

## Utilizing Teaching Interactions to Facilitate Social Skills in the Natural Environment

Alyne Kassardjian and  
Mitchell Taubman  
Autism Partnership

Eric Rudrud  
St. Cloud State University

Justin B. Leaf, Andrew Edwards,  
John McEachin, Ron Leaf  
Autism Partnership

Kim Schulze  
St. Cloud State University

*Abstract: Individuals diagnosed with autism spectrum disorder often display deficits in social skills. While research has shown behavioral interventions to be effective in teaching and/or increasing a variety of appropriate social skills, limited research has shown generalization of these skills to the natural setting. The Teaching Interaction procedure was used to teach social skills to four children with autism. In addition, a fifth participant was utilized; this participant did not receive the Teaching Interaction intervention, and was utilized as a control. Results indicated the Teaching Interaction procedure was effective in teaching new appropriate social skills, of different topographies, that generalized to untrained social interactions in the participants' natural environment.*

Children with autism often exhibit an array of deficits in displaying appropriate social skills (American Psychiatric Association, 1994). Displaying deficits in social skills is one of the three criteria necessary to receive a diagnosis of Autism Spectrum Disorder (ASD). Researchers have found that children with autism make or respond to fewer social initiations and spend more time playing independently than their peers (Nikopoulos & Keenan, 2004). Appropriate social skills, which imply engaging in positive or functional interactions with others (Kamps, Leonard, Vernon, Dugan, & Delquadri, 1992), are necessary to function independently and successfully in society. Although exhibiting deficits in social skills are necessary to receive a diagnosis of ASD, this broad category remains somewhat poorly represented within research, with a

limited body of social skills being taught. In addition, effective generalization of social skills taught within the body of research has been demonstrated at best in limited fashion.

Numerous social skills training programs have been utilized to teach social skills. For example, script fading (e.g., Kranz & McClannahan, 1998; Sarokoff, Taylor, & Poulson, 2001), live and video-taped modeling (e.g., LeBlanc et al. 2003; Nikopoulos & Keenan, 2004), role playing (e.g., Lumley, Miltenberger, Long, Rapp, & Roberts, 1998), and the Teaching Interaction procedure (e.g., Leaf et al., 2009). Social skills trainings have been conducted in both individual and group settings (e.g., Hazel, Schumaker, Sherman & Sheldon, 1995; Leaf, Dotson, Oppenheim, Sheldon, & Sherman, 2010).

One procedure that is implemented to teach social skills to children and adolescents with autism is the Teaching Interaction procedure (Leaf et al., 2009; Dotson, Leaf, Sheldon, & Sherman, 2010). The Teaching Interaction procedure involves six essential steps: 1) initiation/ identification/ labeling, 2) rationale, 3) description and demonstration, 4) practice (role-play), 5) feedback, and 6) rein-

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forcement. The Teaching Interaction procedure has been used to teach appropriate behaviors to youth in the Boys Town Family Home Programs (Dowd, Czyz, O’Kane, & Elofson, 1994) and conversational skills to girls in the Achievement Place residential youth homes (Minkin et al., 1976). Although the Teaching Interaction procedure is not a new procedure, there is currently little research demonstrating the efficacy of the treatment package with children with ASD. Dotson et al. (2010) utilized the Teaching Interaction procedure to teach conversational skills to adolescents diagnosed with autism. The researchers provided teaching in a group setting to teach five children conversational basics, how to give positive feedback to a speaker, and how to answer and ask open-ended questions. Across all behaviors targeted, participants only began demonstrating correct responding following the implementation of the Teaching Interaction procedure. Following the commencement of the treatment phases, four out of the five participants met mastery criteria for the skill of conversational basics, and all five participants mastered both the skills of giving positive feedback to a speaker and how to answer and ask open-ended questions.

Leaf et al. (2010) utilized the Teaching Interaction procedure to assess the efficacy of a group Teaching Interaction procedure for teaching social skills to five children with autism. Three of the participants were taught four social skills (i.e., showing appreciation, giving a compliment, making an empathetic statement, and changing the game when someone was uninterested), while two of the participants were taught two social skills (i.e., changing the game when someone was disinterested, and making empathetic statements). During baseline probes, each of the participants displayed the skills at consistently low levels, with no participant displaying more than 50% of the steps correctly. With the implementation of the Teaching Interaction procedure, four of the five participants reached mastery criteria for each of the skills. The fifth participant reached mastery criteria for three of the four social skills. Within this study, efforts were made to plan for generalization. However, following implementation of additional programming (reinforcement and/or priming), generalization to natural

environments, without these components, was not evaluated. Leaf and colleagues suggested that future researchers should look to use these components as phases to achieving generalization; however, generalization should be assessed following these phases within the natural environments, free from motivational or artificial conditions.

