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An Individualized Approach to Teach Greeting and Conversation Skills with Persons with Autism: Efficacy, Generalization, and Social Acceptability Outcomes

Stephanie A. Hood
University of Nebraska Medical Center

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by

Stephanie A. Hood, Ph.D., BCBA

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Supervisory Committee:

Wayne W. Fisher, Ph.D., BCBA-D
Nicole M. Rodriguez, Ph.D., BCBA-D
Valerie M. Volkert, Ph.D., BCBA-D.

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Individuals with an autism spectrum disorder commonly exhibit deficits in social skills, which can lead to a lack of friendships (Howlin, 2003) and underemployment (Shattuck et al., 2012). We selected social skills based on a parent interview and a direct assessment of three individuals' conversation and greeting deficits. We taught the conversation and greeting skills using behavioral skills training and within-session prompting. We assessed generalization of the conversation and greeting skills across unfamiliar conversation partners and maintenance over time. We obtained parent responses on the social acceptability of their child's social skills. A multiple baseline design across behaviors was used to demonstrate experimental control over the effects of the teaching procedures on skill acquisition and generalization to novel adults. The teaching procedures produced robust acquisition, maintenance, and generalization for all participants. The results provide initial support for an individualized assessment and intervention process in addressing social-skills deficits during unscripted conversations and greetings.

Key words: autism spectrum disorders, behavioral skills training, conversation skills, greeting skills, social skills, generalization, social validity, treatment extension

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURES

LIST OF ABBREVIATIONS

ASD	Autism spectrum disorder
IOA	Interobserver agreement
NCR	Noncontingent reinforcement
DRA	Differential reinforcement of an alternative response
mDRO	Momentary differential reinforcement of other respons

Introduction

Individuals with an autism spectrum disorder (ASD) exhibit deficits in communicating and interacting with peers and adults, commonly referred to as social skills (Diagnostic and Statistical Manual of Mental Disorders 5th edition, 2013), and the skills vary along a continuum from basic to complex. On one end, examples of basic skills include eye contact (Koegel & Frea, 1993), bids for preferred materials, and responding to one's name (Beaulieu, Hanley, & Roberson, 2012; Hanley, Heal, Tiger, & Ingvarsson, 2007), and these skills are important in that they are prerequisites to reciprocal (back-and-forth) interactions. On the other end, examples of complex skills include developing friendships and intimate relationships (Grantman, Kapp, Orenski, and Laugeson, 2012) and interviewing for a job (Kelly, Wildman, & Berler, 1980). A starting point for these reciprocal interactions is an initial greeting and conversation. Thus greeting and conversation skills are prerequisites for extended interactions and should be universally taught to all individuals diagnosed with an ASD because notable deficits in this skill area may lead to unsuccessful interactions with others, negatively affecting the likelihood of future interactions.

A conversation is comprised of many speaker and listener skills, and normative qualitative and quantitative descriptions of typically developing individuals can serve as a starting point for identifying the type of skills and the extent to which each should occur. For example, Turkstra, Ciccia, and Seaton (2003) conducted a descriptive assessment of 50 typically developing adolescents, ages 13 to 21, and measured their performance during conversations with peers. As a speaker in the conversation, the authors reported that adolescents spoke for about half of the conversation (57% of the time), asked the listener a few questions (about 16% of the adolescent's speaking opportunities), and responded to the content of the conversation partners' statement most of the time (about 86% of the opportunities). In addition, the adolescents rarely repeated verbatim (echoed) the conversation partners' statement and rarely completed the

conversation partners' statement (less than 3% of the opportunities), and they nearly always answered the conversation partners' questions (more than 99% of the opportunities). Turkstra et al. also measured the adolescents' performance as a listener in the conversation, which included positive feedback (vocal comments, such as saying, "Yes" and "I see" or nonvocal actions such as nodding along and smiling) and eye gaze toward the speaker. Adolescents engaged in positive feedback during 22% of the time and directed their gaze toward the speaker 69% of the time. The findings suggest that, as a speaker, an individual should answer all questions and ask several, respond to the content of what conversation partner say, and not echo nor complete the conversation partner's statement; as a listener, one should engage in some positive feedback and look at the conversation partner for the majority of the time. Actuarial data on how individuals with an ASD exhibit differences in these skill areas would serve as an important comparison to Turkstra et al.'s results.

To directly compare the conversational skills of 15 individuals with an ASD to 15 individuals of typical development, Capps, Kehres, and Sigman (1998) arranged 6-min semi-structured conversations with an adult confederate as a conversation partner, who was naive to the children's diagnostic status. Capps et al. matched groups of children on language age and mental age. The confederate introduced common topics such as vacation, friends, and school events to initiate a conversation with the child. Following a confederate's comment, children with an ASD were less likely than their peers to continue a reciprocal exchange of information; instead, they were more likely to remain silent. When asked an open-ended question (e.g., "What do you like to do when you are not in school?"), children with an ASD were as likely as their peers to answer, but more often the content of the answer was constricted (e.g., "Stay home sick") or took the form of an acontextual response (e.g., perseverative speech). Children with an ASD also occasionally gave acontextual statements; for example, during a discussion of afterschool activities, a child with an ASD stated, "Sabre-tooth tigers can't fly." In contrast, peers of typical

development described activities they partook in and interactions they had with friends in more detail, which aligned with Turkstra et al.'s (2003) findings. It is problematic that the children with an ASD followed the conversation less often because extending the conversation partner's topic with comments or questions contributes to the discussion by introducing new information. These results identified critical deficits exhibited by individuals with an ASD such as providing constricted responses to questions and acontextual comments that typically developing adolescents did not exhibit as reported by Turkstra et al. (2003). These types of skill deficits relate to what Black and Hazen (1990) described as a decrease in responsiveness and incoherent contributions to the conversation, which may affect the conversation partner's motivation to continue conversing and to partake in future conversations (see also Place & Becker, 1991).

In an experimental evaluation of conversation features that may negatively affect peer preference, Place and Becker (1991) played five scripted recordings of a confederate student requesting help from a confederate librarian. Each script consisted of seven back-and-forth exchanges between the confederate student and librarian. In one recording, the student made no conversational errors, and, in each of the remaining four recordings, the student made one type of error. The errors were in the form of demanding requests (e.g., "You have to pick it for me, right now!"), interrupting the speaker, long latencies to respond to a question (greater than 9 s), and bizarre statements unrelated to the content of the conversation (e.g., following a request for help for a report on the country France, the confederate child stated, "My dad took a picture of our dog, and it got in the paper!"). After listening to each recording, the students, who were of typical development, were asked to rate on a five-point Likert scale how much they would like to play with the confederate student. Place and Becker found statistically significant differences in students' likability ratings; students rated the confederate child as more likable when she did not make any errors and rated her as less likable when she made errors. It is problematic that these types of deficits were the same as those Capps et al. (1998) reported to observe with individuals with an ASD during conversations. Therefore, if these deficits are not addressed and an initial

interaction consists of these errors that result in a non-preferred or even aversive exchange with a conversation partner, the likelihood of future interaction and the formation of a friendship is diminished. The present study describes an individualized assessment and intervention process designed for persons with an ASD to improve greeting and conversation skills.

Despite that successful greetings and conversations require multiple speaker and listener skills as well as the absence of non-preferred behaviors such as interrupting the speaker, researchers have focused on teaching one or several conversation skills to young children and adolescents with an ASD. As examples, individuals have been taught to maintain a reciprocal exchange of information (Davis, Boon, Cihak, & Fore, 2010; Dotson, Leaf, Sheldon, & Sherman, 2010) and engage in eye contact or gaze orientation while listening to the conversation partner (Davis et al., 2010) and throughout the entire conversation (Dotson et al., 2010; Koegel & Frea, 1993). In addition, individuals have been taught to make comments and ask questions related to the topic of conversation and to limit discussion of perseverative topics (e.g., talking about Batman, Star Wars, or violent topics; Fisher, Rodriguez, & Owen, 2013). With respect to listener skills, Dotson et al. (2010) taught adolescents to provide positive feedback while listening to the conversation partner. These studies contributed experimentally rigorous demonstrations of teaching a small number of social skills, but they provide limited guidance toward developing an assessment and intervention process in which comprehensive deficits are identified and addressed.

Regarding the assessment process, social skills are often selected based on parent or client nomination via indirect rating scales (e.g., Social Skills Rating Scale; Gresham & Elliot, 1990) or interviews. As championed by Wolf (1978), the concerns of stakeholders should serve as one source of information to guide the development of treatment goals. However, relying solely on the reports of the client, caregivers, or both may miss other skill deficits due to the number and complexity of the skills that comprise a preferred greeting and conversation. In a

review of social-skill interventions for children with an ASD, Matson, Matson, and Rivet (2007) called for more systematic assessment and identification of social skills that should be taught (see also, Peters & Thompson, in press). An assessment that arranges situations to observe how an individual responds (referred hereafter as evocative situations) may provide additional information beyond that obtained via caregiver and client reports. This is in contrast to assessment methods that include a description of the evocative situation and asking the individual how they would respond in that situation (see Matson & Wilkins, 2007 for a review). Arranging the evocative situation in the context in which likely to occur allows one to assess the behavior of interest rather than individuals description of how they may respond. Regarding the intervention process, after identifying social-skill deficits, interventions that produce, satisfactory generalization and maintenance effects, as well as socially valid outcomes, have long been valued (Stokes & Baer, 1977). In recent years, analyses of these outcomes have been incorporated into research and practice more frequently (e.g., Ducharme & Holborn, 1997; Hanley, Jin, Vanselow, & Hanratty, 2014; Jin, Hanley, & Beaulieu, 2013; Luczynski, Hanley, Rodriguez, 2014).

Stokes and Baer (1977) and Stokes and Osnes (1989) discussed the importance of thoughtful programming during teaching to promote stimulus generalization rather than teaching and hoping for improvements in performance with other people and in other situations (train and hope). With respect to conversations and greetings, stimulus generalization refers to the spread of the effects of teaching from the instructional context to other contexts differing in, for example, the conversational partner, the setting, and the content of the conversation. Some researchers have assessed treatment extension[1] following acquisition (e.g., Beaulieu, Hanley, & Santiago, 2013; Davis, Boon, Cihak, & Fore III, 2009), and other research on conversation and greeting skills included one to three measures of generalization (e.g., Dotson, Leaf, Sheldon, & Sherman, 2010).

[1] Defined by the absence of preteaching measures.

Relatively few studies, however, have collected repeated measures of generalization outcomes (see Charlop & Milstein, 1989; Charlop & Trasowech, 1991 as notable exceptions)..

Charlop and Milstein (1989) collected extensive generalization data on conversation skills across novel individuals and settings not associated with teaching. They used video modeling to teach three six- and seven-years old children to ask and answer WH- questions during five scripted exchanges. During each exchange in the conversation, the child answered the conversation partner's question and then asked the conversation partner a question for three back-and-forth turns. For instance, the children were taught two examples of the following script: The therapist asked, "What do you have?" to which the child was taught to say, "A (box or barrel). Are you holding something?" Next, the therapist said, "Yes, a (box or barrel). What's in your box?" and the child was taught to respond by saying, "A (ball or duck). Is there something in your box?" The last exchange consisted of the therapist saying, "Yes, a (puppet or bubbles). Do you want to play with the toys?" and the child was taught to finish the exchange by saying, "Yes. Can I play with the (puppet or bubbles)?" The same five scripted conversations present during teaching were also present during the generalization evaluation. Charlop and Milstein did not observe any generalization for the first two conversations; however, following direct teaching for the first three conversations, generalization was observed for the remaining three conversations. The generalization observed is promising; however, functional control over generalization was not demonstrated in that generalization was only observed in 60% of the conversations. Although Charlop and Milstein's evaluation is an exemplary demonstration of teaching children with limited conversation skills to engage in reciprocal exchanges, it is unlikely that teaching scripted, invariant responses will allow individuals to converse with new conversation partners when they engage in different responses not included in the script.

Nuernberger et al. (2013) taught a more comprehensive set of listener and speaker skills

via a task analysis, which included a description of the skills and the order in which each should occur. They taught three young adults, from 19 to 23 years old, to stand or sit an arm's length away from the conversation partner, a peer, look at the conversation partner's face, say a greeting statement, ask an appropriate question, and wait for the conversation partner to respond. Next, the adults were taught to make a statement or ask a question related to the same topic and wait for the conversation partner to respond for a total of three back-and-forth exchanges and then end the conversation if there was a pause longer than 4 s, the conversation partner only responded with yes or no responses, or the conversation partner ended the conversation. The adults acquired all the conversation skills and maintained the skills for up to 8 weeks following teaching. A limitation with the design of maintenance evaluation was that the experimenter, who taught the skills, was present during all the conversations such that the stimulus control exerted by the presence of the experimenter may have influenced the children's performance.

