

COMPARING THE TEACHING INTERACTION PROCEDURE TO
SOCIAL STORIES FOR PEOPLE WITH AUTISM

JUSTIN B. LEAF, MISTY L. OPPENHEIM-LEAF, NIKKI A. CALANCA, JAN B. SHELTON,
AND JAMES A. SHELTON

UNIVERSITY OF KANSAS

AND

MITCHELL TAUBMAN, JOHN MCEACHIN, JAMISON D'AMICO, AND RONALD LEAF

AUTISM PARTNERSHIP

This study compared social stories and the teaching interaction procedure to teach social skills to 6 children and adolescents with an autism spectrum disorder. Researchers taught 18 social skills with social stories and 18 social skills with the teaching interaction procedure within a parallel treatment design. The teaching interaction procedure resulted in mastery of all 18 skills across the 6 participants. Social stories, in the same amount of teaching sessions, resulted in mastery of 4 of the 18 social skills across the 6 participants. Participants also displayed more generalization of social skills taught with the teaching interaction procedure to known adults and peers.

Key words: autism, behavioral skills training, social skills, social stories, teaching interaction

Autism spectrum disorders (ASD) are marked by qualitative impairments in social behavior (American Psychiatric Association, 2000) that can lead to failures in developing meaningful friendships (e.g., Bateman & Kasari, 2000), depression (e.g., M. E. Stewart, Barnard, Pearson, Hasan, & O'Brien, 2006), and problems in school (e.g., Ladd, Birch, & Buhs, 1999). Over the past 30 years, a variety of methods have been implemented to teach social behaviors, including video modeling (e.g., Charlop-Christy, Le, & Freeman, 2000), discrete-trial teaching (e.g., Lovaas, 1981), pivotal response training (e.g., Stahmer, 1995),

behavioral skills training (e.g., K. K. Stewart, Carr, & LeBlanc, 2007), social stories (e.g., Gray & Garand, 1993), and the teaching interaction procedure (e.g., Leaf et al., 2009). Despite the numerous interventions to help people with ASD improve their social skills, relatively few studies have compared these different interventions.

Social stories are brief passages, written by a teacher, that describe a behavior to be displayed by a participant. The story describes when the participant should display the desired behavior, why he or she should display the desired behavior, and how displaying the desired behavior will affect others (Gray & Garand, 1993). Teachers either read the stories aloud to the students or students read the stories to themselves or out loud. In some studies, the teacher either asked the participant comprehension questions (e.g., Delano & Snell, 2006) or role-played the social skill with the participant (e.g., Thiemann & Goldstein, 2001) after the participant read the story.

Gray and Garand (1993) and Gray (1994) provided several guidelines related to the implementation of social stories to teach social

Justin B. Leaf is now at Autism Partnership, Seal Beach, California, and Great Strides Behavioral Consulting, St. Louis, Missouri; Misty L. Oppenheim-Leaf is now at Behavior Therapy and Learning Center, Seal Beach, California.

This investigation was conducted to meet, in part, the requirements for the doctoral degree in Behavioral Psychology at the University of Kansas. We thank Sarah Johnson for her work throughout the project. We also thank Keith Miller, Nancy Brady, and Matthew Reese for their help on an earlier version of this study.

Correspondence concerning this article should be addressed to Justin B. Leaf, 200 Marina Drive, Seal Beach, California 90807 (e-mail: jblautpar@aol.com).

doi: 10.1901/jaba.2012.45-281

skills. First, participants should be in the “trainable mentally impaired range or higher who possess basic language skills” (Gray & Garand, p. 2). Second, the teacher should write an individualized story at the participant’s comprehension level. Third, social stories should include four sentence types: descriptive sentences that specify when, where, and why the participant should display the desired social behavior; perspective sentences that describe the reactions and feelings that others may have if the participant displays the social behavior; affirmative sentences that describe a shared belief of society; and directive sentences that specify how the participant should display the behavior. Gray (1995) recommended a total of two to four descriptive, affirmative, or perspective sentences for every directive sentence in the story. Subsequent research on social stories has evaluated several presentation variations, including the use of pictures or icons (e.g., Barry & Burlew, 2004; Brownell, 2002), different story layouts (e.g., book format or single-page format), role playing (e.g., Thiemann & Goldstein, 2001), and comprehension checks (e.g., Delano & Snell, 2006), and found each to be effective.

The teaching interaction procedure is another method to teach social skills to children with autism. In the teaching interaction procedure, the teacher describes a skill, provides a rationale for why the participant should display the skill, describes the cues and characteristics of situations in which the participant should display the skill, divides the skill into smaller behavioral components, models the skill, and role plays the skill with the participant. During role playing, the teacher provides simulated opportunities for the participant to display the social skill and provides feedback (e.g., praise, tangible consequences, or corrective feedback) based on the participant’s performance.