Although the previous research has demonstrated that the Teaching Interaction procedure can be effective in teaching social skills to children with autism it has, in each case, been implemented in a structured and formulaic manner. Although a Teaching Interaction procedure is guided by a precise arrangement of components (as in the previous research), in a clinical setting, the application of each teaching component is shaped by circumstances occurring within the teaching session and by the unique needs of the learner. For example, if the teacher has modeled for the student the behavior to be learned in each of the previous Teaching Interaction sessions, and the student has shown understanding of this behavior based on probe derived data, the trainer may choose to omit the modeling component of the Teaching Interaction procedure within that particular training session. Even though, in a clinical setting (Taubman, Leaf, & McEachin, 2011), the Teaching Interaction procedure has been utilized in a “flexible” manner (that is, where implementation is shaped, under clear guidelines, by factors occurring in the moment), it has not yet been evaluated in the literature. Therefore research in this area seems warranted. Although previous research has not evaluated clinical flexibility with the Teaching Interaction procedure, there have been studies that have evaluated this approach with other behavioral interventions for children with autism. For example, the application of a flexible prompting procedure has been shown to result in enhanced mastery of teaching targets (Saluaga, Leaf, Taubman, McEachin, & Leaf, 2008) as compared to a more formulaic teaching paradigm.

A second area warranting further investigation pertains to the generalization of skills, learned through the use of the Teaching Interaction procedure, to more natural environments. The generalization of newly acquired behaviors to the natural environment is a fun-

damental dimension of applied behavior analysis (Stokes & Baer, 1977). However, many social skills studies either do not address generalization, make no attempt to train or assess generalization in the natural environment, or report limited or no generalization to the natural environment. In those cases when generalization is described it is often limited to untrained tasks or role-play scenarios, unfamiliar stimuli, new models within the training setting, and/or follow-up probes. For example, Nikopoulos and Keenan (2004), and Kamps et al. (1992) conducted follow-up probes to assess maintenance and generalization of social skills following training. LeBlanc et al. (2003), Krantz et al. (1998), and Sarakoff et al. (2001), utilized untrained tasks, unfamiliar conversant, unfamiliar activities, and/or unfamiliar role-plays to assess generalization. Although each of these studies assessed some aspect of generalization, none evaluated generalization from the training setting to more natural environments.

When generalization to the natural environment has been assessed, the results have often been discouraging. As noted by Lumley et al. (1998) and Miltenberger et al. (1999), generalization of trained skills was not convincingly demonstrated because performance during the naturalistic probes was not at the level obtained during role plays. Generalization of social skills may be facilitated by providing learners the opportunities to practice the new skill in increasingly naturalistic environments incorporating a teaching strategy within the natural environment and gradually fading instructions and prompts.

Therefore, the purpose of this study was to investigate the use of a flexibly implemented Teaching Interaction procedure to teach social skills to children with autism, and to assess the generalization of those social skills in more naturalistic settings. This study was seeking to demonstrate the efficacy of the Teaching Interaction procedure in establishing pro-social behaviors (i.e., sportsmanship, responding to modern greetings, responding to peers, and expansion of conversations) in children with autism. Moreover, the study was designed to assess the effectiveness of a systematic generalization plan in promoting the transfer of learned pro-social skills to the natural environment.

## Method

### *Participants*

Participants included five children diagnosed with autism, ranging in age from 4 to 13 years old. Each of the participants had been diagnosed with ASD by independent diagnosticians prior to the study. All participants had been receiving behaviorally oriented treatment or educational services prior to this study being conducted. Four participants were each taught one social skill that was integral to their appropriate social interaction with peers; while a fifth child served as a control participant and did not receive intervention. Social skill training was provided for the control participant upon the completion of the study.

Billy was a 4 year old boy diagnosed with an autism spectrum disorder. He had full scale IQ score of 96 on the WPPSI-III test, and was placed in a general education classroom setting with support. Billy displayed deficits in social behavior, which included limited range of interests and limited conversational skills. During this study, Billy received 10 hours of behavioral intervention per week from a provider of intensive behavioral intervention which was provided in a one to one format. Prior to the study, Billy had experience with the Teaching Interaction procedure.

Robby was a 6 year old boy diagnosed with an autism spectrum disorder. He had a full scale IQ score of 100 on the WPPSI-III test, and was placed in a general education classroom setting with individualized support. Robby displayed deficits in social behavior, which included difficulty picking up on social cues and restricted conversational skills. During this study, Robby received 10 hours of behavioral intervention per week from a provider of intensive behavioral intervention which was offered in a one to one format. Prior to the study, Robby had experience with the Teaching Interaction procedure.

Cameron was a 6 year old boy diagnosed with autism spectrum disorder. He had a full scale IQ score of 91 on the WPPSI-III test, and was placed in a general education classroom setting with individualized support. Cameron displayed deficits in social behavior, which included a restricted range of interests and def-

icits in initiating and responding with peers. During this study, Cameron received 10 hours of behavioral intervention per week from a provider of intensive behavioral intervention which was provided in a one to one format. Prior to the study, Cameron had limited experience with the Teaching Interaction procedure.

Kyle was a 13 year old boy diagnosed with autism spectrum disorder. He had a full scale IQ of 54 on the WISC-IV test, and was placed in a special education classroom setting. Kyle displayed deficits in social behavior, which included rote, un-natural language, and difficulties joining in conversation with peers. During this study, Kyle was in a moderate to severe ABA classroom, being served for 7 hours per day. He did not receive behavioral intervention in a one to one format and had no experience with the Teaching Interaction procedure.