In addition to promoting generalization, achieving socially significant outcomes requires improvements in conversation and greeting skills that maintain in the absence of continued teaching. Often, one session probes are conducted at different lengths of time (e.g., 1 week, 1 month, or 3 months) in place of obtaining repeated measures of performance over an extended period. As an exception, Dotson, Leaf, Sheldon, and Sherman (2010) taught adolescents with an ASD to (a) exhibit appropriate eye contact, distance from the conversation partner, body posture, voice tone and volume; (b) give positive feedback while listening; and (c) ask and answer questions. Following acquisition, repeated measures of maintenance was observed from three weeks to three months, except for providing positive feedback, which required remedial teaching for two of five participants.

An important consideration of intervention programs is the social acceptability of the selected skills, the teaching procedures, and the degree of improvement in performance (Wolf, 1978). In addition, interventions with a high social acceptability are more likely to be adopted by

clinicians. In a review of communication interventions, Goldstein (2002) identified that only 3 of 60 studies evaluated included measures of social validity. As one example, Beaulieu, Hanley, and Santiago's (2013) social-validity results indicated a strong acceptability of the teaching procedures (behavioral skills training [BST] and visual prompting) and the participant's improvements in conversation skills, as rated by the participant. In addition, based on individuals' social-validity ratings, who did not know the participant and were naive to the experimental questions and procedures, the acceptability of the participant's social skills on a 7-point Likert scale (1 corresponding with poor and 7 corresponding with excellent) improved from pre-treatment (M = 2.3, range, 1 to 4) to post-treatment (M = 5.3, range, 5 to 6). In summary, research is needed on improving greeting and conversation skills that (a) employs a more comprehensive assessment of concerns that informs the necessary skills to teach for each individual, (b) includes extensive generalization and maintenance measures, and (c) produces improvements that are highly satisfactory to the intervention recipient and his or her stakeholders.

Grantman, Kapp, Orenski, and Laugeson (2012) conducted a randomized clinical trial to evaluate the effectiveness of a standardized social-skills intervention, known as the PEERS Treatment Manual for Teaching Social Skills for Teenagers with Developmental and Autism Spectrum Disorders. The curriculum consisted of 14 weekly 90-minute sessions in which each week a new social skill was taught using BST methods separately to parents and young adults. Following each session, parents and the young adults were asked to practice the skills for a week. The social skill domains included conversational skills, entering and exiting a group conversation, electronic communication, developing friendships, using humor appropriately, initiating get-togethers with friends, handling embarrassing feedback, dating etiquette, and properly handling a disagreement. The results of the Social Skills Rating System found statistical significant improvements in parental reports of the social skills for individuals in the treatment group in comparison to individuals in the delayed-treatment group. These results are impressive, but they

should be viewed cautiously because the primary dependent measure was parental report rather than direct-observation measures of improved performance. Direct-observation measures avoid issues related to the construct or predictive validity of indirect measures. Therefore, the extent to which each targeted social skill improved for each participant is unknown, and the generalization and maintenance of acquired skills were not evaluated.

In contrast, Beaulieu, Hanley, and Santiago (2013) used direct-observation methods to assess the efficacy, treatment extension, and maintenance of a BST intervention to teach a young adult to wait for the conversation partner to finish a statement prior to speaking (not to interrupt), ask questions, engage in an appropriate amount of content specificity, and provide positive feedback when listening. Beaulieu et al. selected the conversations via a 15-min interview with the participant. Behavioral skills training consists of (a) providing instructions regarding the conditions under which to engage in the target skill and the necessary response components of the skill, (b) modeling examples and nonexamples of the skill, (c) role-play the skill, and (d) providing feedback following correct and incorrect responses. Each session consisted of a nonscripted conversation in which both the participant and the conversation partner initiated topics of conversation. Throughout the conversation, after incorrect responses, the conversation partner gave visual feedback for the interruptions skill and vocal feedback for all other skills. The visual feedback consisted of the conversation partner sliding a bead along a string each time the participant engaged in an interruption. A unique aspect of this strategy was that the conversation partner gave feedback without interrupting the flow of the conversation. These prompting strategies make the conversation more naturalistic, may promote more generalization, and individuals may preferred them to vocal prompts.

The present study systematically extended previous literature on improving greeting and conversation skills during unscripted interactions with two teenagers and a child with an ASD without an associated intellectual impairment. The study aimed to synthesize conversation and

greeting skills into a more thorough intervention process. In addition, we assessed generalization across several unfamiliar individuals and the maintenance of performance over a one- to three-month period. Last, we assessed participants' social acceptability of the teaching procedures and the participants' and parents' ratings of the social acceptability of the participants' improvements in social skills.

Chapter 1: Method

Participants, Setting, and Materials

Two teenagers and one child who were referred for social skill deficits with the goals of increasing greeting skills, conversation skills, or both participated. Following institutional review board approval, we obtained parental consent and participant assent. Mike was a 16-year-old boy with Asperger's Syndrome, Maggie was a 15-year-old girl with an ASD, and Chris was an 8-year-old boy with an ASD. All participants were in mainstream education and maintained grades of A's and B's (Maggie and Mike) or satisfactory grades (Chris; the teachers did not give letter grades in his elementary school), and Mike and Maggie were preparing to apply to college. Mike and Maggie reported that they needed to improve their conversation and greeting skills based on the importance of interacting with unfamiliar professionals (e.g., interviews) as well as improving their comfort level during interactions.

We conducted all sessions in a room (4 m by 3 m) equipped with a one-way observational panel and video-recording equipment at a university-based clinic. We used a stationary camera to record the conversation partner and the participant. We used these recordings to score all the dependent measures, with the exception of eye contact. We scored eye contact from a video camera that was worn by each conversation partner (Looxie LX2). The video camera rested on top of the conversation partner's ear and lay perpendicularly with their eyes, which gave a point-of-view based on where the conversation partner was looking. We also collected treatment-extension data in a conference room without a one-way observation panel by

concealing the video-recording equipment. There was a window with blinds in a room adjacent to the conference room, and we placed a camera to record through the blinds. In addition, we had the conversation partners record the audio with a portable digital recorder in their pant pocket. We then spliced the video and audio files together to measure the participants' performance.

We used a textual prompt to provide feedback following incorrect responses during Teaching. The textual prompts were laminated pieces of paper (7.62 cm by 27.94) with the correct skill typed in size 15.9 mm to 19.8 mm in height in Times New Roman. We used different colored paper for each prompt to help increase the trainer's fluency with prompting when multiple prompts were used in the same session. With the textual prompts, the trainer was able to provide the participant feedback without interrupting the flow of the conversation. We confirmed that all participants could read the textual prompts prior to implementation, by asking them to read aloud each typed skill.

Dependent Measures and Interobserver Agreement

Observers collected second-by-second data from a video player after the sessions were completed via paper and pencil; observers could pause and rewind during scoring. During each session, we arranged evocative situations for the targeted skills. See a description of each evocative situation and the corresponding operational definition for each conversation and greeting skills in Table 1. Each evocative situation represented a separate trial during which observers scored a correct response, incorrect response, prompted correct response, or prompted incorrect response. Observers recorded the exact time at which the conversation partner programmed an evocative situation and the occurrence of the participant's response. A *correct response* was scored when the participant engaged in the skill within 5 s of the onset of the evocative situation. An *incorrect response* was scored when the participant did not respond or engaged in a response other than the skill within 5 s of the onset of the evocative situation. A *prompted correct response* was scored when the skill occurred within 5 s of the textual prompt,

and a *prompted incorrect response* was scored when a response other than the skill or no response was observed. We reported these response types as the percentage of evocative situations for each session. The number of correct responses for each skill was divided by the number of evocative situations, and we converted the quotient to a percentage. If a correct response and incorrect response occurred during the same trial, an incorrect response was scored; therefore, the scoring of these responses was mutually exclusive. Correct and incorrect responses were scored throughout all conditions; prompted correct and prompted incorrect responses were only relevant to the Teaching sessions.

For greetings, there was only one opportunity to engage in the target skills due to the short duration of the greeting (approximately 2 min). The one exception was answering questions. The greeters were instructed to ask at least one question but, at times, additional questions were asked, thereby increasing the number of opportunities.

In addition to measuring responses during programmed evocative situations, we scored *distracting nonvocal behavior* each time the participant engaged in the following responses without being related to the content of the conversation; (a) touched any part of their face; (b) exhibited arm movements that were not related to the content of the conversation, which included manipulating Pokemon cards or an iPad and drawing in a sketch book; and (c) rested his or her head on the table, chair, or wall. We reported these measures as a percentage of session time, in min; the number of seconds participants engaged in distracting nonvocal behavior was divided by the total amount of session time and we converted the quotient to a percentage.

A second data collector independently scored the dependent measures for 29%, 25%, and 29% for Mike, Maggie, and Chris, respectively of sessions in each condition for all participants. Observers' records were compared using a time window analysis (Mudford, Martin, Hui, & Taylor, 2009). For evocative situations, we scored an agreement if the secondary observer recorded the same response within 3 s of the primary observer's timestamp. For duration

measures, we scored an agreement if the secondary observer recorded the same response as the primary observer and was within a ± 3-s window of the onset and offset of the primary observer's timestamp. We calculated interobserver agreement (IOA) scores by dividing the number of agreements by the number of agreements plus disagreements and converting the quotient to a percentage. See Table 3 for interobserver agreement data.

Procedural Fidelity

We measured the extent to which procedures were implemented as programmed during Preteaching, Trial-Based Teaching, Teaching phases (i.e., session-based teaching), and Postteaching in the study. During Preteaching, fidelity measures were collected during 26% for Mike, 33% for Maggie, and 24% for Chris, during Trial-Based Teaching, fidelity measures were collected during 38% for Maggie, and 50% for Chris, during all Teaching phases during 26% for Mike, 31% for Maggie, and 23% for Chris, and during Postteaching phases during 25% for Mike, 24% for Maggie, and 21% for Chris. Procedural fidelity was not calculated for Mike during Trial-Based Teaching due to a loss of the videos. We measured whether the trainer explained the rationale for the skill; explained the value of the tokens for Chris only; modeled independent correct, prompted correct, and prompted incorrect responses; and role-played with the participant for 10 trials. Procedural fidelity for the 10-trial role-play session was scored in the identical manner to the Teaching phases described below. In Preteaching, Teaching, and Postteaching for each skill, we programmed two evocative situations for Mike and three evocative situations for Maggie and Chris in every session. To ensure high levels of procedural fidelity with the number of programmed evocative situations, we re-programmed any evocative situation for which the data collectors observed an error live. For instance, if the trainer asked a question rather than making a statement during the evocative situation for following the conversation, an additional following the conversation evocative situation was programmed in the same session. For this reason, we expected a high level of procedural fidelity. Similar to the IOA calculations, during

each evocative situation we scored correct and incorrect implementation of consequences for correct, prompted correct, and prompted incorrect responses. A *correct implementation* was scored when the conversation partner implemented the prescribed consequence within 5 s of a correct response and incorrect response, depending on the condition. An *incorrect implementation* was scored when the conversation partner did not implement the prescribed consequence within 5 s of a correct response and incorrect response. We reported procedural fidelity as the percentage of correct implementation across all evocative situations for each session. The number of evocative situations with correct implementation was divided by the number of evocative situations, and we converted the quotient to a percentage. The procedural fidelity percentages were then averaged across all sessions to a yield a fidelity percentage for each condition and participant. Because the level of fidelity was similar across conditions, we combined the averages to report a single fidelity percentage for each child. See Table 3 for procedural fidelity data.

Table 1

Description of Evocative Situations and Corresponding Conversation Skill

Conversation Skills	
Evocative Situation	Skill
Skills to Increase	
1. Index of Boredom: a. Looking at cell phone or watching, b. Absence of speaking or active listening c. Yawning d. Looking around the room e. Doodling f. Reading a book	*Shifting the Conversation.* Changes the topic of conversation by making a statement or asking a question (e.g., Changing the conversation from talking about videogames to a different topic by saying, "Do you have any plans this weekend?")
2. Change in Conversation (e.g., The partner says, "It is really nice outside. I want to ride my bike." Then after the participants question the partner says, "I think I will go to one of the bike paths here in Omaha.")	*Following the Conversation.* Makes two related statements in a back-and-forth manner(e.g., The participant says, "Where are you going to ride your bike?" Following the partner's statement, the participant says, "Omaha has nice bike paths.")
3. Given a Compliment	*Saying, "Thank you".* Says, "Thanks" or "Thank you." (Kamps et al. 1992)
4. Given a Compliment	*Smiling.* Smiling was defined as upward movement of the sides of the mouth and cheeks, with or without showing teeth.
5. Asked a Question	*Answering Questions.* Responding with at least three words and the content of the response corresponds with the question.
6. Throughout the Entire Conversation	*Asking Questions.* A vocal response that requests information from the conversation partner (Beaulieu et al., 2013; Nuernberger et al., 2013; Spence, 1981).
7. While the Conversation Partner is Speaking	*Eye Contact.* Looks directly at the face of the communication partner while listening (Nuernberger et al., 2013).
8. While the Conversation Partner is Speaking	*Positive Feedback.* A vocal response of acknowledgement, question feedback responses, and gestures (e.g., "um hum," "yes," "that's cool," and "really," and nodding along, respectively) (Beaulieu et al., 2013; Spence, 1981).
9. While the Participant is Speaking	*Gestures.* Movements of hands, arms, or both that serve to illustrate or emphasize aspects of the statements (Spence, 1981).
10. Mumbles an Unintelligible Statement *	*Clarifying Statements.* Makes an appropriate clarifying statement (e.g., "What was that?", "Can you say that again?", and "What did you say?").