The teaching interaction procedure first was implemented and evaluated as a component of the Achievement Place Teaching-Family Model

(Phillips, Phillips, Fixsen, & Wolf, 1971, 1974). Subsequent research has demonstrated the effectiveness of this strategy in both one-on-one (Leaf *et al.*, 2009) and group (Leaf, Dotson, Oppenheim, Sheldon, & Sherman, 2010) teaching arrangements. In addition, the teaching interaction procedure is similar to another well-researched procedure, behavioral skills training; the main difference between the two is the inclusion of rationales in the teaching interaction procedure (K. K. Stewart *et al.*, 2007).

Thus, available evidence indicates that both social stories and the teaching interaction procedure are effective methods for teaching social behaviors to children and adolescents with ASD. However, the relative effectiveness of the two procedures is unknown, in that no direct comparison of these teaching strategies have been conducted to date. This study was designed to compare these two interventions. We selected these two procedures because they both have been implemented with numerous children and adolescents with autism, share common components, and have been found to be effective in the empirical research. The purposes of the current study were (a) to assess the relative effectiveness of the two procedures in teaching social skills to children and adolescents with ASD and (b) to assess the level of generalization of the social skills taught by each method.

METHOD

Participants

Six boys, ages 5 to 13 years old, were recruited to participate in this study. Each participant met the following criteria: (a) He had been diagnosed with an ASD; (b) he spoke in full sentences; (c) he had no immediate history of self-injury, severe aggression, or severe disruptive behaviors; and (d) he had a standard score of 70 or higher (i.e., within two standard deviations of the average range and considered to be a moderately low score) on the Peabody Picture Vocabulary Test ⁴ (PPVT-4).

Buddy was a 6-year-old boy who had been diagnosed with autistic disorder. The PPVT-4 placed him in the 27th percentile of receptive language with a standard score of 91 (6 years 1 month age equivalent). He had a Mullen's intelligence score (IQ) of 87, and a Social Skills Rating Scale-Parent (SSRS-P) score of 69 (2nd percentile of children his age). Buddy attended a general education kindergarten classroom without supports and previously had been taught with both social stories and the teaching interaction procedure prior to this study.

Hank was a 5-year-old boy who had been diagnosed with pervasive developmental disorder not otherwise specified. The PPVT-4 placed him in the 97th percentile of receptive language with a standard score of 128 (8 years 3 months age equivalent). He had a Wechsler Intelligence Scale for Children (WISC IV) IQ score of 117, a SSRS-P score of 91 (27th percentile of children his age), and a Vineland Adaptive Behavior Composite score of 87. He attended an early intervention clinic for children with ASD and had a prior history with both social stories and the teaching interaction procedure.

Nick was a 5-year-old boy who had been diagnosed with autistic disorder. The PPVT-4 placed him in the 8th percentile of receptive language with a standard score of 79 (3 years 11 months age equivalent). He had a Kaufman IQ score of 65, a SSRS-P score of 70 (2nd percentile of children his age), and a Vineland Adaptive Behavior Composite score of 68. He attended a general education kindergarten classroom without any supports and had a previous history of being taught with social stories but not with the teaching interaction procedure.

Lang was a 5-year-old boy who had been diagnosed with Asperger syndrome. The PPVT-4 placed him in the 61st percentile of receptive language with a standard score of 104 (5 years 11 months age equivalent). He had a Wechsler Preschool and Primary Scale of Intelligence (WPSSI-3) IQ score of 89, a SSRS-P score of

106 (66th percentile of children his age), and a Vineland Adaptive Score of 85. He had been placed in a general education kindergarten classroom setting with supports and had a previous history of being taught with both social stories and the teaching interaction procedure.

Apollo was a 12-year-old boy who had been diagnosed with autistic disorder. The PPVT-4 placed him in the 47th percentile of receptive language with a standard score of 99 (12 years 1 month age equivalent). He had a WISC-IV IQ score of 80, and a SSRS-P score of 73 (4th percentile of children his age). He attended a general education sixth-grade classroom without supports and had a previous history of being taught with social stories but not with the teaching interaction procedure.

Mickey was a 13-year-old boy who had been independently diagnosed with autistic disorder, attention deficit hyperactivity disorder, and Tourette syndrome. The PPVT-4 placed him in the 73rd percentile of receptive language with a standard score of 109 (14 years 3 months age equivalent). He had a WISC IV IQ score of 82 and a SSRS-P score of 96 (39th percentile of children his age). He attended a general education junior high school (seventh grade) without supports and had a previous history of being taught with social stories but not with the teaching interaction procedure.

