pressure to continue in the program would have suggested that participants were only doing so to bow to the demands of their caregivers. Any form of "mandated treatment" would have resulted in limited buy-in and thus minimally engaged participants, which in turn would have resulted in negligible social benefits. The START program elements were specifically selected and combined to create

Table 4 Pre and post outcome measures results for the combined START cohort

Measure	Pre		Post		n	95% CI for mean difference	t	*p*	Cohen'sd
	M	SD	M	SD					
Parent SSIS	77.7	13.1	86.6	14.8	32	4.8, 12.9	4.52	< .001	0.80
Parent SRS-2	75.1	19.3	65.7	10.0	32	− 12.8, − 6.1	3.47	.002	1.02
Parent SMCS	73.4	11.5	91.9	14.0	32	12.9, 24.0	− 5.78	< .001	1.20
Teen SSIS	93.4	21.4	106.8	17.2	32	5.5, 21.3	6.77	< .001	0.61
Teen SMCS	96.1	18.9	106.7	12.6	32	3.5, 17.7	3.03	.005	0.54

a motivational interpersonal context. As a result of these components, many participants reported increased self-confidence and willingness to take social risks with peers. Anecdotally, many participants reported the group as their first positive peer experience and reported making new connections and learning crucial skills for the first time. Interestingly, two of the families who discontinued the project mid-way through the START program reportedly did so because their adolescent now felt comfortable enough to enroll in extracurricular social activities with peers that conflicted with the START program time.

Limitations and Future Directions

The significant difference in pre-intervention SSIS adolescent-self report total scores is a important selection bias concern, because it suggests that the groups potentially varied on critical variables and were not equal despite randomization procedures. This concern is partially alleviated by the fact that they did not significantly vary on any other demographic variable or pre-intervention measure (including the corresponding parent report SSIS), indicating that the groups seemed to be comparable on all other measured characteristics. However, because the START group adolescent pre-intervention SSIS scores fell below average and subsequently entered the average range by post-intervention (see Fig. 5), it is possible that this change reflects simple regression towards the mean rather than evidence of treatment efficacy.

In the secondary, nonexperimental analysis of the entire project cohort, significant differences were noted in the pre-post comparisons across all five outcome measures; however, this larger sample analysis only allows us to look at observational data trends and not make additional claims of treatment effectiveness due to a lack of experimental control. It is possible that the majority of the dependent variable change observed in this secondary analysis may not be attributable to the treatment itself. Therefore, any conclusions drawn from this nonexperimental analysis must understandably be tempered. As a future direction, a larger multi-site RCT replication is needed with a significantly increased sample size to make more definitive claims about the START group's efficacy.

The time intensive nature of START intervention program is a study limitation that could restrict the perceived acceptability and replicability of the treatment protocol. Participants committed to a 90-min session for 20 weeks (not including time outside of sessions practicing their group and individual goals). However, there was evidence that parents and adolescent participants perceived the group to be both highly enjoyable and effective. After all, altering the social trajectories of individuals with ASD is a formidable task, as the impairments in social motivation and competence are perhaps deeply rooted within the very biology of the disorder (DiCicco-Bloom et al. 2006). Addressing such challenges requires a comprehensive, time-intensive approach to create the necessary momentum to counteract the asocial inertia that may have accumulated as the result of limited social competence and peer rejection/indifference. Nevertheless, the time commitment may be too burdensome for particularly busy adolescents and their families. A future component analysis of each session phase may be a potential strategy for identifying the high-impact components of the START program and ultimately reducing the overall time commitment required to participate while preserving general program efficacy.

The reliance on parent and adolescent survey-based outcome measures also has noteworthy limitations. While widely used in the ASD intervention literature, survey measures are susceptible to inherent drawbacks and validity risks, including the risk of random responding, social desirability biases, and demand characteristics, especially among parties invested in a particular outcome (Furr and Funder 2007; Moskowitz 1986). As one example, the participants consistently rated themselves as more socially competent than their parents did on corresponding measures of competence—a finding that suggests that socialization ratings are inherently subjective, which has been replicated across many studies (McMahon and Solomon 2015; Lerner et al. 2012; Vernon et al. 2016). Correlated measurement error is a serious concern, as parents and adolescents were not blind to group assignment and served as raters in this particular investigation. They also invested significant time and effort into participation in this trial, which may have biased them when responding to post-intervention survey measures into endorsing benefit when it may not have actually existed. To address this limitation, efforts are now underway to analyze video-recorded social interactions that may provide more objective, observable social data as additional evidence of possible program efficacy. The use of examiners and raters who are blind to treatment condition will further strengthen future research efforts.

START Conceptual Model

In order to better understand the design and conceptualized mechanism of change of the START program, it may be helpful to explore its theoretical underpinnings. The model is grounded in a transactional model of social development focused on the construct of social readiness. *Social readiness* can be conceptualized as the combination of two essential components needed for optimal interpersonal functioning: *social motivation* and *social competency*. In turn, *social competency* can be further broken down into mastery of *social insight* and *social skills* (Vernon et al. 2016). The START socialization curriculum was intentionally designed

to integrate both experiential and didactic training components within a single peer-facilitated intervention to target these components.