Conversation Skills	
Evocative Situation	Skill
<u>Skills to Increase</u>	
11. Talking about preferred and non-preferred topics (identified via parental report)	*Following the Conversation (2) or Asking Questions (5).*
<u>Skills to Decrease</u>	
12. Talking about preferred and non-preferred topics *	*Rude or Offensive Statements.* A vocal response that contained vulgar language or a statement made to dismiss or refute the point-of-view of the conversation partner (e.g., "You are stupid; football is lame").
13. While the conversation partner was speaking	*Interrupting.* Waiting to speak until a natural pause in the partner's response. An interruption was scored for each verbal response made by the participant prior to the conversation partner finishing a response. This excluded verbal initiations in the form of positive feedback, for which the aim of the response is not to take over the speaker role (Beaulieu et al., 2013; Hagopian et al., 2009; Nuernberger et al., 2013; Spencer, 1981).
14. Throughout the Entire Conversation	*Distracting Nonvocal Behavior.* Touching any part of their face and any arm movements that are not related to the content of the conversation. This included manipulating cards or an iPad and drawing; and resting his or her head on a hard surface. Distracting nonvocal behavior was not scored if these actions occurred below the surface of the table (Dotson et al., 2010; Hughes et al., 1998).
15. Throughout the Entire Conversation (identified via parental report and confirmed with baseline measures)	*Restricted or Perseverative Speech.* The first response pertaining to pre-identified topics was designated as appropriate. All subsequent response emitted during a session pertaining to one of these topics were scored as perseverative (Fisher et al., 2013; Rehfeldt et al., 2003).
16. Throughout the Entire Conversation	*Abruptly Ending Conversation.* Any vocal response about not wanting to continue to talk to the conversation partner or getting up and walking away without excusing himself.
17. Controversial Topics (identified via parent report; e.g., creationism versus evolution) *	*Rude or offensive statements (12).*

Table 2

Description of Evocative Situations and Corresponding Greeting Skill

Greeting Skills	
Evocative Situation	Skills
Skills to Increase	
18. Greeter Enters the Room during an Ongoing Conversation and Approaches the Participant.	*Handshake.* Standing up and shaking the hand of the greeter.
19. Greeter Enters the Room during an Ongoing Conversation and Approaches the Participant.	*Salutation.* A vocal response to recognize the presence of the greeter or to initiate conservation (e.g., "hi" or "good afternoon, Kate"). This does not include nonvocal gestures such as waving.
20. By the Participants' First 3 Statements	*Smiling.* Any upward movement of the sides of the mouth and cheeks, with or without showing teeth (Spence, 1981).
21. Asked a Question	*Answering Questions.* Answering the question using at least three words and the content of the response corresponds with the question.
22. Throughout the Entire Greeting	*Self-Statement.* An appropriate self-statement (e.g., "I am a sophomore in high school").
23. Throughout the Entire Greeting	*Asking Questions.* A vocal response that requested information from the greeter (Beaulieu et al., 2013; Nuernberger et al., 2013; Spence, 1981).
Skills to Decrease	
23. Throughout the Entire Greeting	*Abruptly Ending the Greeting.* Any vocal response about not wanting to continue to talk to the conversation partner or getting up and walking away without excusing his or her self.
24. Throughout the Entire greeting	*Inappropriate Posture.* Bending the back backward and protruding of the chest.

Table 3

Interobserver Agreement and Procedural Fidelity Data

	Interobserver Agreement *M* (session range)		
Dependent Measure	Mike	Maggie	Chris
Accepting Compliment	95% (50% - 100%)	98% (63% - 100%)	NA
Smiling	NA	93% (67% - 100%)	NA
Shifting the Conversation	87% (50% - 100%)	94% (67% - 100%)	97% (83% - 100%)
Following the Conversation	NA	95% (75 % - 100%)	95 % (67% - 100%)
Interrupting	82% (61% - 95%)	NA	NA
Distracting Nonvocal Behavior	84% (58% - 100%)	83% (52% - 100%)	83% (25% - 100%)
Clarifying Statements	NA	NA	97% (67% - 100%)
Handshakes	100% (100%)	NA	NA
Self-Statements	96% (0% - 100%)	NA	NA
Inappropriate Posture	96% (0% - 100%)	NA	NA
	Procedural Fidelity		
Preteaching	99% (95% - 100%)	96% (87% - 100%)	99% (95% - 100%)
Trial-Based Teaching	-	98% (98% - 100%)	98% (97% - 100%)
Teaching	87% (50% - 100%)	96% (83% - 100%)	98% (96% - 100%)
Postteaching	99% (92% - 100%)	100% (95% - 100%)	98% (93% - 100%)

Note. The mean and range for all phases of the same condition were combined.

Identification Skill Deficits and Selection of Target Skills

Indirect assessment: Parent interview. Prior to meeting the participants, we spoke with their parents to obtain information on (a) the types of social interactions in which they have observed their child struggle, (b) the specific actions that their child does not display during greetings and conversations, (c) the specific actions that their child should be engaging in less during greetings or conversations, and (d) their child's general interests to program preferred and non-preferred topics of conversation. We arranged evocative situations during our direct assessment (described next) to directly observe the concerns reported by the parents. Following the direct assessment, the experimenters shared their observations with parents and confirmed that the skills identified were of importance.

Direct assessment: Semi-structured greeting and conversation. After completing the

caregiver interview, we identified which conversation and greeting skills should be taught via an assessment that involved two experimenters (lead author and second co-author) greeting the participant and then conversing with the participants for 45 min to 60 min (the greeting and conversation were not video recorded). During greetings and conversations, we programmed evocative situations that were culled and adapted from evaluations on social skills (Barry et al., 2003; Beaulieu, Hanley, & Santiago, 2014; Hagopian, Kuhn, & Strother, 2009; Kamps et al. 1992; Nuernberger, Ringdahl, Vargo, Crumpecker, & Gunnarsson, 2013; Park & Gayloard-Ross, 1989; Secan, Egel, & Tilley, 1989) and from a social-validity study on social skills (Spence, 1981). During the greeting, we approached the participant and paused to determine whether the participant shook our hands and engaged in a greeting statement (e.g., "Hi, nice to meet you" or "Hello, I'm Chris"). In addition, we noted whether the participant smiled, asked questions, answered questions, and engaged in at least one self-statement (e.g., "I am a sophomore in high school"; see Table 2 for the operational definitions in greetings) during the greeting.

After the initial greeting, a conversation consisted of the experimenters engaging in a total of three or more of each evocative situation. For example, the experimenters engaged in an index of boredom (Skill 1; See Table 1 for operational definitions), changed the topic of conversation (Skill 2), and gave several compliments (Skill 3). In addition to the evocative situations, we noted skills throughout the conversation such as the presence of smiling, eye contact, positive feedback, the absence of distracting nonvocal behavior and any other undesirable actions. Following the conversation, we asked the participant what, if any, of their actions during greetings and conversations they would like to improve, and none of the participants reported any specific concerns.

Selection of target skills. The conversation (1 to 16) and greeting (17 to 24) skills we observed during the semi-structured assessment, excluding inappropriate posture (Skill 24), are listed along the y-axis in Figure 6. The participants' performance across the skills is denoted by

gray (skill deficits) or black (mastered skills) squares above the left tick mark on the x-axis for each participant (no square indicates the skill was not assessed). The skills in boldface denote concerns reported by the parents that were not a part of our original set of skills to assess in the direct assessment. When we programmed evocative situations related to their concerns, however, we did not always observe the skill deficit (e.g., see Skill 10 and 16 for Mike). The asterisks next to the squares denote which skills were targeted for each participant. Because we identified numerous skills to teach with Maggie, and due to time constraints of the researchers, we addressed, in agreement with her parents, a subset of the deficits. In summary, we selected target skills based on the semi-structured assessment and, in part, caregiver preference.

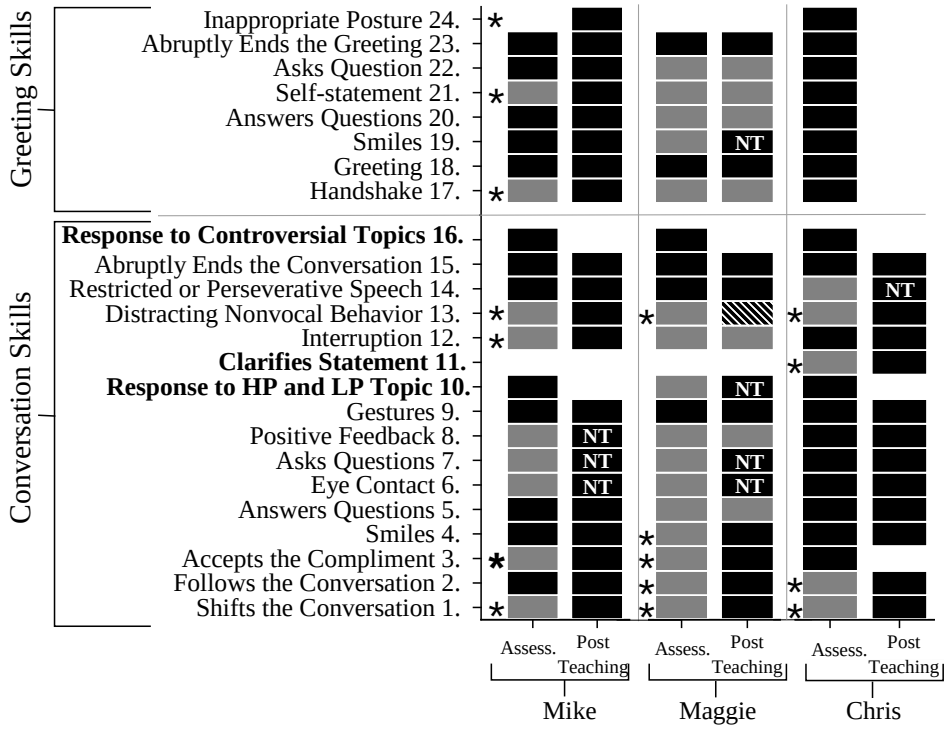

Figure 6. This figure depicts the level of performance across all of the skills assessed during the assessment and Postteaching for each child. Closed squares represent mastered skills and gray squares represents skill deficits. The closed hatched square represents mastered but a limited maintenance was observed. The open squares represents a skills that was not assessed during Postteaching. The asterisk for denotes skills that we taught and the bold skills on the x-axis denotes the idiosyncratic skills nominated by the parents.

General

We conducted conversations and greetings in a one-on-one format. Each participant visited a university-clinic once or twice a week for 1 to 2 hr. Each conversation was 10 min for Mike and Maggie and was 5 min for Chris. If needed, we extended session time until the programmed number of evocative situations for each skill was arranged; for instance, session was extended until the participant stopped talking for 5 s so that the trainer could program a pause as an index of boredom. During Preteaching and Postteaching, conversation sessions were conducted in a semi-random order during each block of sessions across one trainer and two generalization adults (conversation) and three generalization adults (greetings), based on the adults' availability. When the peer was available to converse with Chris, she conducted sessions for a 30-min block, and this block was comprised of two or three sessions. The sessions conducted by the two generalization adults and the peer allowed for the assessment of generalization across conversation partners not associated with teaching. During Teaching, only the trainer conducted conversations.

During conversations, a greeter entered the session room and began talking with the conversation partner and then paused to provide the participant with an opportunity to initiate a greeting. If the participant did not initiate the greeting within 20 s, the greeter initiated the interaction. The greeter never initiated a handshake; rather he or she started the greeting with a statement such as saying, "Hey, Mike. How are you today?" All greetings were approximately 2 min, and we programmed one to two greetings throughout a conversation. During Preteaching, each greeter conducted only one greeting per session block based on their availability. During Teaching, only the trainer conducted sessions, and two greetings were conducted during every conversation to increase the opportunity to teach the target skills. During Postteaching, the trainer and the generalization adults conducted one or two greetings during a conversation. The greeting time was subtracted from the conversation session time. The trainer and generalization adults who conducted greetings were different than the trainer and generalization adults who

conducted conversation sessions.

The topics during the conversations and the greetings were not scripted, and different topics were discussed based on the interests of the participant and conversation partner. At prescribed times, the conversation partner programmed evocative situations in which the participant was expected to engage in the corresponding social skill. The conversation partner engaged in two or three of each of the evocative situations for Mike, Chris and Maggie, respectively. The conversation partner did not interrupt the participant at any time. The conversation partner sat at a table across from the participant so that the participant was facing away from the one-way observation mirror. To signal the type and timing of each evocative situation to the conversation partner, a cue was held against the one-way panel (i.e., a 7.62 cm by 7.62 cm piece of paper with the initial letter of the evocative situation typed in Times New Roman at 39.7 mm in height). Because the participant was facing away from the panel, the participant could not observe cue presentations; to this point, anecdotally, we never observed the participants look back at the mirror. When the peer conducted sessions with Chris, she wore a Bluetooth headset that allowed the experimenter to vocally instruct her when and how to engage in the evocative situations. For example, rather than instructing her to change the topic of conversation, we told her what specifically to say (e.g., “I am going to a birthday party this weekend”).