Setting

One 45-min session was conducted 3 to 6 days per week, either in a research room at a midwestern university, at the participants' homes (Lang, Apollo, and Mickey), or both (Buddy, Hank, and Nick). All teaching sessions and performance probes were conducted in the same location. Some of the generalization probes were conducted in the same location, and some generalization probes were conducted in other research rooms or in other rooms in the participant's house. The research room at the university was 3 m by 1.5 m and contained a cabinet, two chairs, toys, and a one-way mirror that allowed the participants' parents to observe

Table 1
Skills Taught

Participant	Teaching Interaction Skill 1	Social Story Skill 1	Teaching Interaction Skill 2
Buddy	Losing graciously (3 steps)	Negotiation (4 steps)	On-topic conversation (7 steps)
Hank	Sportsmanship (4 steps)	Losing graciously (3 steps)	Changing the conversation (4 steps)
Nick	Giving compliments (2 steps)	Appropriate greetings (5 steps)	Sportsmanship (4 steps)
Lang	Cheering up a friend (6 steps)	Changing the conversation (4 steps)	Losing graciously (3 steps)
Apollo	Showing appreciation (3 steps)	Negotiation (4 steps)	On topic conversation (3 steps)
Mickey	Reciprocal compliments (5 steps)	Providing assistance (3 steps)	Losing or winning graciously (3 steps)

the research sessions. Sessions at the participants' homes took place in a living room or in a basement. Available items in the participants' homes included a table, chairs, couches, cabinets, and entertainment equipment (e.g., television, video game consoles, DVD player).

Skills Taught

The experimenter used parent answers on the Social Skills Rating Scale (Greshman & Elliot, 1990), informal parental interviews, and direct observation of the participants to identify six social skills to be taught to each participant. Each social skill was divided into smaller steps, including a set of basic skill steps (e.g., face the person, look the person in the eye, have a relaxed body posture, use a neutral voice tone, smile, display no aggression, use no curse or nonsense words, and engage in no crying) and a varying number of skill-specific steps (e.g., providing a negotiation statement). Table 1 provides information on the number of skill-specific steps in each of the social skills taught (contact the first author for a listing of the skill steps).

Following social skill selection, the experimenter then attempted to pair social skills together that had roughly the same number of skill steps, and randomly assigned (by a computer program) the skills either to the teaching interaction procedure or to the social stories procedure. In addition, if a particular social skill was taught to two different participants and the other skills being taught to the two participants were equivalent in number of steps, the particular social skill was taught using the randomly assigned procedure for one

participant and the other procedure for the other participant. Unfortunately, skills taught in the teaching interaction procedure for Buddy and Hank resulted in a greater number of steps. In addition, not all skills were taught with both procedures.

Dependent Measure

The dependent variable was the percentage of skill steps exhibited by the participant during performance probes with the experimenter, generalization probes with other known adults, and generalization probes with peers. Performance probes were conducted during baseline, intervention, and maintenance conditions (described below) to determine mastery of each of the social skills taught. The mastery criterion was defined as the participant displaying 100% of all skill steps correctly during performance probes for three consecutive sessions during intervention. If the participant reached the mastery criterion for one of the two skills, but did not reach mastery criterion for the third skill (e.g., a participant reached mastery criterion for a skill taught with the teaching interaction procedure but did not reach mastery criterion for a skill taught with social stories), teaching continued for the nonmastered skill until at least five additional teaching sessions for that skill and at least a total of 12 performance probes had been completed.

Generalization probes were conducted before, during, and after the intervention (described below). Probes with other adults were conducted to determine whether participants would generalize the social skills to known

Table 1.
(Extended)

Social Story Skill 2	Teaching Interaction Skill 3	Social Story Skill 3
Sportsmanship (4 steps)	Clarifying instructions (7 steps)	Changing the conversation (4 steps)
Showing off work (4 steps)	Interrupting (7 steps)	Cheering up a person (6 steps)
Making empathetic statements (3 steps)	Changing the game (7 steps)	Showing appreciation (3 steps)
Explaining a prior "cool" event (4 steps)	Joining into a game (7 steps)	Interrupting appropriately (7 steps)
Losing or winning graciously (3 steps)	Changing the game (7 steps)	Disagreeing appropriately (6 steps)
Showing interest (7 steps)	Changing the game (7 steps)	On-topic conversation (6 steps)

adults (e.g., parents or research assistants) who had not taught the various social skills. Generalization probes with peers were conducted to determine if participants would generalize social skills to situations during which peers were present.