Daniel, the control participant, was an 11 year old boy that had average or above average intellectual ability, academic performance, and language skills. He had a full scale IQ of 115 on the WISC-IV test. Daniel was in a general education setting with individualized support. He received 2 hours per week of behavioral therapy services from a provider of intensive behavioral and intervention was provided in a one to one format.

### *Setting*

Location of training was determined based on the setting in which participants received behavioral intervention. Initial social skills training was conducted, for Billy and Robby, in the participants' homes (in a designated therapy room); for Cameron, at his behavior therapy clinic (in a designated therapy room), and, for Kyle, in the student's classroom. Generalization training and probes were conducted in more naturalistic settings, where the social interactions were allowed to transpire in a naturalistic state. These settings included places in the community, school, a sports team, and/or play-dates with peers.

### *Social Skills Taught*

Target behaviors for each participant were determined by conducting observations of the

participants with peers in their natural environments (e.g., school, after school social skill groups). For one of the participants, Kyle, the target behavior was determined by his classroom teacher as a skill deficit. For the other three participants, Billy, Robby, and Cameron, and the control participant, Daniel, their behavioral therapy coordinators' identified each target behavior as a deficit behavior. Billy had difficulty maintaining conversations with peers, therefore he was taught the social skill of expansion of conversations. Robby often "gloated" and "showed off" when he won a game, therefore, he was taught sportsmanship skills when he won a game. Cameron did not initiate nor respond to social initiations from his peers, therefore, he was taught the skill of responding to peers. Kyle utilized rote responses that often did not make sense, when responding to peers' initiations, therefore, he was taught to use modern greetings in response to peer initiations. Daniel, the control participant, had average verbal skills; however, when a conversation did not involve him, especially when he was not interested in the topic of conversation, he would not participate. His target behavior was joining into conversations. Each social skill was task analyzed and broken down into individual components.

### *Dependent Measures*

How participants' displayed their targeted social skills with their teachers and with peers (as described above) was evaluated. In order to evaluate how well participants displayed social skills with a teacher, teaching probes were utilized. In order to evaluate how well participants displayed social skills with a peer in natural circumstances, free from artificial and motivational conditions the researchers implemented generalization probes. Data collection occurred three times per week for each participant in the intervention group and one time per week for the control participant. Generalization probes occurred one time per week for each participant for the duration of the study.

*Teaching Probes.* Teaching probes were implemented as part of the Teaching Interaction procedure. The fourth step of the Teaching Interaction procedure includes the participant having the opportunity to practice the

social skill that is being taught and probes were conducted during this step of the Teaching Interaction procedure. During these role-plays the teachers or peers engaged in behavior that set the occasion for the participant to display the targeted social behavior. For example, for the target behavior of good sportsmanship, the teacher would play and lose a game with the participant and record which of the behavioral steps the participant displayed correctly and which of the steps the participant displayed incorrectly or omitted.

Teachers had participants role-play the targeted social behavior three to five times during the Teaching Interaction procedure. Under the general guidelines, the teachers had some flexibility in determining when the session would be stopped. The teacher could apply the guidelines by making decisions under those parameters based upon presenting conditions in the moment. For example, if the participant was on the cusp of acquiring a skill, the session could be extended for an additional trial to allow for the acquisition of the skill. The last opportunity that the participant had to role-play the skill was considered the teaching probe and was used to assess acquisition of the targeted social behavior. Mastery criterion was set as the participant displaying 80 to 100% of the behavioral steps across three consecutive teaching probes.

*Generalization probes.* The second measure of the study assessed how well the participants displayed the social skills taught with peers, under highly natural conditions. This was measured utilizing generalization probes. During generalization probes the researchers set up opportunities for the participant to engage in the target behavior with his peers. For example, for the target behavior of good sportsmanship, the teacher would have the participant and a peer play a game. When the participant won the game the researcher would score which of the behavioral steps the participant displayed correctly and which of the steps the participant displayed incorrectly or omitted. Since one of the purposes of the study was to explicitly program for generalization there were various phases of generalization (described below).

Generalization probes were conducted during training, programmed generalization, and follow-up conditions. The generalization

probes occurred in the participants natural environments, including school, social groups, and/or home. The peers or siblings who participated in the generalization probes were not part of the probes conducted during the Teaching Interaction training. These interactions were otherwise natural social circumstances, not in any way orchestrated or choreographed.

### *Materials*

The materials used included task analysis data sheets to record the acquisition and generalization of each skill. The ability of the teacher to utilize the 6 components of the Teaching Interaction methodology was assessed via a treatment fidelity data sheet. Reinforcers for correct responses during training were individualized for each participant, chosen based on the students' choice preferences conducted prior to training commencing. Reinforcement for each of the participants was provided in the form of breaks, during which participants engaged in video games, computer games, or board games. Various stimulus items were used during the role-play scenarios, (e.g. pictures, toys) depending on what was necessary in a role-play to replicate natural situations. For example, for the student with the target behavior of "good sportsmanship when winning", a variety of games, including "Connect 4", "Sorry", and "Uno" were utilized within the role-play scenarios.