Each participant experienced a break between sessions (i.e., intersession interval). Prior to the start of the evaluation, we asked each participant what he or she would like to do during this break. Mike requested to play electronic video games on the Xbox gaming system with the experimenter. Maggie requested to play with her tablet or draw on a drawing pad alone. Chris requested to play games on a computer alone or with the peer when the peer served as the conversation partner. We used visual inspection to evaluate the effects of teaching on participants’ performance, except during Trial-Based Teaching for which the mastery criterion

was 100% of trials with independent correct responses in one session.

Efficacy Evaluation

Preteaching.

NCR (Mike, Maggie, and Chris). During each evocative situation, the conversation partner allowed 5 s for the participant to respond before continuing the conversation; there were no programmed consequences for correct or incorrect responses. All participants had greetings, conversations, or both with the trainer and two generalization adults; in addition, Chris had conversations with a peer. After each session regardless of performance, noncontingent reinforcement (NCR) was provided; Mike played Xbox with the experimenters for 5 min, Maggie played alone with her tablet and drawing pad for 5 min, and Chris played computer games for 2.5 min, due to the shorter duration of conversations (5 min instead of 10 min).

DRA (Chris). These procedures were identical to Preteaching (NCR) with the addition of the delivery of tokens following correct responding. Throughout Chris's early intervention program, differential reinforcement of alternative behavior (DRA) using token reinforcement was provided after correct responses for acquisition programs. A token reinforcement assessment was conducted with mastered tasks in a concurrent free-operant schedule, and Chris allocated responding exclusively to the task associated with the fixed-ratio 1 delivery of tokens, which he exchanged for access to the backup reinforcer following session, and he never responded toward the identical task that was associated with extinction. During the conversation, if Chris responded correctly, the trainer placed a blue poker chip in a clear bowl in the center of the table without breaking the flow of conversation and without providing praise. The trainer gave tokens on an FR-1 schedule for correct shifting the conversation, following the conversation, and clarifying statements. Chris exchanged each token for 30 s of video games on the computer between sessions. We did not program contingencies for distracting nonvocal behavior. The trainer, two generalization adults, and the peer had conversations with Chris.

Trial-Based Teaching.

NCR (Mike and Maggie). We used BST (Poche, Brouwer, & Swearingen, 1981) to teach the greeting and conversation skills. First, we described the evocative situation, the corresponding social skill, and rationale for the importance of the skill. For example, in the context of teaching following the conversation, we described that a conversation should be about equal in talking about our interests and talking about the conversation partner's interests because some people do not want to have conversations with others who will only talk about things they prefer. We explained that when a conversation partner initiates a new topic that is unrelated to the previous conversation, you should show interest by making at least two statements or asking at least two questions about the topic in a back-and-forth manner. Second, the participant observed an adult and the trainer have a conversation during which the adult modeled correct and incorrect responses of the skill. The adult modeled three independent correct responses, prompted correct responses, and prompted incorrect responses for Mike and Maggie. For Chris, the adult modeled three of these response types for following the conversation and shifting the conversation and six for distracting nonvocal behavior. The form of the incorrect responses modeled by the adult were topographically similar to each participant's incorrect responses observed during Preteaching and consisted of both commission and omission errors. After each trial, the trainer asked the participant whether the response modeled by the adult was correct or incorrect. If the participant responded correctly, the trainer gave descriptive praise. If the participant responded incorrectly, the trainer gave the appropriate response and the corresponding rationale. Third, the participant practiced the social skill in 10-trial sessions. After correct responses, the trainer gave descriptive praise, and after incorrect responses, the trainer held the textual prompt just above the table. The trainer continued to display the textual prompt until the participant engaged in the correct response. For Mike and Maggie, we taught more than one social skill at a time; whereas, for Chris, Trial-Based Teaching was implemented for only one

skill at a time. We conducted Teaching after the mastery criterion was met.

DRA (Maggie and Chris). The procedures were identical to Trial-Based Teaching NCR except that following an independent correct response, a token was delivered for Chris and the conversation partner told Maggie prior to the initial session each day the contingency for correct responding and following each session reported how much time she had earned to engage with her tablet or drawing pad.

Teaching.

NCR (Mike, Maggie, and Chris). The same evocative situations arranged during Trial-Based Teaching were programmed during a 2-min greeting or a 10-min conversation. The conversation partners did not provide differential praise and vocal feedback following the participant's response; instead, the trainer continued the conversation following correct responses. The only teaching component involved the textual prompt following incorrect responses.

NCR & DRA (Maggie). In addition to the noncontingent 5 min of preferred activities, Maggie could earn 30 s of additional time for each correct response. The trainer did not provide feedback on correct responses during the session; instead, Maggie was informed of how much time she had earned at the end of the session to keep the conversation as naturalistic as possible.

NCR & DRA plus Continuous Textual Prompt (Maggie). Maggie continued to exhibit incorrect responses for skills that involved shifting the topic of conversation during indices of boredom (Skill 1) and following changes in the topic of the conversation (Skill 2). Despite Trial-Based Teaching, Maggie reported that she did not know how to respond in these evocative situations (e.g., "I don't know what to say"). We introduced a continuous textual prompt that had multiple exemplars of correct responses with respect to shifting the topic of conversation and following changes in the topic. For the skill of following a change in topic, Maggie could either engage in a statement about the topic, or if she was not familiar with the topic, she could ask a question; therefore, we gave multiple exemplars for both response types (see the exemplars in the

continuous textual prompt in Supporting Information 1). We also gave multiple exemplars of questions to say when the conversation partner appeared bored (see the exemplars in the continuous textual prompt in Supporting Information 1). The continuous textual prompt was a standard letter piece of paper that was present on the table during the conversation session. Following three sessions of the initial Teaching NCR and DRA + Continuous Textual Prompt, the prompt was turned over on the table. Maggie could turn over the continuous textual prompt at any point to reference it; however, this never occurred. During the Teaching DRA (described next), the textual prompt remained facing up until we observed high levels of shifting the conversation and following the conversation without Maggie referencing the continuous prompt for the entire session. We removed the continuous prompt after five sessions in which Maggie did not reference the prompt and there were stable levels of following the conversation and shifting the conversation.

DRA (Maggie and Chris). For Maggie, the noncontingent 5-min of access to the preferred material was removed, and the number of correct responses determined the duration of preferred materials between sessions. Maggie earned 1 min for each correct response. We increased the duration earned for each correct response to maintain the same available break time as Teaching NCR and DRA (9 min). For Chris, these procedures were identical to Preteaching (DRA) with the exception that trainer presented the textual prompts following incorrect responses.

Supporting information 1

Supplemental Table 1
Continuous textual prompt for Maggie

When someone changes the conversation, make two statements related to the topic.

Possible responses	Questions to ask
I like …	What is/are ….?
I have never …	Please tell me more?
When I …, I ….	Why did/will you ….?
I would like to ….	When did/will you ….?
I need to ….	

When someone is bored, ask him or her a question related to a ***new*** topic.

Questions about daily/weekly activities	Questions about the other person
How was your day?	Do you have siblings? How many?
What are you doing this weekend?	What do you like to do in your spare time?
What did you do this past weekend?	What do you like to do to relax?
What are you doing tonight?	What is your favorite holiday?
School or work related questions	Where did you grow up?
What's the first thing you do after school/work?	Do you have any pets?
Where did (do) you go to school/work?	Where do you see yourself 5 years from now?
What was (is) your favorite subject?	Do you like to play video games?
What was (is) your least favorite subject?	Do you like to draw?
What is your dream job?	

Current events	Vacation
What do you think about this …?	Do you like long road trips?
Have you seen…?	What was your best vacation experience?
Did you see the … last night?	Where would you like to go on vacation?
Did you see on the news … happened?	What countries have you traveled to?
I read in the paper today that ... Did you hear this?	If you could live anywhere in the world, where would it be?
What is your favorite movie?	Do you like to fly?
	Where was the last place you went on vacation?

Sports conversation starters

Who is your favorite athlete?
How often do you exercise?
Do you play any sports?
What is your favorite sports team?

mDRO (Maggie and Chris). For both Maggie and Chris, we used a momentary differential reinforcement of other behavior (mDRO) of 30 s with a 5-s observation window and a textual prompt to decrease distracting nonvocal behavior. That is, following 5 s of continuous distracting nonvocal behavior, the trainer held up a textual prompt that said "hands down." As for the other skills, the trainer did not provide a signal to Maggie during the session if she met the mDRO contingency. The maximum break Maggie could earn during this condition was 13 min and 45 s. When we observed insufficient maintenance with the generalization adults during Postteaching NCR, we introduced the teaching procedures with the generalization adults. For Chris, however, we used token reinforcement to signal in the session whether he met the reinforcement contingency. That is, every 30 s, the trainer conducted a 5-s observation and placed a white token in the bowl if there were no distracting nonvocal behavior. If at any point during the 5 s Chris engaged in distracting nonvocal behavior, the trainer did not place a token into the bowl. We used a white token to allow Chris to discriminate between the tokens delivered for distracting nonvocal behavior relative to those delivered for all other social skills (blue token). The white tokens were exchangeable for 15 s of video games.

Postteaching.

NCR (Mike, Maggie, and Chris). The procedures were the same as described for Preteaching NCR.

DRA; mDRO (Maggie). These procedures were identical to Teaching DRA and Teaching mDRO; however, the trainer and the generalization adults had conversations with Maggie without the presence of the textual prompts. By removing only the textual prompts, the reinforcement contingencies were held constant and that allowed us to assess if Maggie's acquired skills would maintain with the trainer and generalize to the other adults.

DRA (delayed token); mDRO (delayed token; Chris). The reinforcement contingencies remained in operation as described in Teaching DRA and Teaching mDRO, but earning a token during the conversation was not signaled and the tokens earned were delivered after the conversation ended (instead of following each correct response during the conversation). The purpose of this arrangement was to maintain Chris's motivation to respond and to create a more naturalistic conversation because teaching procedures were not implemented during a session.

Generalization and Treatment Extension

Throughout the efficacy evaluation, all participants engaged in repeated greetings, conversations, or both with the generalization adults. The same evocative situations as arranged with the trainer were present during the generalization greetings and conversations. In addition to assessing generalization, an important outcome measure is the participants' performance in conversations or greetings with an adult or peer they had never met, which is described as treatment extension. After all participants performed the target skills at a high level with the trainer and generalization adults and a generalization peer (Chris only), novel adults and a novel peer (Chris only) served as the conversation partner for one session. For Mike and Maggie, the adults wore professional attire to simulate the interaction with a professional adult in the teenagers' life.

Prior treatment extension, the trainer described the evocative situations to the adult or peer and role-played each situation once. The adult was asked to talk about topics and ask questions in a way that was most comfortable to how he or she typically interacts with unfamiliar people. It is important to note that the adults and peer were not told about the greeting and conversation skills. Each adult was given a piece of paper (5.08 cm x 5.08 cm) with a list of the evocative situations, which was present during the sessions but out of the participant's view. The same prompting procedures were used with the new peer as previously described for generalization sessions with the peer. There were no programmed consequences for correct and

incorrect responses.

Design

We used a concurrent multiple baseline design (Baer, Wolf, & Risley, 1968) across responses with each participant to determine the effects of teaching on skill acquisition. We conducted a reversal design within the multiple baseline design to evaluate maintenance of the acquired skills. In addition, we used a multiple baseline design across responses to evaluate the effects of stimulus generalization, for Mike and Maggie only.

Social Validity

After completion of the study, we obtained social-validity measures from the participants and their parents. We asked the parents (mother and father) to watch videos of sessions and rate their satisfaction with their child's performance. We selected sessions that were representative of the participant's performance in Preteaching NCR and Postteaching NCR (Mike and Maggie) and Delayed Token (Chris) using the following process. First, we identified sessions in which the level of social skills was within 1 *SD* of the mean performance in each phase, and, second, from this set of sessions, we selected the last session of each phase that met the inclusionary criteria (see asterisk on the top panel for each participant). This selection process controlled for potential biases in video selection. We randomized the order that the parents viewed the videos, so the parents were naive to which video was from Preteaching NCR and Postteaching NCR for Mike and Maggie and Postteaching DRA (delayed tokens) for Chris. Parents gave satisfaction ratings with respect to their child's overall performance on a Likert scale that ranged between one and seven, with one denoting strongly disagree or highly unsatisfied, four denoting neutral, and seven denoting strongly agree or highly satisfied. After each question, we asked them to provide rationale for their rating (see Tables 3 and 4). Next, we asked the parents to watch two additional videos and provide ratings for the skills taught to their child. Prior to viewing the videos, the parents read a description of the evocative situations and skills that were taught, and we asked

them to attend specifically to these skills when viewing the next set of videos. Throughout this assessment, the parents could change their ratings for any video at any time to be sensitive to potential changes in their ratings after both the Preteaching and Postteaching videos had been watched. After watching all videos, we asked the caregivers if there were any additional conversation or greeting skills they thought the participant would benefit from learning.