Design and General Procedure

Design. A parallel treatment design (Gast & Wolery, 1988) was used to evaluate the effectiveness of the two social skills interventions. Differences in effectiveness would be indicated if one of the teaching procedures reliably produced more behavioral change in a shorter time than the other teaching procedure. The study consisted of three phases: an initial baseline, intervention, and maintenance. Due to the nature of the design, during the intervention, some skills were being taught while other skills that had been previously taught were in the maintenance condition, and skills not yet taught were in the baseline condition. Performance and generalization probes took place during baseline, intervention, and following treatment.

Performance probes. During performance probes, the experimenter engaged in a behavior that set the occasion for the participant to display one of the social skills. Multiple exemplars (two or more) were used during performance probes, except for the skills of sportsmanship and cheering up a person. For example, for giving a compliment, the experimenter showed the participant a picture that the experimenter had drawn or a photograph that the experimenter had taken and waited to see if

the participant would respond. After approximately 1 min, the experimenter recorded which steps the participant displayed and which steps the participant did not display. No reinforcement or other consequences were provided during probes.

Generalization probes. Generalization probes with adults were similar to performance probes except that they were conducted with an adult who was not involved in teaching. The adults were instructed to use multiple exemplars (two or more) during generalization probes (except for the skills of sportsmanship and cheering up a person). During generalization probes with adults, there were no consequences for participant performance. Generalization probes with peers were the same as generalization probes with adults, except that peers conducted them. Peers were primed prior to the session on how to conduct probes, and the experimenter remained present during the probes to prompt the peer on when to initiate probes. The peers were instructed to use multiple exemplars (two or more) during generalization probes (except for the skills of sportsmanship and cheering up a person). For Mickey and Apollo, generalization probes with peers were conducted before and after the intervention. For Buddy, Nick, and Lang, these probes were conducted only after the intervention. No generalization probes with peers were implemented for Hank, because his family moved before they could be conducted.

Initial baseline. In the initial baseline, each session began with the experimenter implementing performance probes for each of the six

social skills to be taught. The order of the performance probes was determined randomly ahead of time. The probes were followed by a short 5-min break during which the participant played with toys or other items in the room. After this short break, a research assistant or the participant's parent implemented generalization probes with adults for each of the six social skills. The order was determined randomly ahead of time.

After all six generalization probes with adults had been conducted for Buddy, Hank, Nick, and Lang, the session ended. However, Apollo and Mickey had another 5-min break, during which time they could play with toys or other items in the room. Following this short break, generalization probes were conducted with peers. The order of the generalization probes was determined randomly.

Intervention. Two social skills (one assigned to the teaching interaction procedure and one assigned to social stories) were taught while the other four skills were exposed to either the baseline or maintenance conditions. Each session began with the implementation of performance probes for both social skills that were currently being taught and for some of the other randomly selected social skills that were in either the baseline or maintenance conditions. The order of the performance probes for each skill was determined ahead of time. A 5-min break was provided after all of the performance probes were conducted. Participants were allowed to play with toys or other items during this break. After this break, the experimenter implemented one of the two teaching conditions (i.e., teaching interaction or social stories) followed by another 5-min break. After this break, the experimenter implemented the other teaching condition. The order of the two teaching conditions was selected randomly before each session. Following implementation of both procedures, the session either was terminated or the participant had a 10- to 20-min break, during which he could play with toys or could interact with other people. Next, generalization probes with adults were conducted.

Maintenance. After the participant had reached the mastery criterion for a social skill, performance and generalization probes were periodically conducted during certain sessions. After the participant had reached the mastery criterion for all social skills, all three types of probes were implemented three more times.

Reinforcement procedures. Potentially reinforcing stimuli were selected for each participant prior to beginning the teaching conditions. These potential reinforcers were identified based on interviews with the participants' parents and teachers and observations of participants in their natural setting. Stimuli included tangible reinforcers (e.g., bouncy balls or Whoopie cushions) and privileges (e.g., going outside to play or visiting a professor). A token economy was in place during the teaching conditions (see further description below). Participants did not earn tokens during any of the probe sessions. At the end of each session, participants could exchange tokens (i.e., tickets) for preferred items or activities. Participants could also save tickets across sessions to earn larger reinforcers (e.g., fountain pen or gift card). Reinforcement opportunities were equated so that a participant had the possibility of earning the same amount of tickets for both teaching procedures within a given session. To equate the amount of possible tickets to be provided in the two conditions, we took the total amount of possible tickets that a participant could earn in the social stories procedure (i.e., one ticket per page of the social story and four tickets for the four comprehension questions) and provided the same amount of possible tickets in the teaching interaction procedure.