### *Procedure*

*Baseline.* Baseline occurred prior to teaching any of the social skills. Participant 1 had three baseline sessions over a 1 week period, participant 2 had six baseline sessions over a two week period, participant 3 had nine baseline sessions over a three week period, participant 4 had 12 baseline sessions over a four week period, and the control participant had baseline sessions throughout the study. During a baseline sessions, the researcher implemented teaching probes (as described above). No intervention procedures (e.g. teaching or reinforcement) were applied during baseline assessments.

*Intervention.* Intervention started with the teachers implementing the Teaching Inter-

action procedure. The Teaching Interaction procedure is a six step procedure. The first step of the procedure is initiation of the session, and identification and labeling of the targeted social skill. During this step, the teacher identified the skill that was being taught, gave it a brief, participant friendly label, and the kinds of situations in which the new skill could be used were explored. The second step of the procedure is the rationale. During this step, the teacher provided the student with a rationale for learning and using the new skill/behavior in terms of meeting the students' personal needs. The rationales were individualized to the student and pertained to naturally occurring outcomes. For example, if the rationale of "You'll look like a nice person" was not a meaningful rationale for the participant, this rationale was not provided. Conversely, if the rationale "Kids will want to talk about what you want to talk about" was meaningful for the child and truly likely to result in the utilization of the skill, it would be used. Rationales were specifically chosen as rationales that were thought to be motivating for the participants.

The third step of the Teaching Interaction procedure is describing and demonstrating (modeling). During this step, the teacher described the specific steps of the behavior to the student, and demonstrated the skill for the student. It is in this step the task analysis of the correct response was discussed with and modeled for the student. Within this phase, discrimination training occurred, in which the student needed to identify when the skill was being used, and not used. The fourth step is the learner having the opportunity to practice (role-play) the targeted social skill. The skill scenario was role-played with the student and correct responses were taught. Each student was provided with the opportunity to practice his target behavior within multiple exemplars. For example, within the role-play component for the target behavior of "expansion of conversations", practice scenarios included different conversational partners and different topics of conversation. The last role-play (teaching probe) was used to assess skill acquisition of the targeted behavior (as described above).

The final two steps are feedback and reinforcement. Specific, verbal feedback was pro-

vided immediately following a role played scenario. The teacher identified the components of the skill which the participants' role-played correctly. If errors occurred, specific suggestions for correct responding were provided for the participant. Reinforcement, consisting of social praise, as well as other forms of reinforcement (e.g., video game, computer games, and board game breaks), were provided for the students' participation in the Teaching Interaction. Reinforcement was provided for the quality of participation (e.g. compliance, attention), and was not offered contingently for correctness of specific skill components.

The flexible application of the Teaching Interaction procedure was displayed throughout each of the components. As was described above, flexibility in application was utilized during teaching sessions, when, although guided by a circumscribed set of parameters, teachers were allowed to make decisions based on the circumstances in the moment. For example, teachers were given the authority to make the decision of how many role-plays to practice with the participant during the role-play component, based on guidelines delineating factors which indicated that practices should be extended or discontinued. In addition, flexibility was displayed during the reinforcement component of the Teaching Interaction procedure. Instead of one specific reinforcer identified in advance, students were given choices of reinforcement, and choices were rotated based on what was reinforcing during the moment.

*Generalization.* Generalization probes were implemented both during intervention and following intervention (as described above); however the researchers explicitly programmed for generalization once the participants reached mastery criterion on the teaching probes. Once participants' moved into the generalization training phases, they had to achieve three consecutive probes at 80%–100% to move through each generalization phase. The researchers implemented a fading procedure to promote generalization which consisted of four phases.

*Generalization Phase 1.* In generalization phase 1, the researchers primed the student with the information that they may or may not encounter occasions to display the newly learned skills, and reminded them to utilize

the skills learned. Both tangible reinforcement and social consequences were provided by the teachers following the correct responses to generalization probes.

*Generalization Phase 2.* In generalization phase 2, the student did not receive priming; however, both tangible reinforcement and social consequences were provided by the teachers following correct responses during generalization probes.

*Generalization Phase 3.* In generalization phase 3, the student did not receive priming, and was provided by the teachers with social consequences only following the utilization of the skill during generalization probes. Tangible reinforcement was not provided.

*Generalization Phase 4.* In the last phase of generalization, the student did not receive priming, and no reinforcement or social consequences were provided following the utilization of the behavior by the researchers (although naturally occurring social consequences or outcomes may have resulted within the natural social contexts).

#### *Follow-Up*

Data was collected for each participant for 2 weeks after they had reached mastery criterion on the fourth phases of programmed generalization. Additionally, such data was collected for each participant for 5 probes over a 3 month, post-intervention period for follow up data.

#### *Design*

A multiple baseline across subjects (including a no treatment control) design was utilized. Concurrently, the researchers conducted generalization probes prior to, during, and following intervention.