We also asked the participants to rate their satisfaction with their performance (they did not watch videos of their performance). Mike and Maggie completed the questionnaire independently, but a researcher was available to answer questions. For Chris, the researcher read the questionnaire, answered Chris's questions, and took dictation of his answers. We asked how comfortable they were engaging in the social skills with unfamiliar adults and how satisfied they were with the teaching procedures. In addition, we asked whether there were any additional conversation or greeting skills they could benefit from learning. They gave ratings and rationale as described for the parents.

Chapter 2: Results

Mike's, Maggie's, and Chris's performances are depicted in Figures 1, 2, and 3, respectively. Each skill is depicted in a pair of panels, and for each skill, the description in the parentheses on the y-axis denotes the skill number which corresponds to Table 1 and 2 and how the skill was measured and, if the skill was based on programmed evocative situations, the number of opportunities is reported, which served as the denominator for calculating the participant's performance. The top panel in each pair of panels depicts the percentage of evocative situations with correct responses or percentage of session with the skill with the trainer associated with teaching and the bottom panel depicts the same skill with the conversation partners who were only associated with generalization and treatment extension. The participants' performance during Trial-Based Teaching, with the exception of saying, "Thank you" with Maggie, are not reported; these data are available from the first author.

Mike

Mike was taught both conversation and greeting skills. For the conversation skills, during Preteaching NCR, Mike exhibited low or variable levels of shifting the topic of conversation during an index of boredom with the trainer (first panel; closed circles; figure 1) and generalization partners (second panel; gen-adult 1, open squares; gen-adult 2, open triangles). Low levels were also observed for saying, "Thank you" with all conversation partners (third and fourth panels). The levels of interrupting the trainer and gen-adult 2 were slightly elevated (*M* = 15% and *M* = 17%, respectively*)*; a near-zero level of interruptions was observed with gen-adult 1 (*M* = 3%; fifth and sixth panels). Mike engaged in moderate levels of distracting nonvocal behavior with the trainer and gen-adult 3 (*M* = 26% and *M* = 35%, respectively) and there was a decreasing trend with gen-adult 2 (*M* = 26%; seventh and eighth panels).

During Trial-Based Teaching NCR, we taught all four conversation skills, and Mike met the mastery criterion for each skill following one training session with each skill (data not shown). Next, during Teaching NCR, Mike exhibited high, variable levels of shifting the conversation and saying, "Thank you" following compliments with the trainer, low levels of interruptions and distracting nonvocal behavior. Following stable levels of responding, teaching was removed (i.e., no textual prompts) to evaluate maintenance of the social skills with the trainer and generalization across two adults (Postteaching NCR). Across 3 months, Mike continued to engage in high, variable levels of shifting the conversation and saying, "Thank you" following compliments and low levels of interruptions and distracting nonvocal behavior with the trainer. In addition, Mike engaged in similar levels of responding across all social skills with gen-adults 1 and 2. There were only two or three opportunities for shifting the conversation such that one incorrect response decreased performance to 50% or 67%. Although the target skill did not occur on every trial the form of the incorrect responses represented an improvement from their Preteaching performance. For the last 10 sessions, incorrect responses for shifting the

conversations took the form of not exhibiting the skill within 5 s of the evocative situation but otherwise were correct. In addition, of the incorrect responses for saying, “Thank you,” Mike acknowledged the compliment in 60% of the trials but instead of saying, “Thank you” he made a comment related to how he thought the compliment was inaccurate (e.g., “I am actually not very good at physics”) and only in 40% of the trials Mike did not acknowledge the compliment. Taken together, generalization was observed for all skills across all conversation partners for which a sufficient baseline was obtained.

After Mike acquired the conversation skills, we taught the greeting skills (bottom 6 panels). During Preteaching NCR, low levels of self-statements and handshakes across the trainer and gen-adults 1 and 2 were observed. Mike met the mastery criterion following one session of Trial-Based Teaching NCR (data not shown). During Teaching NCR, Mike was nearly perfect in shaking the conversation partner’s hand and making a self-statement, and this outcome showed functional control over the direct effects of the teaching procedures. During Teaching NCR, we unexpectedly observed that Mike was engaging in inappropriate posture during the greetings (i.e., repeatedly bending his back with protrusions of his chest). In response, we began measuring the inappropriate posture via delayed baseline, and it occurred at a high level (bottom panel). After Trial-Based Teaching NCR was implemented, robust decreases in inappropriate posture were observed during Teaching NCR for inappropriate posture. Following consistent, satisfactory levels of the greeting skills with the trainer, performance during Postteaching NCR was evaluated. Across 1 month, Mike continued to perform at high levels with the trainer, and generalization was observed across gen-adult 1 and gen-adult 2 for self-statement and handshakes, which also demonstrated functional control over the indirect effects of the teaching procedures. In addition, Mike also engaged in low levels of inappropriate posture with gen-adult 1 and 2 (treatment extension). In Mike’s final session, he greeted and conversed with an adult he had not met before in a conference room (gray diamond), and he exhibited appropriate levels of

all conversation and greeting skills. In summary, Mike acquired all social skills with the trainer and demonstrated those skills in conversations with additional adults.

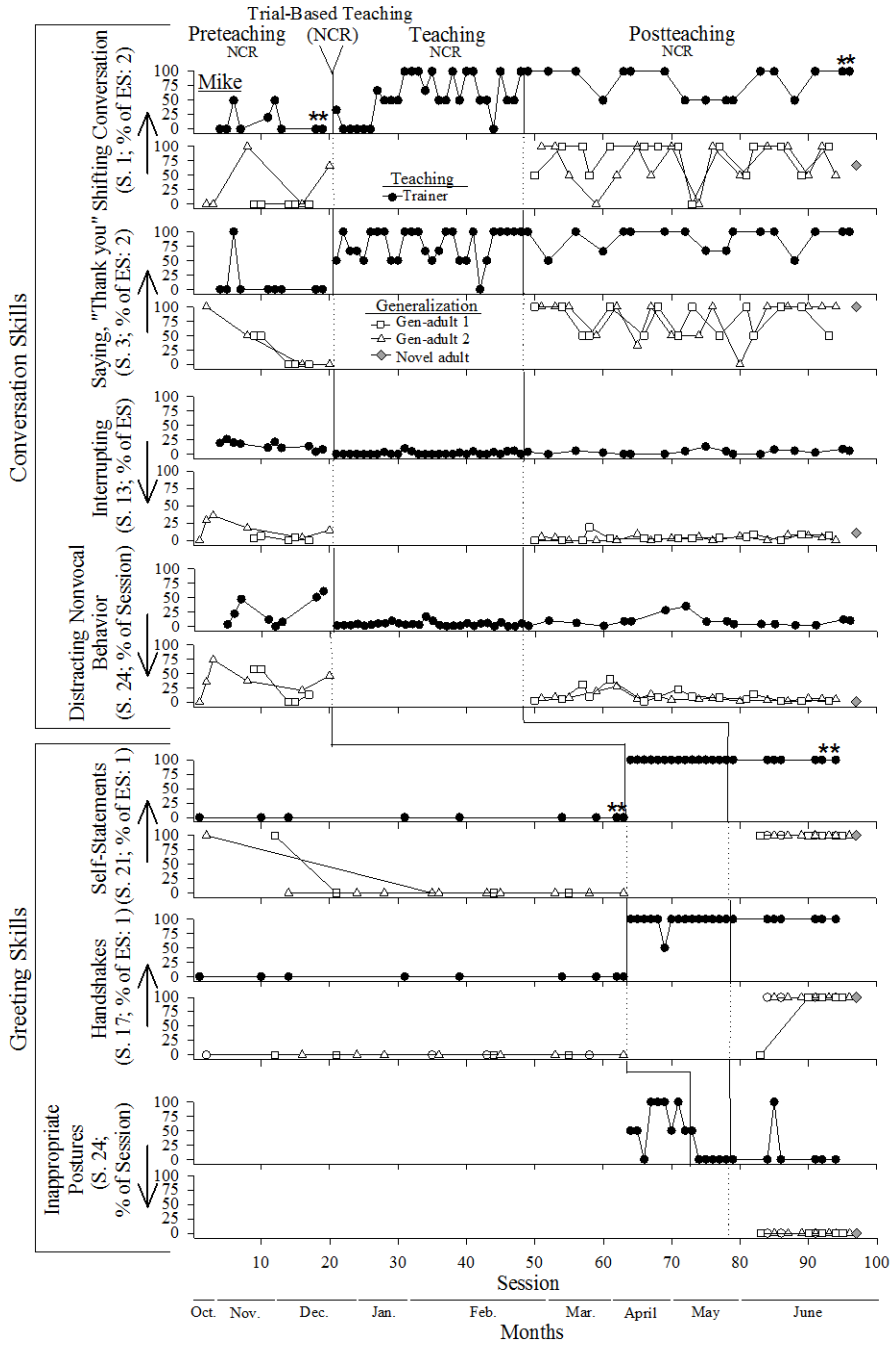

Figure 1. Percentage of opportunities with target skills across sessions on the primary x-axis and months on the secondary x-axis for Mike. The closed data path represents efficacy data and responding with the trainer. The open data path represents responding with gen-adult 1 and gen-adult 2 (square and triangle, respectively) that were never associated with teaching. The gray diamond represents responding with a novel adult. Brackets denote greeting and conversation target skills. In the parenthetical the skill number is denoted and subsequently the number of opportunities is reported. The arrows on the y-axis represents the desired level of performance. The asterisks in the top panel denote the representative sessions used to assess social validity.

Maggie

Preteaching, Teaching, and Postteaching are listed in the bottom, middle, and top rows, respectively, at the top left of Figure 2. The beginning and end of a line in a row denotes that the condition is in place, and the descriptor above the line denotes that contingencies in operation. During Preteaching NCR, Maggie engaged in low levels of saying, “Thank you” and smiling following compliments with the trainer (Figure 2, first and third panels) and low, variable levels of saying, “Thank you” following compliments with gen-adult 2 (second panel, open triangles) and low levels with gen-adult 1 (second panel, open square). Maggie engaged in low levels of smiling with both gen-adults 1 and 2 (fourth panel). For shifting the conversations during an index of boredom, Maggie engaged in low levels of correct responding with all conversation partners (fifth and sixth panels). In addition, Maggie engaged in low, variable levels of following the conversation topic (seventh and eighth panels) as well as high, variable levels of distracting nonvocal behavior with all conversation partners (ninth and tenth panels).

We conducted Trial-Based Teaching NCR for saying, “Thank you” and smiling following compliments after stable levels of responding during Preteaching NCR. Maggie met the mastery criterion across saying “Thank you” and smiling following seven training sessions (data not shown). During Teaching NCR, an immediate increase in saying, “Thank you” and smiling was observed with the trainer (second phase). Following stable levels of responding, teaching was removed to assess maintenance and generalization (Postteaching NCR). We observed maintenance of saying, “Thank you” with the trainer with moderate variability. In addition, Maggie exhibited similar levels of saying, “Thank you” with gen-adult 1 and gen-adult 2. For smiling, a decrement was observed with the trainer, but responding was elevated compared to baseline. Maggie exhibited high levels of smiling with gen-adult 1 and initially moderate levels of smiling followed by a decreasing trend with gen-adult 2. Taken together, we observed maintenance of the skills, with a slight worsening in performance, with the trainer, and

we observed generalization across the two other adults, although high levels of the skills were not observed across both adults.

Next, we implemented Trial-Based Teaching for shifting the conversation during an index of boredom and following the conversations when the topic changes. We also conducted additional (booster) teaching sessions in the trial-based format for saying “Thank you” and smiling after compliments due to the variability and slight decreases observed during Postteaching NCR. During Trial-Based Teaching NCR, we observed a decreasing trend for both saying, “Thank you” and smiling, as shown in the first phase of Figure 3. In response, we evaluated the effects of Trial-Based Teaching DRA contingency in a reversal design. With the DRA contingency, an immediate increase to 100% correct responding was observed for two consecutive sessions, and these outcomes were replicated. Given these results, we subsequently taught shifting the conversation and following the conversation with the DRA contingency sequentially, and Maggie met the mastery criterion following one training session for shifting the conversation and after two training sessions for following the conversation.

To increase Maggie’s motivation to engage in the correct response, we conducted Teaching NCR & DRA. We observed an immediate increase in saying “Thank you” and smiling after a compliment. However, low levels of shifting and following the conversation were observed (fifth and seventh panels; second phase). For these skills, Maggie exhibited omission errors, and stated that she did not know what to say when someone was bored or how to follow the conversation. For this reason, we returned to Trial-Based Teaching DRA for shifting the conversation and following the conversation and introduced the continuous textual prompt (see Supporting Information 1). To increase Maggie’s discrimination between the two different evocative situations for these skills, we conducted five trials for both shifting and following the conversation interspersed randomly throughout the 10-trial session. Maggie met the mastery criterion following one training session. Next, we returned to Teaching NCR & DRA plus

Continuous Textual Prompt, and immediate increases in shifting and following the conversation were observed. We collected data on Maggie's frequency of looking at the continuous textual prompt (data not shown), and, after three sessions, she exhibited correct responding without looking at it; the session at which Maggie stopped using the textual prompt is denoted by the dashed line in the fifth and seventh panels.