Teaching Procedure

Teaching interaction procedure. First, the experimenter made a statement (e.g., "Today we are going to talk about saying 'hello.'") and then asked the participant to state the skill to be taught. If the participant accurately labeled the

skill within approximately 10 s of the instruction, positive reinforcement was provided (i.e., tickets and praise [e.g., "Good job dude."]). If the participant did not label the skill correctly or did not respond within 10 s of the instruction, the experimenter provided corrective feedback (e.g., "You need to try." or "That's not it.") and repeated the sequence (i.e., labeling the targeted skill and asking the participant to repeat the skill) until the participant accurately labeled the skill. Next, the experimenter explained why the participant should engage in the behavior (e.g., "If I say 'hello,' my friends might ask me to play."), and asked the participant to state a rationale. The participant was given approximately 10 s to respond to the instruction and received the same consequences as described above. Then, the experimenter described times or situations in which it might be appropriate to display the skill (e.g., "I should say 'hello' when I see a friend for the first time.") and asked the participant to repeat the description. The participant was given approximately 10 s to respond to the instruction and received the same consequences as described above.

After the first teaching session of a new skill, the same procedures were used, except that the experimenter simply asked the question (e.g., "What skill are we going to talk about today?") without providing the model of the correct response. The participant was given 10 s to respond and received positive reinforcement (i.e., tickets and praise) if he responded correctly (e.g., "saying 'hi'"). If the participant did not respond within 10 s or responded inaccurately (e.g., "saying 'bye'"), the experimenter provided corrective feedback (e.g., "That's not it.") and repeated the question. If the participant responded correctly on this remedial instruction, positive reinforcement was provided (i.e., tickets and praise). If the participant responded inaccurately or did not respond within approximately 10 s, the experimenter again provided corrective feedback (e.g., "That's not it.") and repeated the

question. This process continued until the participant stated what skill he was working on. The same procedure was implemented for the participant providing a rationale and a time and place when he should display the desired social skill.

The skill was then divided into its smaller behavioral steps. During the first teaching session of a new skill, the experimenter named the basic skill steps (e.g., face the person, look him in the eyes, smile) and the skill-specific steps and asked the participant to name the steps. If he did not name all of the skill steps, the experimenter restated the step and continued to do so until the participant repeated the step. The same procedure was used to teach the participant to name all of the steps of the social skill. Throughout teaching, the participant received praise and tickets for correct responses. After the first teaching session, the participant was asked to name all of the steps (i.e., basic and skill specific) in the correct order (i.e., basic skill steps followed by skill-specific steps). If the participant correctly labeled all of the skill steps in the correct order, he received praise and tickets. If he did not name a step or named the steps out of order, the experimenter had the participant start over, asked him to state the first step, and gave a verbal prompt (e.g., "The first step was to look at the person in their eyes.").

Next, the experimenter demonstrated the skill steps using either the participant or a research assistant who set the occasion for the skill to be displayed. In this demonstration, the experimenter displayed all of the steps correctly, displayed one or more steps incorrectly, or left some steps out. Steps that the participant had displayed inaccurately or had omitted during the performance probe during that session were the steps that the experimenter displayed incorrectly or left out. If a participant displayed all steps of a skill correctly in the performance probe during that session, the experimenter's subsequent demonstration of the skill was always complete and correct. After the first demonstration, the participant was asked if the

experimenter provided a correct or an incorrect demonstration of the social skill. If he answered correctly, he was given praise and tickets and was asked to name which steps the experimenter had demonstrated correctly and which ones had been demonstrated incorrectly or left out (if applicable). If the participant did not respond accurately, he was given corrective feedback and again was asked to label each of the demonstration steps as correct, incorrect, or not displayed. After feedback, the experimenter demonstrated the social skill for the second time; this time, however, the experimenter always displayed all of the steps correctly and followed the same procedure described above.

Immediately following the experimenter's correct demonstration of the skill, the participant practiced the social skill in role-play situations. The participant was told that it was his turn to practice, and the experimenter engaged in behaviors that set the occasion for the participant to display the social behavior currently being taught. Role-play situations were similar to those in performance probes. If the participant correctly displayed all steps in the skill, he was given praise and tickets. If he incorrectly displayed any steps in the skill or omitted a step, the experimenter named the steps that he had displayed correctly, praised him for displaying them correctly, and named the steps that he displayed incorrectly. Then the role-play was repeated with the same consequences for correct and incorrect performances. If, after two role-play practices, the participant did not perform all skill steps correctly, a third role-play was conducted, and the experimenter vocally prompted (e.g., "Remember to say 'hi.'") the participant throughout the role-play. After the role-play, the participant was given a short break.