#### *Interobserver Reliability*

Interobserver agreement was calculated for 33% of baseline, treatment, and generalization probe sessions. The trainers conducting the sessions served as the primary observers and data collectors within the study. All trainers were familiar and proficient in utilizing the Teaching Interaction procedure within behavioral therapy sessions, with each of the

trainers having worked at an applied behavior analysis autism treatment services agency (Autism Partnership) for a minimum of 2 year prior to beginning the study. The experimenter and a colleague served as the secondary observers within the study. Training of the primary observers, as well as the secondary observer, included explanation of the target behavior, explanation of the Teaching Interaction procedure, explanation of the data sheet, role-play of the Teaching Interaction procedure and data collection protocol, opportunity for questions, and provision of feedback. Interobserver reliability on the scoring of participant performance on the social skill task analysis was calculated by dividing the number of agreements by the total number of agreements and disagreements and multiplying by 100%.

#### *Treatment Fidelity*

At the same rate that interobserver agreement was calculated, treatment fidelity probes were conducted for 33% of baseline, treatment, and generalization probe sessions. The secondary observers who conducted interobserver agreement sessions also conducted treatment fidelity probes. Each component of the Teaching Interaction which was performed within the teaching session by the trainer was rated. A score of 1 was assigned when the component was not adequately performed. A score of 2 was assigned when the component was partially performed to criteria. A score of 3 was assigned when the component was performed to criteria.

## **Results**

#### *Skill Acquisition and Generalization*

The percentage of correct responses per probe for each participant, per condition, is shown in Figure 1 and Table 1.

Participant 1, Kyle, was taught appropriate responses to three modern greetings during Teaching Interaction sessions. Specific responses were taught for “How’s it going?; What’s going on?; and What’s cracking?”. During baseline, Kyle was able to independently perform, as measured by the task analysis, an average of 42.7% of the steps (range 28.5

## Non-Intervention Data- Control Participant

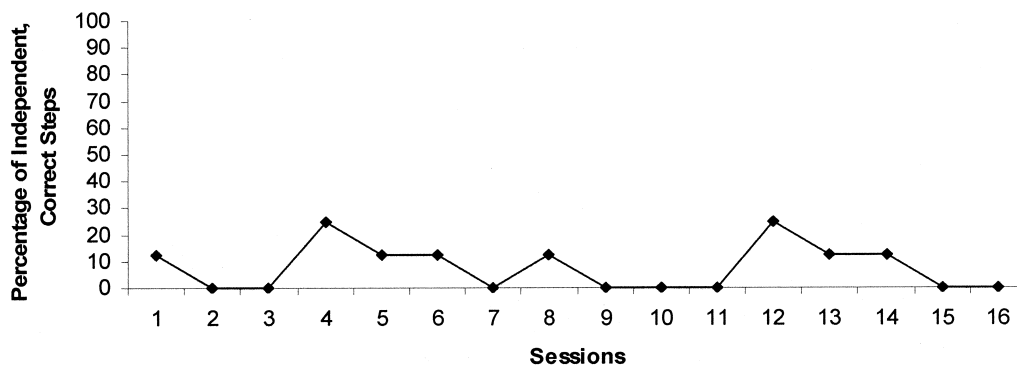


Figure 1. Social skill acquisition-control participant

to 57%). Following the implementation of Teaching Interaction procedure, Kyle displayed appropriate responding to modern greetings an average of 57.1% of steps (range 14.2 to 100%), Throughout the four generalization phases, Kyle displayed appropriate responding to modern greetings an average of 94% (range 71 to 100%), During follow-up probes, Kyle displayed appropriate responding to modern greetings an average of 97.2%. Kyle responded appropriately to 4.7% of generalization probes that occurred during the Teaching Interaction condition, 14.2% during Generalization Phase 1, 85.6% during Phase 2, 86% during Phase 3, and 100% during Phase 4.

During baseline Robby displayed an average of 21.25% of the steps (range 14 to 28.5%) of

good sportsmanship when winning. During the treatment phase, Robby displayed an average of 67.8% of the steps (range 14 to 100%). Throughout the four generalization phases, Robby displayed an average of 99% of the steps (range 85.7 to 100%) of good sportsmanship when winning. During follow-up probes, Robby displayed an average of 97.1% of the steps. Robby responded appropriately to 14.0% of generalization probes that occurred during the Teaching Interaction condition, 71% during Generalization Phase 1, 85.7% during Phase 2, 85.7% during Phase 3, and 100% during Phase 4.

During baseline Billy displayed an average of 23.7% of the components of expansion of conversation. During the Teaching Interaction instruction, Billy displayed an average of

**TABLE 1**

**Mean Percentage Correct Responding Across Conditions and Probes**

Participant	Baseline	Teaching Interaction	Generalization				Follow-up
			Phase 1	Phase 2	Phase 3	Phase 4	
Kyle	42.7	57.1	95.3	94.2	95.5	92.5	97.2
Probes		4.7	14.2	85.6	86.0	100.0	
Robby	21.3	67.8	100.0	95.2	100.0	100.0	97.1
Probes		14.0	71.0	85.7	85.7	100.0	
Billy	23.7	82.8	100.0	100.0	89.7	100.0	100.0
Probes		49.9	71.0	42.8	100.0	100.0	
Cameron	27.7	79.6	90.6	100.0			
Probes		44.3	66.3	83.0			



82.8% of steps (range 57 to 100%). Throughout the four generalization phases, Billy displayed an average of 95.2% of the steps (range 57 to 100%). During follow-up probes, Billy displayed expansion of conversations an average of 100%. Billy responded appropriately to 49.9% of generalization probes that occurred during the Teaching Interaction condition, 71% during Generalization Phase 1, 42.8% during Phase 2, 100% during Phase 3, and 100% during Phase 4.