Following elevated and stable levels of all four skills, we removed teaching and assessed maintenance and generalization in Postteaching DRA & NCR. High levels of responding for saying, "Thank you" with all conversation partners were observed (first and second panels). Maggie initially exhibited high levels of smiling with all adults, which was followed by a decreasing trend with the trainer and gen-adult 1 and an increasing trend for gen-adult 2 (third and fourth panels). Moderate and high levels of shifting the conversation and following the conversation were observed with the trainer, respectively, and low and variable levels of shifting and following the conversation were observed with gen-adults 1 and 2, respectively.

Due to the variability observed across the four skills, we removed all noncontingent reinforcement by arranging Postteaching DRA. Maggie exhibited high levels of saying, "Thank you" (all conversation partners) and smiling (trainer and gen-adult 1). With gen-adult 2, we observed continued variability in responding. For shifting and following the conversation, however, we observed continued low levels of responding across all conversation partners. Therefore, we returned to teaching for all four skills targeted thus far and reintroduced the continuous prompt for shifting and following the conversation (Teaching DRA plus Continuous Textual Prompt). With the continuous textual prompt for shifting and following the conversation, high levels of correct responding were observed. For shifting the conversation, Maggie continued to make approximately one incorrect response per session (67% correct responding). This consistent pattern of incorrect responses may have been related to Maggie's elevated level of distracting nonvocal behavior (ninth panel), which involved playing on her tablet, drawing

pictures on her sketchpad, laying her head down on the table, or fidgeting. Engaging in these behaviors may have interfered with her attending to the evocative situations and the content of the conversation, which is necessary for shifting the conversation. Therefore, we implemented Trial-Based Teaching for distracting nonvocal behavior.

Maggie met the mastery criterion following one training session during Trial-Based Teaching mDRO. During Teaching DRA - Teaching mDRO, a decreasing trend in distracting nonvocal behavior and a concomitant increase in shifting the conversation was observed. To further assess the possible interaction between skills, we removed the textual prompts for distracting nonvocal behavior while the teaching procedures for the other four skills remained the same in Teaching DRA. Maggie exhibited increasing levels of distracting nonvocal behavior and a decrease in shifting the conversation (ninth panel; third phase). We reintroduced the textual prompt for distracting nonvocal behavior (Teaching mDRO) and observed a low, stable level of this behavior along with robust concomitant increase in shifting the conversation. With Teaching DRA - Teaching mDRO in place, we observed desirable levels of responding across all skills.

We assessed maintenance and generalization of all skills, but the text prompt remained in place for distracting nonvocal behavior due to potential negative effects of this behavior on shifting the conversation (Postteaching DRA - Teaching mDRO). Maggie engaged in high levels of saying “Thank you” and smiling following compliments and following the conversation with all conversation partners. Maggie exhibited moderate to high levels of shifting the conversation with the trainer and variable responding with gen-adults 1 and 2. Low levels of distracting nonvocal behavior with the trainer and gen-adults 1 and 2 were observed. Following low, stable levels of distracting nonvocal behavior in Teaching mDRO, the textual prompt was removed in Postteaching mDRO. A low level of distracting nonvocal behavior in maintenance (ninth panel) and generalization (tenth panel) were observed for the first 6 and 17 sessions, respectively; however, an increasing trend was observed thereafter with all adults.

With stable levels of shifting the conversation with the trainer but variable levels with gen-adults 1 and 2 (seventh panel; Postteaching DRA), we introduced teaching with gen-adults 1 and 2 (eighth panel; Teaching DRA). An increase in shifting the conversation was observed with both gen-adults 1 and 2. During the same time, we observed a worsening in distracting nonvocal behavior with the trainer and gen-adults 1 and 2. Therefore, we introduced the textual prompt, first, with the generalization adults and, then, with the trainer (Teaching mDRO). An immediate and robust decrease in distracting nonvocal behavior was observed with all adults. Following stable and satisfactory levels of performance across all skills, we evaluated maintenance by arranged Postteaching NCR in which the textual prompts and DRA contingency were removed. We observed maintenance of responding across a 1-month period for all skills with all adults except for distracting nonvocal behavior, for which variable levels occurred. Similar levels of responding were observed in the treatment-extension conversations with novel adults for all skills; however, improvements in distracting nonvocal behaviors were observed.

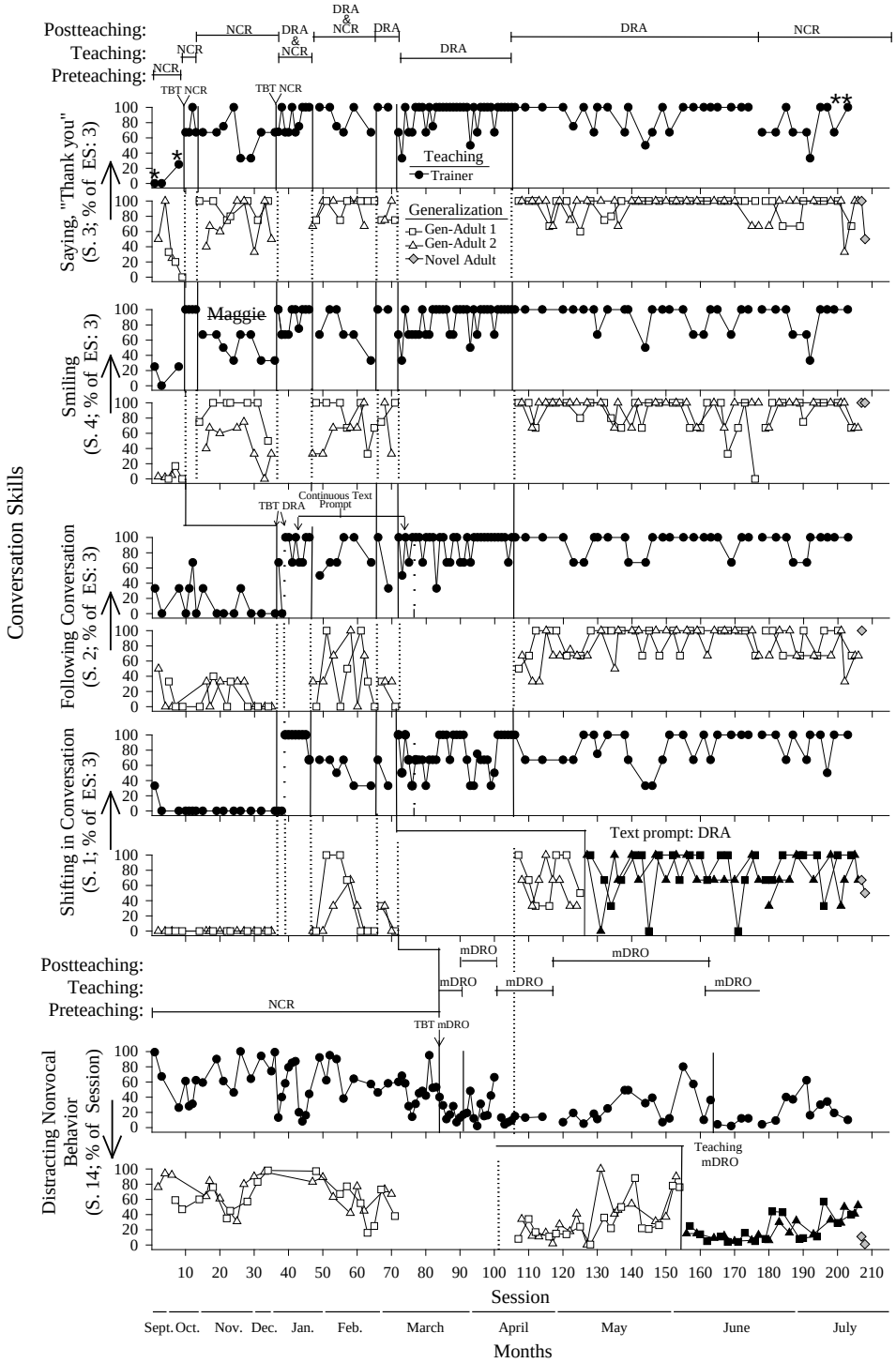

Figure 2

Percentage of opportunities with target skills across sessions on the primary x-axis and months on the secondary x-axis for Maggie. The closed data path represents efficacy data and responding with the trainer. The open data path represents responding with gen-adult 1 and gen-adult 2 (square and triangle, respectively) that were never associated with teaching. The gray diamond represents responding with a novel adult. In the parenthetical the skill number is denoted and subsequently the number of opportunities is reported. The arrows on the y-axis represents the desired level of performance. The asterisks in the top panel denote the representative sessions used to assess social validity.

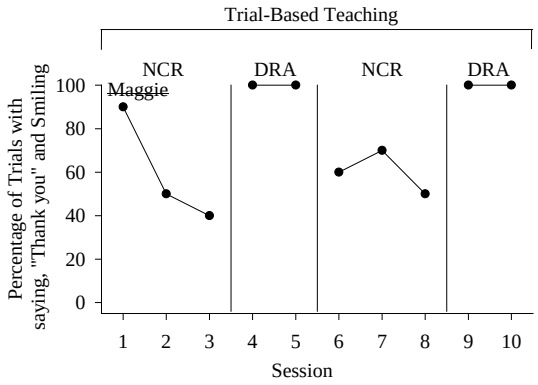

Figure 3. The percentage of trials with saying, "Thank you" and smiling during Trial-Based Teaching for Maggie.

Chris

During Preteaching NCR, Chris engaged in low levels of shifting the conversation, following the conversation, and clarifying statements (Figure 4, first and second, third and fourth, and seventh and eighth panels, respectively). In addition, he engaged in moderate levels of distracting nonvocal behavior (fifth and sixth panels). Similar levels of responding across all skills were also observed during Preteaching DRA.

Following undesirable performance for shifting the conversation, we implemented Trial-Based Teaching DRA. Chris met the mastery criteria following four sessions, and an immediate increase in correct responding was observed during Teaching DRA. We then taught Chris to follow the conversation. He mastered this skill following two trial-based sessions. An immediate and robust increase in following the conversation was observed with Teaching DRA. Following teaching of shifting and following the conversation, Chris's clarifying statements increased to high stable levels without teaching. With high, stable levels of shifting and following the conversation, we addressed Chris's distracting nonvocal behavior. Chris met the mastery criterion following one trial-based session. An immediate, robust decrease in distracting nonvocal behavior was observed in Teaching mDRO.

We removed teaching (i.e., textual prompts) and the DRA contingency when all skills were occurring at satisfactory levels, and a worsening in all the taught skills was observed with the trainer, gen-adults 1 and 2, and the peer in Postteaching NCR. By contrast, clarifying statements maintained in the absence of teaching with the trainer and generalized to the conversations with gen-adults 1 and 2 and the peer. We reintroduced Teaching DRA and reestablished high levels of all the skills. Toward the goal of maintenance in naturalistic conversations, we wanted to remove artificial aspects of the teaching procedures (i.e., tokens and textual prompts), but retain the motivation to engage in the social skills. During Postteaching DRA (delayed tokens), all textual prompts were removed and the tokens were delivered after the session. High levels of shifting the conversation, following the conversation, and clarifying statements and low levels of distracting nonvocal behavior with all conversation partners were observed. In summary, we observed both maintenance and generalization across a 1-month period and similar levels of responding were observed in the treatment-extension conversations with novel adults, a peer, and Chris's mother.