Social Motivation is the desire the voluntarily engage in social pursuits and the anticipation that one will derive pleasure from such interactions, serving as a popular conceptualization of autism-related vulnerabilities (Chevallier et al. 2012; Dawson et al. 2005). Social motivation is a prerequisite that makes social immersion and experiential learning possible. At its foundation, the START program was intended to maximize the motivation of individuals who are very interpersonally vulnerable. A safe, accepting space was fostered for practicing social skills without the fear of rejection or judgment. Group cohesion and unconditional acceptance was emphasized. By creating a supportive experiential context, the participants were granted the opportunity to become fully immersed and accepted by a peer group, which then became the ideal forum in which to practice and master critical social competencies. Specifically, participants were given the freedom to experiment with different social tools and gradually build comfort with wielding these strategies over time. Over the course of 20 weeks, they accumulated frequent, reoccurring experiences of social success to establish both confidence and valuable social momentum.

Social Insight is the understanding of underlying principles that govern successful social behavior, encompassing various concepts of social cognition (i.e., empathy, theory of mind, problem-solving capacities, and executive functioning skills; Schmidt et al. 2011; Solomon et al. 2004). Several program components were specifically incorporated into the program to foster social insight. The check-in and check-out phases of each group provided a private forum to intentionally reflect on one's social experiences and process perceived success and failure. Participants were also made to think through role-plays and videos and describe the reasoning behind certain social decisions. Finally, during group topic discussions, the rationale underlying the use of certain social strategies was explored and explicit links were made to principles of empathy, courtesy, respect, and constructive problem solving.

Finally, *Social Skills* describe concrete behaviors that are employed in the proper context at the proper time to facilitate a successful exchange (Bellini et al. 2007). The hands-on activities and self-management components of the START program facilitated the development and mastery of this concrete social skillset. Individual skills were modeled, practiced, and critiqued each session. Intentional practice redundancies were also used to promote eventual automaticity of skill use. Specifically, individualized target skills were practiced during check-in, self-managed during group, and assigned as homework in between group sessions. Similarly, weekly skills highlighted in the group curriculum were critically analyzed during role-play sessions and video examples, demonstrated, practiced in pairs, and assigned as weekly social homework.

The Socialization Dilemma

As previously discussed, social immersion is a prerequisite to develop social readiness components of motivation and competence, and yet, sufficient social motivation and competence are also prerequisites to access receptive social partners needed for immersion to occur. There creates a perpetual feedback loop that is highly dependent on one's initial (starting) levels of social motivation and competency (depicted in Fig. 7). The catch-22 is that individuals who fail to possess sufficient adequate motivation and/or competencies cannot access the receptive social partners needed to enhance these deficiencies. This dilemma creates a sort of social stagnation that can only be resolved if both internal and external interpersonal barriers are addressed simultaneously. Specifically, an effective intervention package needs to create an accepting social context while also targeting social motivational and competency barriers. This dual-pronged approach ensures that the social environment is conducive to ongoing experimentation and experiential learning while also providing direct instruction and guided practice of fundamental social tools and rules.

The promising findings of this trial may be an important step in identifying optimal strategies to simultaneously target the complex, intertwined factors that often limit social development in adolescents with ASD. Using a curriculum that cumulatively builds upon previous lessons, participants established early foundational social strategies that increase the likelihood of success in later social opportunities. The club-like context and the inclusion of typically developing peers also appears to have created an environment of inclusion and acceptance while minimizing the stigma typically associated with acknowledging and

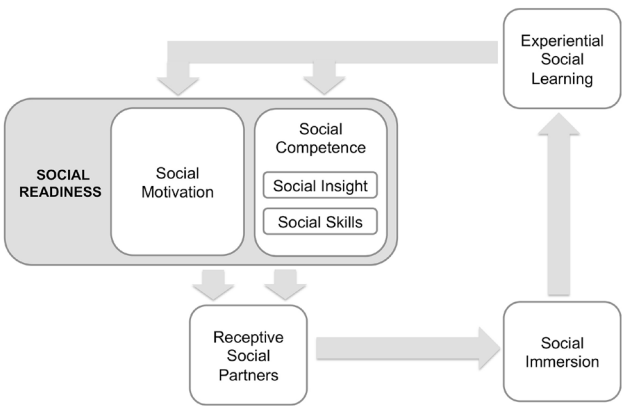

Fig. 7 Social readiness conceptual model and transactional feedback loop

discussing one's personal vulnerabilities. Furthermore, the use of individualized treatment targets and private pre- and post-session check-in and out meetings allowed the total intervention package to be responsive and tailored to address the unique profiles of each adolescent.

The START program was not designed to simply teach a finite set of social skills; rather, it was intended to promote broader social readiness capacities—a flexible conceptual framework for approaching social encounters. This framework is combined with an immersive social context to allow one to freely experiment with different strategies and receive both formative and summative feedback during sessions and progress meetings. The current evaluation of the START program yielded important outcomes that suggest that this novel experience-based social program can be effective in increasing the social readiness of adolescents with ASD. By offering a comprehensive group that combined typically developing peers, free socialization periods, structured social activities, individualized and group goals, and an inclusive atmosphere, participants experienced promising levels of improvement in their social motivation and competence.

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Author Contributions TV served as principal investigator for the study; supervised the grant project coordinators; and participated in the design, implementation, and data analysis of the project. TV and AM jointly conceptualized, developed, and pilot-tested the START intervention model. JK assisted with intervention model development, modification, and refinement. AM and JK were the grant project coordinators and trained/supervised all clinicians and research assistants; coordinated daily operations of the project; and oversaw data collection, organization, and analysis efforts. AB and EM supervised START clinicians and high school volunteers in the implementation of the intervention protocol. All authors contributed to significant portions of the manuscript drafting and revision process.

Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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