During baseline, Cameron displayed an average of 27.6% of the steps of appropriate responding to peers/adults. During the Teaching Interaction phase, an average of 79.6% (range 66 to 100%) steps was correctly displayed. During the first two generalization phases, Cameron displayed appropriate responding to peers/adults an average of 91.6% (range 50 to 100%). Cameron responded appropriately to 44.3% of the generalization probes that occurred during Teaching Interaction and 66.3% of opportunities during Phase 1. Following the implementation of generalization phase 2, Cameron moved from the area and was unable to complete all phases of the generalization plan, see Figure 1.

### *Efficiency*

Participants were able to learn each of their individualized social skills in no more than 11 treatment sessions, for an average of 8.5 treatment sessions across each of the participants. Within the first phase of generalization training, all participants met mastery criteria in an average of 3.75 sessions. Within the second phase of generalization training, all participants met mastery criteria in an average of 3.67 sessions. Within the third phase of generalization, all participants met mastery criteria in an average of 5.3 sessions.

### *Interobserver Reliability*

For participant 1, Kyle, inter-observer reliability was 87.8%. For participant 2, Robby, inter-observer reliability was 96.8%. For participant 3, Billy, inter-observer reliability was 100%. For participant 4, Cameron, inter-observer reliability was 100%. For the control participant, Daniel, inter-observer reliability was 100%.

### *Non-Treatment Control Subject*

Data regarding the non-treatment control participant, Daniel, was collected one trial per week for the duration of the study. The specific social skill deficit assessed was “joining in conversations.” Throughout the study, Daniel was able to appropriately join in to a conversation an average of 7.8%, ranging from 0% to 25%, see Figure 2. This suggests the passage of time did not influence the ability to join in a conversation. Following the conclusion of the study, the skill of joining into conversations was taught to Daniel, utilizing the Teaching Interaction procedure. Follow up data was collected approximately 3 months after teaching the skill in the school setting, with typical peers. Results of these follow-up probes indicated that, subsequent to teaching, Daniel was able to appropriately join into conversations at an average of 95.8%.

### *Treatment Fidelity*

When assessing treatment fidelity, an independent observer scored the Teaching Interaction between the participant and teacher. Throughout the course of the teaching, all teachers were rated with scores of 3, indicating teachers accurately implemented all phases of the teaching interaction.

Although always consisting of the same 6-step Teaching Interaction procedure, the presentation differed based on the students’ variability in performance and the resultant flexibility in procedural application noted previously. For participant 1, Kyle, initiation/identification/labeling of the skill occurred during 92.5% of teaching periods. A rationale was provided during 70% of teaching periods. The behavior was described/demonstrated during 100% of teaching periods. Kyle practiced the correct behavior during 100% of teaching periods. Feedback and reinforcement was provided during 100% of teaching periods. For participant 2, Robby, every step of the Teaching Interaction occurred during 100% of teaching periods. For participant 3, Billy, every step of the Teaching Interaction occurred during 100% of teaching periods. For participant 4, Cameron, every step of the Teaching Interaction occurred during 100% of teaching periods.