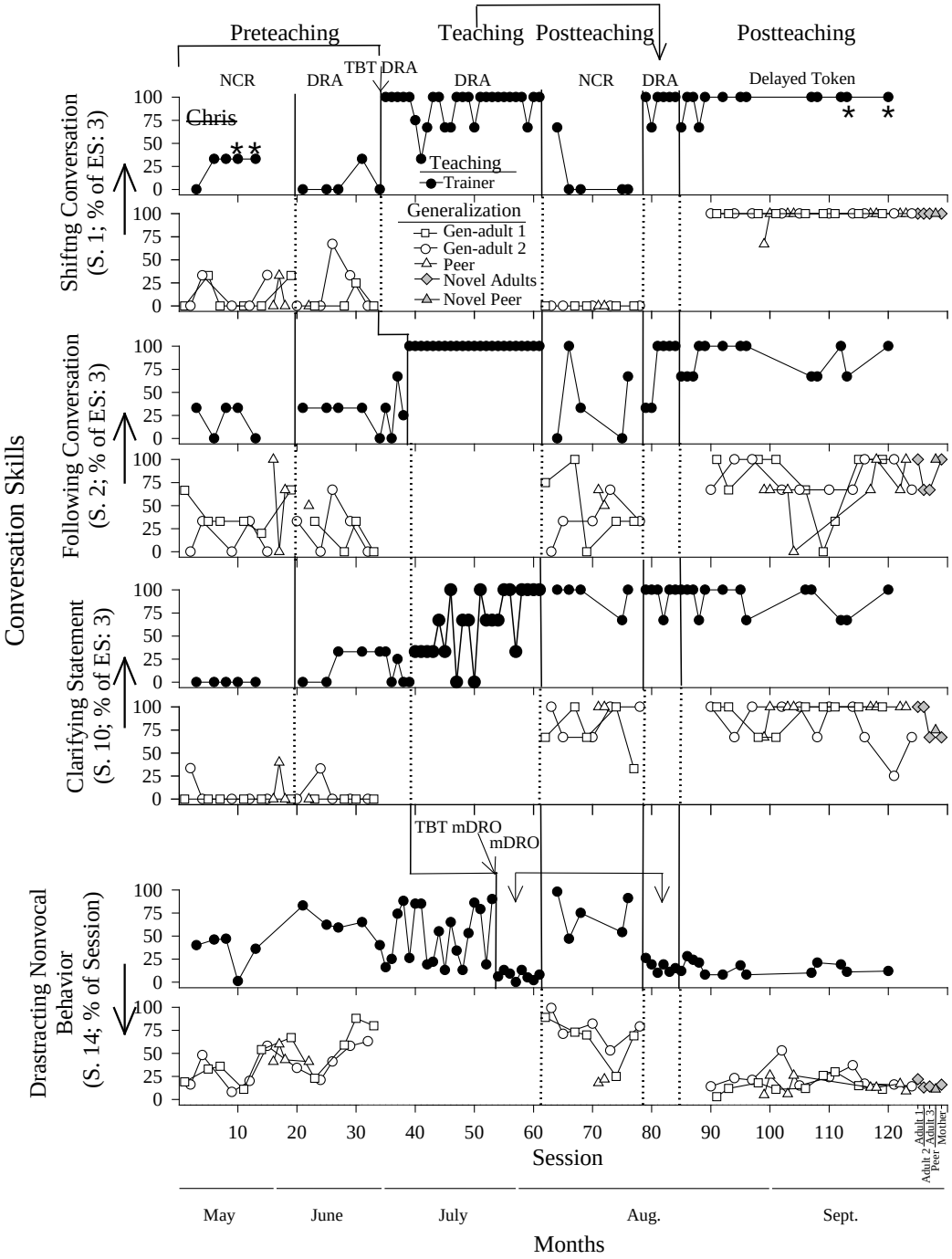

Figure 4. Percentage of opportunities with target skills across sessions on the primary x-axis and months on the secondary x-axis for Chris. The open data path represents responding with gen-adult 1, gen-adult 2, and peer (square, circle, and triangle, respectively) that were never associated with teaching. The gray diamond represents responding with a novel adult. The gray data path represents responding with novel adults and a peer (diamond and triangle respectively). In the parenthetical the skill number is denoted and subsequently the number of opportunities is reported. The arrows on the y-axis represents the desired level of performance. The asterisks in the top panel denote the representative sessions used to assess social validity.

Summary Measures

Figure 5 provides a summary of all participants' performance during the last three sessions of Preteaching NCR (open symbols) and Postteaching NCR (Mike and Maggie) and Postteaching DRA (delayed token; Chris; closed symbols). Performance with the teaching, generalization, and treatment-extension conversation partners is depicted by the square, circle, and triangle, respectively. For all skills across the three participants, except for Maggie's distracting nonvocal behavior with the gen-adults, robust improvements were observed.

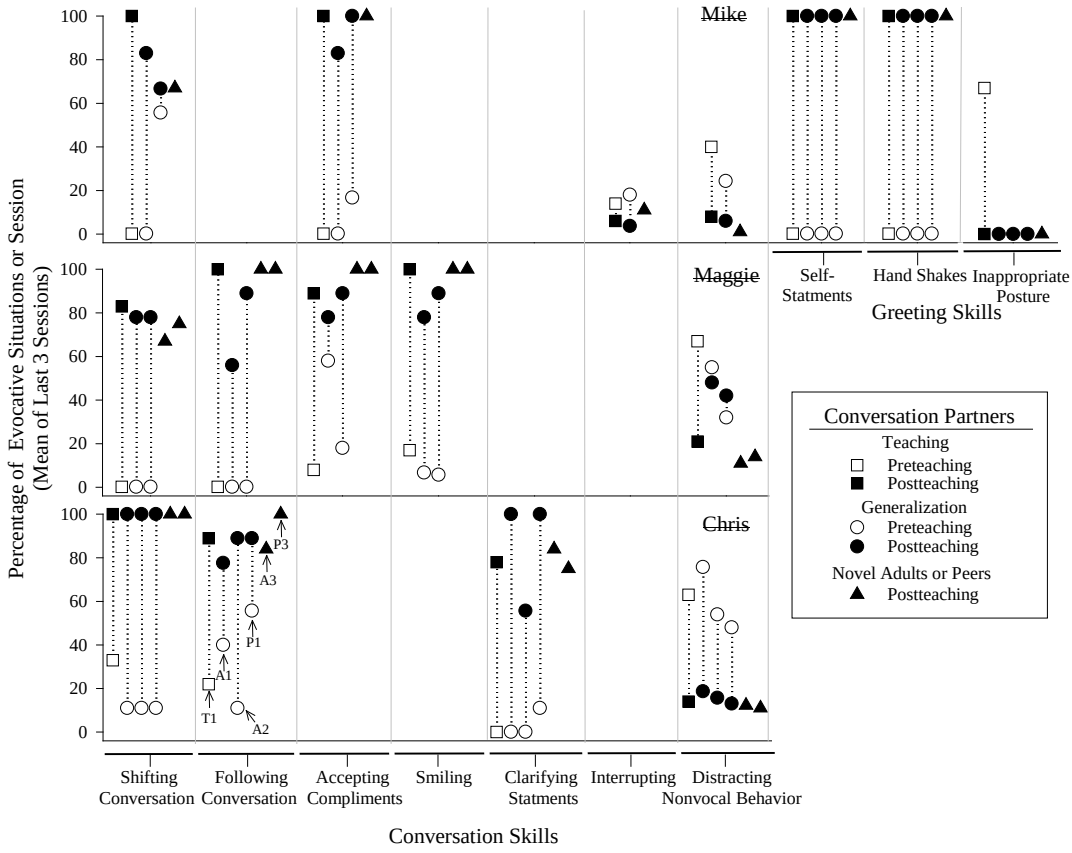

Figure 5. The mean percentage of opportunities with the skill combined during the last three sessions of Preteaching denoted by the open data path and Postteaching denoted by the closed data path for Mike, Maggie, and Chris across the top, middle, and bottom panel respectively. Efficacy data are represented by the square data paths, generalization are represented by the circle data paths, and treatment-extension data represented by the triangle data paths.

Social Validity

Before teaching, all parents reported that they were not satisfied with the participants' conversation (see Supporting Information 2, Questions 1 and 2; *M* = 2; range, 1 to 3) and greeting (*M* = 2) skills in the Preteaching video. In contrast, the mean satisfaction rating across all parents was 6.3 (range, 6 to7) for conversation and 7 for greeting skills in the Postteaching video. The parents also reported that they were not satisfied with the participants' performance of the targeted skills during Preteaching with the mean satisfaction rating of 2.1 (range, 1 to 4). During Postteaching, however, the mean satisfaction rating was 6.1 (range, 5 to 7), with high satisfaction expressed for saying, "Thank you" (*M* = 6.0), shifting the conversation (*M* = 5.8), following the conversation (*M* = 6.0), clarifying statements (*M* = 6.0), interrupting (*M* = 5.3), and distracting nonvocal behavior (*M* = 6.0).

Each participant reported that they were moderately to highly satisfied with their performance during conversations (see Supporting Information; *M* = 6; range, 5 to 7) and greetings (*M* = 6). In addition, they reported being neutral or very comfortable with having conversations with unfamiliar adults (*M* = 5.5; range, 4 to 7). Mike explained that he gave a neutral rating (4) because he thought he needed more practice with additional adults to feel less anxious about conversing with unfamiliar adults. However, Mike reported that he was more comfortable greeting new adults following the training program (5). All participants rated being highly satisfied with the teaching procedures (*M* = 6.5; range 6 to 7), and they would recommend the intervention to other individuals for social-skills training (*M* = 7). When asked if there were additional social skills that they would benefit from learning, Mike responded with "None, but practicing in everyday life will help more than anything," respectively and Maggie responded with "Greetings."

Supporting information 2

Supplemental Table 2
Social Validity Assessment and Results from Caregivers

Questions	Mean Ratings (range)	
	Preteaching	Postteaching
Overall Performance		
Conversations		
I am satisfied with the participant's social skills during the conversation.	2.4 (1 - 3)	6 (5 - 7)
Greetings		
I am satisfied with the participant's social skills during the greeting.	3 (2 - 4)	7
Social Skills		
Conversations		
I am satisfied with the way the participant responded when the conversation partner appeared to be bored (e.g. looked at a cell phone, yawning, or doodling on a note pad).	2 (1 - 3)	5.8 (4 - 7)
I am satisfied with the way the participant accepted compliments from the adult.	2.3 (1 - 3)	6 (5 - 7)
I am satisfied with the participant's body posture and arm movements, that is, the amount of time he is engaging in non-contextual arm movements or resting his head on his hands or arms.	2.3 (1 - 4)	6 (5 - 7)
I am satisfied with the number of times that the participant interrupted the adult.	3.3 (1 - 4)	5.3 (4 - 7)
I am satisfied with the way the participant followed the conversations.	2.6 (2 - 3.5)	6 (5 - 7)
I am satisfied with the way the participant responded when the conversational partner made an unclear statement.	1	6 (5 - 7)
Greetings		
I am satisfied with the way in which the participant stood up and shook the adult's hand.	1	7
I am satisfied with the way in which the participant provided self-statements (e.g., "I am going to the movies this weekend" or "I am Joe Bob and I'm a senor in high school").	1	7

Note. The three caregivers used a 7-point Likert scale with the following ratings: 7 = strongly satisfied, 4 = neutral, and 1 = strongly disagree.

Supporting information 3

Supplemental Table 3
Social Validity Assessment and Results from Participants

Questions	Mean Ratings (range)	
Overall Social Skills	Preteaching (Maggie only)	Postteaching
Conversations		
I am satisfied with my social skills during conversations.	5	6 (5 - 7)
I am comfortable having conversations with new adults.	2	5.5 (4 - 7)
Greetings		
I am satisfied with my social skills during greetings.	2	6
I am comfortable greeting new adults.	2	5
Teaching Procedures		
Conversations		
I was satisfied with the procedures used to teach me social skills during both conversations and greetings. That is, I was satisfied with how the conversation partner explained to me the importance of each social skill, modeled what the new social skills looked like with another adult, a textual prompt to tell me how to respond when I made a mistake, and the practice opportunities.	NA	6.5 (6 - 7)
I would recommend this social skills intervention to other teenagers or children who want to work on how they interact with adults.	NA	7

Note. The two participants used a 7-point Likert scale with the following ratings: 7 = strongly satisfied, 4 = neutral, and 1 = strongly disagree.

Chapter 3: Discussion

We identified deficits in conversations and greetings exhibited by three individuals via a broad assessment comprised of direct and indirect measures and, based on the results, multiple skills were taught that led to generalization across conversation partners and settings as well as maintained over time. Participants and their parents were satisfied with the improvements in performance. These achievements of robust acquisition, demonstration of generalization and maintenance, and high acceptability scores are necessary for helping individuals with an ASD become more confident and successful in greeting and conversing with unfamiliar adults. This is one study in a line of research that is necessary to ultimately develop a comprehensive,

individualized approach that produces meaningful improvements in conversation and greeting skills for children and adolescents.

We used indirect and direct measures to gather qualitative information across a range of greeting and conversation deficits toward the goal of obtaining a broad assessment of the participants' skill set. We incorporated three concerns nominated by parents in the semi-structured direct assessment, which allowed a tailored assessment for each participant. For example, Mike's parents reported that he had difficulties discussing conversation partners' topics if he was not interested in the topic (Skill 10) and if the conversation partner had a differing viewpoint on debated topics (e.g., creationism vs. evolution; Skill 16). In the direct assessment, however, when we programmed evocative situations to assess the parents' concerns, we only observed one of the three reported skill deficits (Chris; Skill 11). Nevertheless, obtaining parental reports should be included in the assessment process to identify idiosyncratic skill deficits such as appropriately requesting clarification for Chris.

Our direct assessment involved a single greeting and conversation (45 to 60 min), and it allowed us to observe conversation and greeting deficits as well as undesirable behaviors that may not be noticed or reported by parents nor the participant. The benefits of our direct assessment are similar to the Assessment of Basic Learning and Learning Skills - Revised (Partington, 2008) and the Verbal Behavior Milestones Assessment and Placement Program (Sundberg, 2008), in which evocative situations are arranged to directly assess a variety of skill domains such as language, social interaction, and motor skills with young children with an ASD. That is, in this type of assessment, the strengths and weaknesses of an individual's skill set can be objectively determined. In addition to using the direct assessment to identify skills to teach, it is important to note that the skill identified as known prior to participating continued to be performed at a high level following the teaching of other skills. The 26 skills observed across all participants in the direct assessment that did not warrant teaching (black boxes in the first column

in Figure 6 for each participant) were also observed during the last three sessions of the final phase of Postteaching (second column for each participant). These preliminary data support the predictive validity of the semi-structured direct assessment to accurately identified skills deficits that warrant intervention. Quantitative measures of participant's performance and interobserver agreement measures should be obtained for the direct assessment in future research. The current assessment identified what skills should be taught but not the order in which to teach those skills. A systematic evaluation of collateral effects of teaching different conversation skills would provide some guidance on the most efficacious and efficient order of teaching. That is, by first teaching shifting the conversation, which requires the individual to look at the conversation partner to discriminate an index of boredom, an increase in eye contact may be obtained without direct teaching.