Development of social stories. Individual social stories were created for each participant for each social skill taught in this study. All stories had descriptive, perspective, affirmative, and directive sentences in the proportions recommended by Gray (1995). Each social story was in a book format: One sentence was printed at the bottom

of each page, center aligned, in Times New Roman 22-point boldface font with a relevant clip-art picture or cartoon picture (e.g., Felix the Cat smiling) above each sentence in the center of the page. The pages were put into a three-ring binder or were professionally bound.

Implementation of social stories. To start the social story, the participant was asked to sit next to the experimenter and was asked if he was ready to begin the story. When the participant was ready, the experimenter read each page aloud. When the experimenter reached the end of a page, he praised the participant and gave him a ticket if he looked at the book the whole time and did not engage in any problem behavior. If, however, the participant engaged in any problem behavior or did not look at the book, he was given corrective feedback (e.g., "You need to pay attention.") and no ticket.

After the experimenter had read all the pages, he asked the participant comprehension questions to ensure that the participant understood the story. The first question was "What did the book talk about?" If the participant answered the question correctly (e.g., "The book talked about losing graciously."), he was given praise and a ticket. If he answered incorrectly or did not respond, he was given corrective feedback (e.g., "That's not it." or "You need to try.") and the question was repeated. If, on this remedial trial, the participant answered correctly, praise and a ticket were provided. If, however, the participant did not answer correctly on the second try, the experimenter provided corrective feedback and asked the question again. The third time, the experimenter asked the question and immediately vocally prompted the participant to state the correct answer. When the participant stated the correct answer, only praise was provided.

The procedures for the second, third, and fourth comprehension questions were the same as for the first question. The second, third, and fourth comprehension questions were "When should you display the desired social behavior?" "Why should you display the desired social

behavior?," and "What are the steps for the desired social behavior?" The participant received a brief break after answering questions correctly.

Interobserver Agreement and Treatment Fidelity

The experimenter and a research assistant independently recorded participant behaviors (in vivo and from video recordings) during 40% of performance probes (range, 34% to 49% across participants), 46% of generalization probes with other adults (range, 33% to 65% across participants), and 37% (range, 33% to 61% across participants) of generalization probes with peers, across all participants. Interobserver agreement was calculated by totaling the number of times observers agreed on the scoring of each skill step (as correct or incorrect) divided by the total number of agreements and disagreements and multiplying by 100%. Mean percentage agreement was 97% (range, 78% to 100% across all probes and participants) for the performance probes, 97% (range, 77% to 100% across all probes and participants) for the generalization probes with adults, and 97% (range, 83% to 100% across all probes and participants) for the generalization probes with peers.

To assess treatment fidelity, a research assistant recorded from videotape whether experimenter behaviors occurred at the planned times during teaching for 69% of teaching sessions with the teaching interaction procedure and 62% of teaching sessions with social stories. Planned experimenter behaviors during the teaching interaction procedure were (a) labeling and asking the participant to label the behavior; (b) asking the participant to provide a rationale; (c) asking the participant to state when to display the behavior; (d) asking the participant to state each of the behavioral steps; (e) demonstrating the social skill; (f) asking the participant to evaluate the experimenter's demonstration of the social skill; (g) asking the participant to role-play the social skill; (h) providing feedback on the role-play; and (i) providing tickets and

praise for appropriate behavior. Planned experimenter behaviors during social stories were (a) asking the participant to sit by the teacher; (b) reading each of the pages; (c) asking the first, second, third, and fourth comprehension questions; and (d) providing praise and tickets for appropriate behaviors.

The research assistant recorded that the experimenter engaged in the planned teaching behaviors correctly on 100% of the occasions during both the teaching interaction procedure and social stories. A second research assistant independently recorded the experimenter's planned teaching behaviors during the teaching interaction procedure for 44% of videotapes scored by the first observer and during social stories for 41% of videotapes scored by the first observer. Interobserver agreement was calculated by comparing the scoring of each of the planned behaviors by the two observers. The observers agreed on the scoring of planned research behaviors 100% of the instances during the teaching interaction procedure and 99% of the instances during social stories.

RESULTS

Figures 1 through 6 show the participants' performance on skill-specific steps for both performance probes (before and after teaching) and generalization probes with adults. Basic steps common to all social skills taught are not displayed in the figures, because these steps were displayed at high levels for all participants across all skills throughout the duration of the study.

Results indicated that the teaching interaction procedure produced higher levels of skill-specific steps than did social stories. All participants met the mastery criterion for all of the skills taught (a total of 18) using the teaching interaction procedure, whereas participants met the mastery criterion for only 4 of the 18 skills taught with social stories. Buddy met mastery on two of the skills taught using social stories, and Lang and Mickey each met mastery on one of the skills taught using social stories.