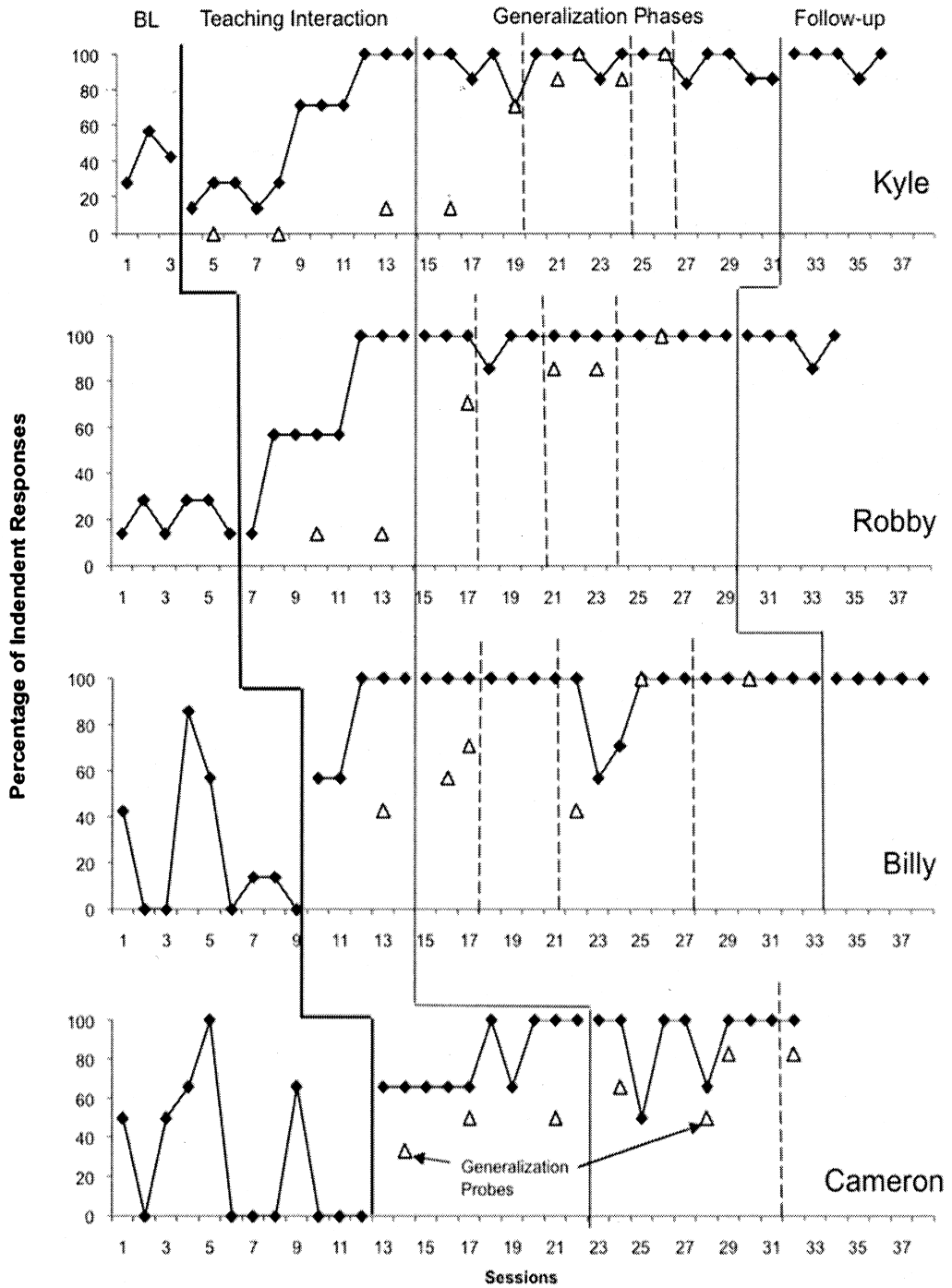


Figure 2. Social skill acquisition

## Discussion

Results of the study indicated the Teaching Interaction procedure implemented in a flexible manner was effective in teaching topographically different social skills to children with autism with varying needs and abilities, across different settings. Further, the systematic fading procedure promoted generalization of newly acquired skills to natural, non-contrived settings, free from motivational arrangements or artificial conditions, with additional peers and typically occurring interactions.

The results support studies by Leaf et al. (2009, 2010) and Dotson et al (2010) demonstrating that the Teaching Interaction procedure can be used to teach topographically dissimilar social skills to individuals with autism, across different ages, settings, and ability levels. In addition, the current study expands on the results of previous studies utilizing the Teaching Interaction procedure because of the flexible application used in this study, as well as the systematic plan for generalization. Although research involving modeling, practice and feedback techniques has occurred for decades, empirical investigation of the application of the unique configured and flexibly applied components comprising the Teaching Interaction procedure to individuals with ASD is a relatively recent phenomenon. This study further replicates findings of its efficacy with additional children with autism and with an additional array of meaningful social targets.

In the area of social behavior in particular, the transfer of learned skills from artificial, structured, contrived learning arrangements to employment in everyday situations is critical. This is especially true given the unpredictable and fluid nature of social demands and phenomena in the natural environment. The study further extends prior research by incorporating a systematic strategy to promote generalization from training environments to natural settings. The study offers support for a systematic protocol for effectuating such generalization for children with autism. Further, the investigation offers evidence that, for children with autism, successful instruction in the social area may not be enough to promote successful application in the natural environment. Only with systematic generalization

training were participants able to consistently, independently and successfully utilize learned skills in non-contrived, everyday social situations; and continue to do so for as long as three months subsequent to intervention.

The present study utilized a multiple baseline across participants, with generalization probes, as well as a control participant who did not receive teaching during the course of the study. All participants demonstrated mastery of social behaviors in the natural environment. Billy and Cameron's performance during baseline was variable, with some probes indicating no correct responses and two probes showing 90 to 100% correct responding. Anecdotally, those high scores were likely acquired because the students were more interested in the subjects that were being discussed during those sessions. However, with the implementation of the treatment and generalization phases, high and consistent levels of performance were obtained across a wide variety of conversation topics. The non-treatment control participant did not show any gains in performance throughout the duration of the study (16 weeks). This lack of progress may have been due to different participant abilities, differences in targeted social skill, or different opportunities available within the natural environment. However, when the study was completed, the Teaching Interaction procedure was introduced and follow-up data indicated this participant acquired and utilized the social skill in his natural environment.

The Teaching Interaction procedure is a multifaceted treatment package. Because the treatment package was utilized in its entirety for each participant (along with motivational arrangements), it is impossible to ascertain if inclusion of all components is necessary or if individual components or combinations are responsible for behavior change. Future research regarding the application of the Teaching Interaction procedure may determine which components are necessary and/or sufficient.