We demonstrated the efficacy of our procedures to teach children and adolescents numerous conversation and greeting skills, which is especially noteworthy given the small dose of teaching per week. Session blocks were conducted only once a week for 1.5 to 2.0 hrs with Mike and Maggie and twice a week for 30 min with Chris. We also applied the teaching procedures successfully across individuals that differed in age, incoming repertoires, and current academic and social programming. Our methods permitted flexibility in modifying the teaching procedures to (a) incorporate features of individuals' educational programming such as the use of token reinforcement with Chris and (b) provide a framework for addressing error patterns such as changing the reinforcement contingency or adding additional prompts (continuous textual prompt) as shown with Maggie.

We make three points regarding the teaching procedures and acquisition outcomes. First, immediate and high levels of performance for most skills was observed during the conversations and greetings following the BST procedures that comprised trial-based teaching, indicating that the corrective feedback during sessions in the form of the textual prompt was not necessary or

had a minor effect on skill acquisition. These results add to the robust literature on the efficacy of using BST to teach different skills with a variety of populations ranging from young children to parents and clinical staff (Miltenberger et al., 2004; Seiverling, Williams, Sturmey, & Hart, 2012; Sarokoff & Sturmey, 2004). Second, the textual prompt served as a more prominent teaching component for complex conversation skills such as shifting the conversation (Skill 1) that required participants to remember the previous topic of conversation, notice an index of boredom, and initiate a new topic for discussion. In technical terms, initiating a new topic is an instance of what Michael, Palmer, and Sundberg (2011) described both convergent and divergent multiple control. The nonvocal discriminative stimulus, index of boredom, strengthens multiple responses to change the topic of conversation. In addition, the previous topic of conversation weakens all responses that are related to that topic of conversation. These are both examples of divergent control. Convergent control is the combination of the index of boredom, the previous topic of conversation, and topics that have engendered good conversation in the past. It is the combination of the divergent control and convergent control that influences the particular response the individual makes. Third, Maggie reported during teaching that she could discriminate an index of boredom and remember the previous topic but did not know how to initiate a new topic of conversation, which may have also negatively affected her performance on following the conversation (Skill 2). Given this type of skill deficit, we introduced a continuous textual prompt with examples of how to initiate a new topic of conversation, and this teaching modification was correlated with improved performance on both skills. Confidence that the continuous textual prompt aided skill acquisition would be enhanced by showing functional control over its effects. Future research should evaluate the use of continuous textual prompts for skills in which the participant makes omission errors, which may be due to deficits in prerequisite skills such as asking WH-questions.

Shifting the conversation may have been affected by distracting nonvocal behavior.

Following the implementation of teaching and obtaining low levels of distracting nonvocal behavior, a corresponding increase in shifting the conversation was observed. Distracting nonvocal behavior may have interfered with the acquisition of shifting the conversation because Maggie may not have observed the index of boredom, attended to the topic of conversation, or both. We chose to first target shifting the conversation and following the conversation to increase Maggie's contribution to the conversation. Anecdotally, prior to teaching shifting the conversation and following the conversation, the conversation partner carried most of the conversation with Maggie only making several one- to two-word comments during the entire conversation. We wanted to increase her engagement with the conversation partner early in training to increase the conversation partner's acceptability of the teaching procedures. We recommend teaching following the conversation first to increase the participant's meaningful contributions to the conversation. Second, we recommend decreasing distracting nonvocal behavior, and last, increasing shifting the conversation. This order may increase the efficacy and efficiency of teaching shifting the conversation as well as increase the conversation partner's acceptability of the teaching procedures.

The present study extended Nuernberger et al. (2013) by allowing the conversation topics to be initiated by both the participant and the conversation partner because conversations commonly involve both partners introducing topics for discussion. Consistent with the findings from Capps et al. (1998) that children with ASD extended ongoing conversation by offering new or content-relevant information less often than typically developing peers, we taught children to respond to ongoing conversation topics (Skill 2) and also to initiate a new conversation topic (Skill 1). A limitation of the present study is that we did not teach each participant to end the conversations, as done by Nuernberger et al; the conversation partner ended each conversation in the present study. Future research should teach the participant when it is appropriate to end a conversation. For example, an opportunity to end a conversation may include repeated instances

of the conversation partner engaging in an index of boredom or repeated responses from the conversation partner that consist of one word (e.g., yes or no).

One aspect of the teaching procedures we believe is important is to teach individuals to initiate a new topic of conversation when the conversation partner appears bored. Similar to Peters and Thompson (in press), we taught individuals to discriminate when the conversation partner is bored (disinterest in the topic) and to shift the conversation to a new topic. Peters et al. observed how seven typically developing children responded when asked to show the experimenter what they looked like when they were either interested or uninterested to develop indices of interest and disinterest. Indices of interest consisted of the conversation partner's body and head oriented toward the child, looking at the child's eyes or mouth, and positive feedback. Indices of disinterest consisted of the conversation partner's body and head oriented away from the child, rested their head in their hands, sighed or yawned, and raised their eyebrows without smiling or eye contact. In the present study, several indices of boredom were programmed based on anecdotal observations from the first author and on informal interviews with graduate students in behavior analysis (looking at a watch or a book, doodling, yawning, looking around the room, or long pauses in responding; some of which correspond to the indices of boredom used in Peters et al.). Future research should determine the most common types of indices of boredom to program. Teaching the most common forms of indices of boredom may increase generalization during conversations in the natural environment with novel conversation partners.

Any program designed to teach the basics of brief and extended interactions with novel adults must produce improvements that generalize across contexts and conversation partners, conversation topics, and maintain following teaching. Stokes and Baer (1977) and Stokes and Osnes (1989) recommended designing teaching arrangements that promote generalization; we incorporated several of these strategies. First, we trained loosely in that the topics of conversation were not restricted; thus, participants had experiences talking about a variety of

topics while engaging in the target skills (e.g., entertainment, school, video games and technology, or personal stories). Second, we reinforced multiple exemplars in that the participants engaged in a variety of target responses. For example, we taught the participant to respond to indices of boredom and to change the topic of conversation, but what they changed the topic to was unrestricted.

We arranged challenging generalization and maintenance tests: (a) a minimum of three days (72 hr) elapsed between the end of Teaching and Postteaching (b) all treatment-extension conversation partners were naive to the teaching procedures and research questions (Chris's mother was the only exception), and (c) participant's performance was assessed from one to four months following teaching. Given the arrangement, it is noteworthy that we observed generalization for all conversation and greeting skills. For Chris, his performance in the initial generalization test was unsatisfactory (Postteaching NCR), which was due to the removal of token deliveries for correct responses that was present in Teaching DRA. In other words, the discontinuation of reinforcement decreased his motivation to exhibit the skills. In an attempt to promote generalization while removing contingent token deliveries, we made the reinforcement contingency less discriminable (Stokes & Baer 1977; Stokes & Osnes 1989) by delaying the delivery of tokens (Postteaching Delayed Token). This modification led to robust and sustained levels of generalization across all conversation partners. We also observed the effects of the teaching extend to unfamiliar conversation partners that the participants had never interacted with prior to the greeting and conversation. Maintenance of all but one skill with the trainer and generalization adults was shown for up to four months following the removal of all teaching procedures.

To promote generalization, we did not require the discussion of specific topics in conversation. This flexibility could be viewed as a limitation of our procedures because it presents the possibility that the topics initiated by conversation partners may have been

influenced by the participants' level of engagement in particular topics. That is, the conversation partners may have inadvertently introduced a narrower range of topics across conversations. We analyzed the topics discussed during Postteaching, and across the final five sessions, 47, 54, and 56 different topics were discussed with Mike, Maggie, and Chris, respectively. Moreover, of the topics discussed, the same topic was discussed only 4, 4, and 3 times across the last five sessions for Mike, Maggie, and Chris, respectively. The repeated topics included common weekly events such as Maggie and the conversation partners discussing movies, television, school events, and a school presentation she was creating. These data suggest that the conversation partners did not differentially select topics of conversation based on the participant's level of engagement.

In addition to demonstrating generalization and maintenance, all parents reported high overall satisfaction with their child's conversation and greetings during Postteaching (M = 6). The outcomes were similar to the satisfaction reported by Beaulieu, Hanley, and Santiago (2013) in which three respondents reported an increase in satisfaction in the participant's social skills from baseline (M = 2.3) to Postteaching (M = 5.3) using a similar 7-point Likert scale. The participants in the present study were all verbally competent (although Chris was only 8 years old), and each reported that the teaching procedures were acceptable and they felt more comfortable engaging in social interactions with unfamiliar adults. In addition, each participant indicated that they would recommend a similar intervention to others who wanted to improve their social skills. This outcome is also similar to the participant in Beaulieu et al. who reported that the teaching procedures were acceptable and he was more confident conversing with others. The social acceptability of the direct consumers of the interventions (parents and the participants) is essential but not sufficient in determining overall social acceptability. The most important applied outcome, arguably, is to improve participants greeting and conversation skills to the extent that lead to preferred interactions with unfamiliar individuals. Future research should collect social acceptability ratings from unfamiliar individuals. Gathering social acceptability

ratings after an interaction between the unfamiliar individual and the participant would provide the most informative data.

A normative account of common conversation and greeting skills would enhance the identification of greeting and conversation deficits to teach to individuals with an ASD. Turkstra, Ciccia, and Seaton (2003) conducted a descriptive assessment of conversation skills among individuals of typical development to highlight what skills are commonly engaged in during a brief conversation. However, these data do not evaluate the various skills that are preferred by conversation partners. For example, Turkstra et al. found that individuals looked at the conversation partner about 68% of the time while listening and about 43% of the time while speaking, but it is unknown whether conversation partners' prefer to be looked at more or less often. In other words, teaching conversation and greeting skills should be evaluated based on optimal performance as informed by empirically delivered preferences rather than normative performance. For instance, Lin, Lawrence, and Gorrell (2003) surveyed 3,000 kindergarten teachers' opinions regarding the skills they preferred kindergarteners to have mastered prior to entering school. A similar survey could be conducted to gather data on what conversation skills others deem important. However, creating such a survey may prove to be challenging due to the complexity and subtlety of some skills. For instance, someone may report that they value a conversation partner asking questions but may fail to report at what point the rate of questions becomes aversive in that it drifts away from a reciprocal conversation to more of an interview. An alternative method is to ask individuals to rate the performance after watching vignettes created to systematically change the quantity or quality of particular skills. For example, with maintaining eye contact, vignettes could be created in which an individual looks at the conversation partner for 0%, 20%, 40%, 60%, 80%, and 100% of the conversation both while listening and while speaking. The results of individuals' preferences for the performance in these 12 vignettes should guide the identification of skill deficits and the mastery criterion for teaching

eye contact. A thorough understanding of both the type of skills and amount the skills are critical to the development of a comprehensive and socially acceptable curriculum for teaching conversation and greeting skills.

To build a comprehensive program to teach conversation and greeting skills to all individuals, we need additional research comparing an individualized format, as modeled in the current study, to a group format, as modeled by Grantman et al. (2012) with the PEERS curriculum, to determine the conditions under which each teaching format is most beneficial. We think teaching conversation and greeting skills via an individualized process in a one-on-one format first may prove to be more efficacious. Teaching conversation skills to two or more individuals with conversation deficits who are conversing with each other may decrease the efficacy or efficiency of the teaching procedures. In a typical conversation the listeners' behavior will serve as reinforcement for the speakers' behavior, however, this may not be the case when a conversation consists of individuals who are both learning new skills. For example, if the speaker who is learning a new skill, initiating a new topic, contacts extinction or even punishment from a listener who is also learning a new skill, following conversation, this will likely affect the acquisition of initiating a new topic. The errors made by the conversation partner may decrease the efficiency of the teaching procedures or impede acquisition altogether. After mastering the skills in this format, increasing the complexity of the conversation to a group of individuals for whom all have a history with conversation deficits seems appropriate as a way to promote generalization.

After basic conversation skills have been mastered during both one-to-one and group-based conversation, the complexity of skills should extend beyond the fundamental set targeted in our program. Future research, for example, should continue to evaluate procedures to teach individuals to identify common interests (Grantman et al., 2012) and then to use those topics in subsequent conversations with that same conversation partner. Furthermore, individuals should

be taught characteristics of engaging in a preferred second and third conversation with the same partner. For example, do conversation partners prefer when someone brings up a topic the conversation partner spoke about in the previous conversation? The synthesis of the individual research questions will aid in the design of an efficient, efficacious, and preferred conversation and greeting skills program.

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