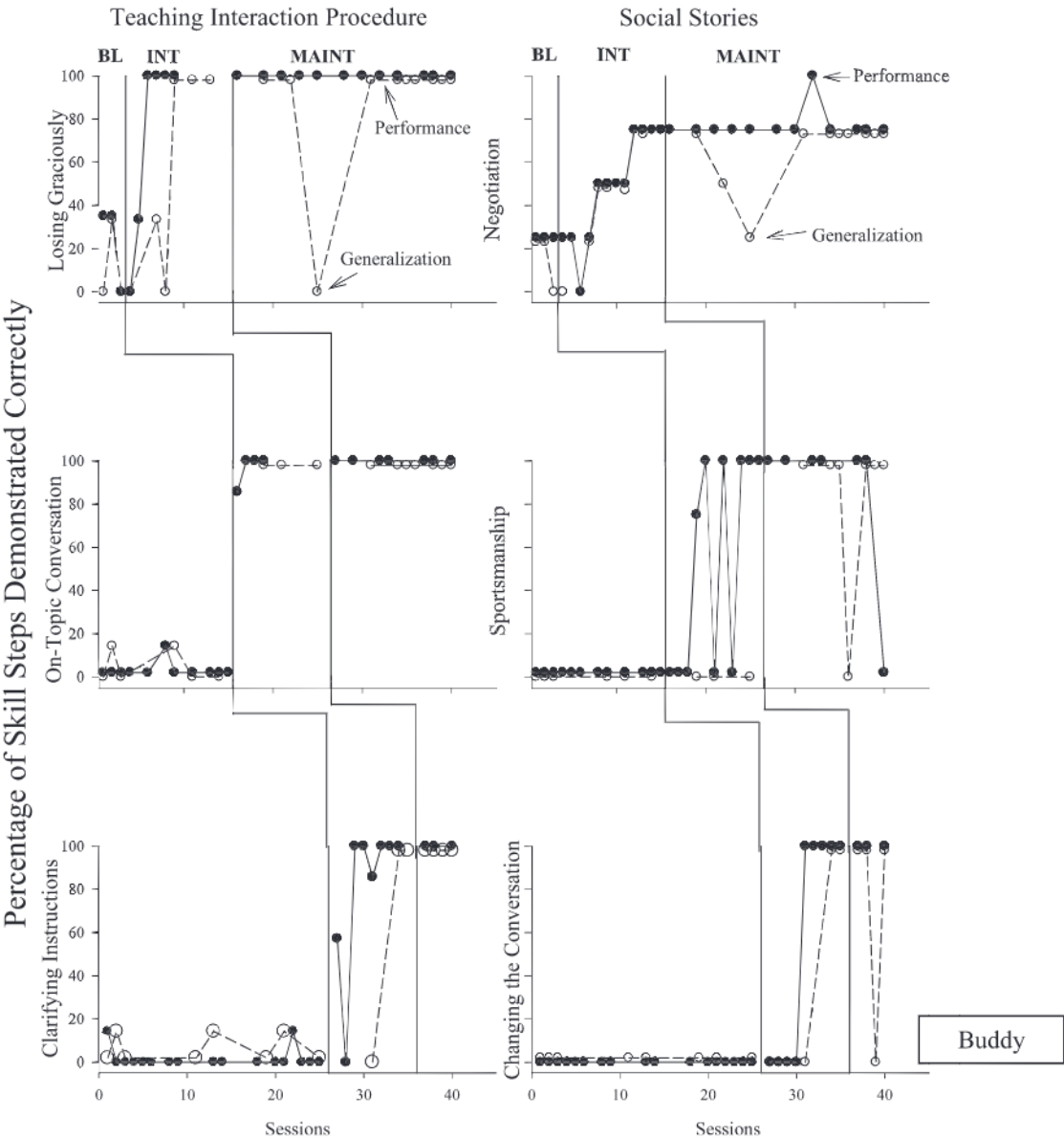


Figure 1. Percentage of skill steps performed correctly for each skill during performance and generalization probes with adults across baseline, teaching and maintenance conditions for Buddy. The skills taught via the teaching interaction procedure are shown in the left panel, and the skills taught via social stories are shown in the right panel. BL = baseline, INT = intervention; MAINT = maintenance.