Questions regarding the extent of the applicability of the Teaching Interaction procedure should be noted. Implications of the study are limited to those individuals with autism who have capabilities similar to the participants. For social skills instruction for

children with autism with limited expressive language, receptive language and interactional abilities, the Teaching Interaction procedure, in its current form, may not be applicable. Future research should assess the appropriateness of the Teaching Interaction procedure for children across differing verbal and language abilities and/or other requisite skills. Although the purpose of the current study was to investigate the use of a flexibly implemented Teaching Interaction procedure, this flexible application may also be considered a limitation of the research. Because the teachers' made some decisions during the time of teaching, the technological aspect of this procedure may be affected. However, the Teaching Interaction procedure is a structured procedure with application governed by a precise set of guidelines.

Children with autism display markedly abnormal or impaired development in social interaction. Because of this fact, it is extremely important that research regarding the teaching and generalization of social skills continue to increase and advance. Although previous research has been devoted to methods teaching various social behaviors, documentation of the generalization of these acquired skills has been limited. The present study extends the body of research in teaching social skills by demonstrating the efficacy of a Teaching Interaction procedure for children with ASD, as well as implementing systematic generalization programming and examining the utilization of learned skills in everyday, naturalistic social situations. Further examination of the use of Teaching Interaction procedure with individuals with autism, to promote a range of meaningful social competencies, as well as skills in other areas essential to a high quality of life, is certainly indicated. Additionally, future researchers should look to compare the Teaching Interaction procedure to other commonly implemented social skills interventions (e.g., social stories) to determine which procedures are the most effective and efficient.

## References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4<sup>th</sup> ed.). Washington, DC: Author.

- Dotson, W. H., Leaf, J. B., Sheldon, J. B., & Sherman, J. A. (2010). Group teaching of conversational skills to adolescents on the autism spectrum. *Research in Autism Spectrum Disorders, 4*, 199–209.
- Dowd, T., Cxyz, J. D., O'Kane, S. E., & Eloffson, A. (1994). *Effective skills for child-care workers: A training manual from Boys Town*. Boys Town, NE: Boys Town Press.
- Hazel, J. S., Schumaker, J. B., Sherman, J. A., Sheldon, J. (1995). *Asset: A social skills program for adolescents*. Champaign, IL: Research Press.
- Kamps, D. M., Leonard, B. R., Vernon, S., Dugan, E. P., & Delquadri, J. C. (1992). Teaching social skills to children with autism to increase peer interaction in an integrated first-grade classroom. *Journal of Applied Behavior Analysis, 25*, 281–288.
- Krantz, P. J., & McClannahan, L. E. (1998). Social interaction skills for children with autism: A script-fading procedure for beginning readers. *Journal of Applied Behavior Analysis, 31*, 191–202.
- Leaf, J. B., Dotson, W. H., Oppenheim, M. L., Sheldon, J. B., & Sherman, J. A. (2010). The effectiveness of group teaching interaction for young children with a pervasive developmental disorder. *Research in Autism Spectrum Disorders, 4*, 186–198.
- Leaf, J. B., Taubman, M., Bloomfield, S., Palos-Rafuse, L. I., McEachin, J. J., Leaf, R. B., & Oppenheim, M. L. (2009). Effectiveness of a training package for teaching friendship development and maintenance skills for young children with autism. *Research in Autism Spectrum Disorders, 1*, 275–289.
- LeBlanc, L. A., Coates, A. M., Daneshvar, S., Charlop-Christy, M. H., Morris, C., & Lancaster, B. M. (2003). Using video modeling and reinforcement to teach perspective-taking skills to children with autism. *Journal of Applied Behavior Analysis, 36*, 253–257.
- Lumley, V. A., Miltenberger, R. G., Long, E. S., Rapp, J. T., & Roberts, J. A. (1998). Evaluation of a sexual abuse prevention program for adults with mental retardation. *Journal of Applied Behavior Analysis, 31*, 91–101.
- Miltenberger, R. G., Roberts, J. A., Ellingson, S., Galensky, T., Rapp, J. T., Long, E. S., & Lumley, V. A. (1999). Training and generalization of sexual abuse prevention skills for women with mental retardation. *Journal of Applied Behavior Analysis, 32*, 385–388.
- Minkin, N., Braukmann, C. J., Minkin, B. L., Timbers, G. D., Timbers, B. J., Fixsen, D. L., Phillips, E. L., & Wolf, M. M. (1976). The social validation and training of conversational skills. *Journal of Applied Behavior Analysis, 9*, 127–139.
- Nikopoulos, C. K., & Keenan, M. (2004). Effects of video modeling on social initiations by children

- with autism. *Journal of Applied Behavior Analysis*, 37, 93–96.
- Saluaga, D., Leaf, J., Taubman, M., McEachin, J., & Leaf, R. (2008). A comparison of flexible prompt fading and constant time delay for five children with autism. *Research in Autism Spectrum Disorders*, 2, 753–765.
- Sarokoff, R. A., Taylor, B. A., & Poulson, C. L. (2001). Teaching children with autism to engage in conversational exchanges: script fading with embedded textual stimuli. *Journal of Applied Behavior Analysis*, 34, 81–84.
- Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis*, 10, 349–336.
- Taubman, M., Leaf, R., & McEachin, J. (2011). *Crafting connections. Contemporary applied behavior analysis for enriching the social lives of persons with autism spectrum disorder*. New York, NY: DRL Books Inc.
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