In general, participants' performance in generalization probes with adults were similar to their performances in performance probes. Across all six participants, skill-specific steps taught with the teaching interaction procedure improved considerably from an average of 5.3% (range,

0% to 33.9% across participants) before teaching to an average of 76.5% (range, 43.6% to 92.2% across participants) across all skill-specific steps after teaching, across all skills taught. Skill-specific steps taught with social stories, on the other hand, did not improve as much, from an average of

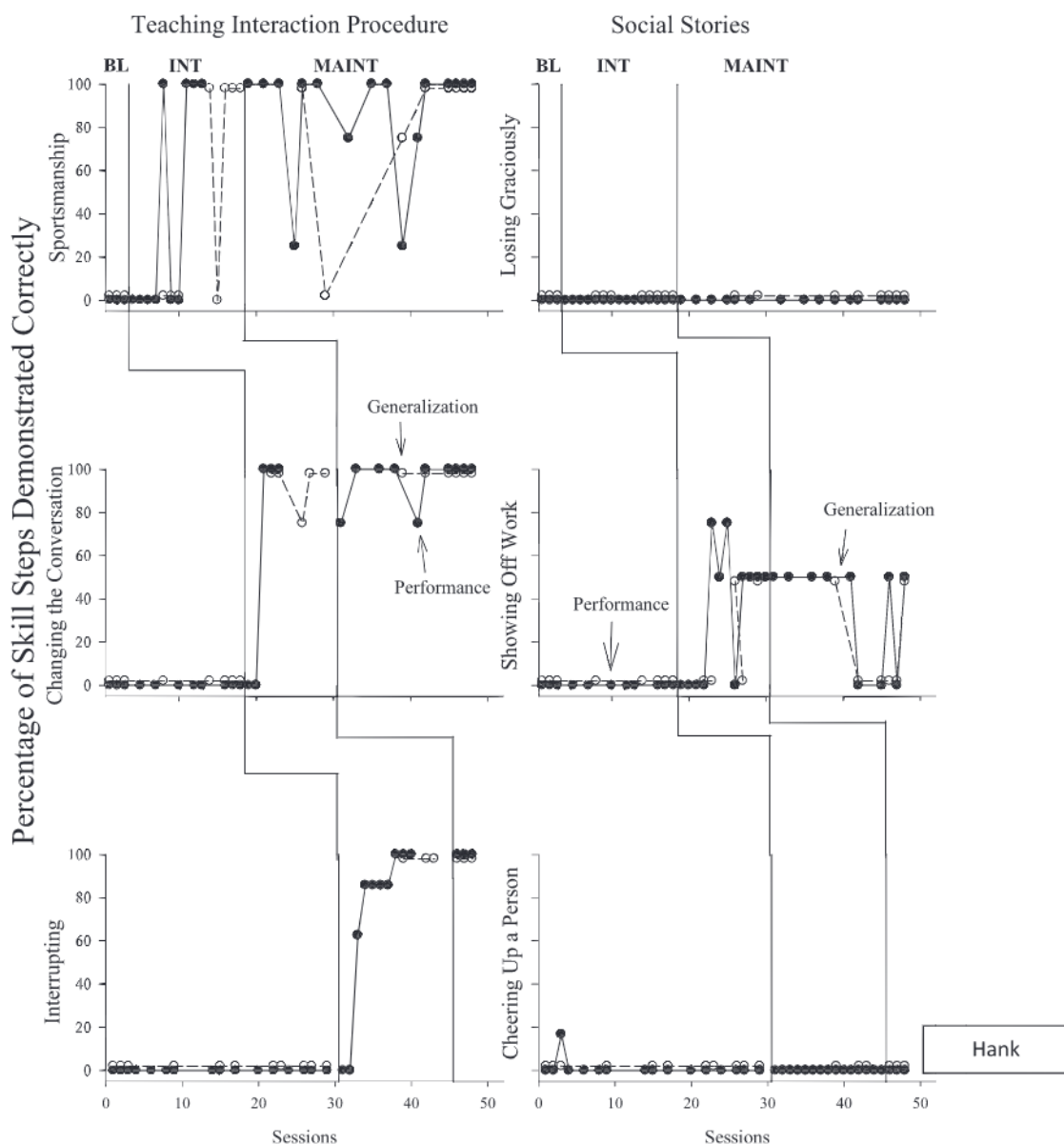


Figure 2. Percentage of skill steps performed correctly for each skill during performance and generalization probes with adults across baseline, teaching, and maintenance conditions for Hank. The skills taught via the teaching interaction procedure are shown in the left panel, and the skills taught via social stories are shown in the right panel. BL = baseline; INT = intervention; MAINT = maintenance.

1.2% (range, 0% to 5.7% across participants) before teaching to an average of 28.7% (range, 4% to 61% across participants) across all skill specific steps after teaching, across all skills taught.

As noted previously, two participants (Apollo and Mickey) were exposed to both pre- and

postintervention generalization probes with peers. Three participants (Buddy, Nick, and Lang) were exposed to only postintervention generalization probes with peers. Both the pre and postintervention probes consisted of three separate occasions during which a peer set the

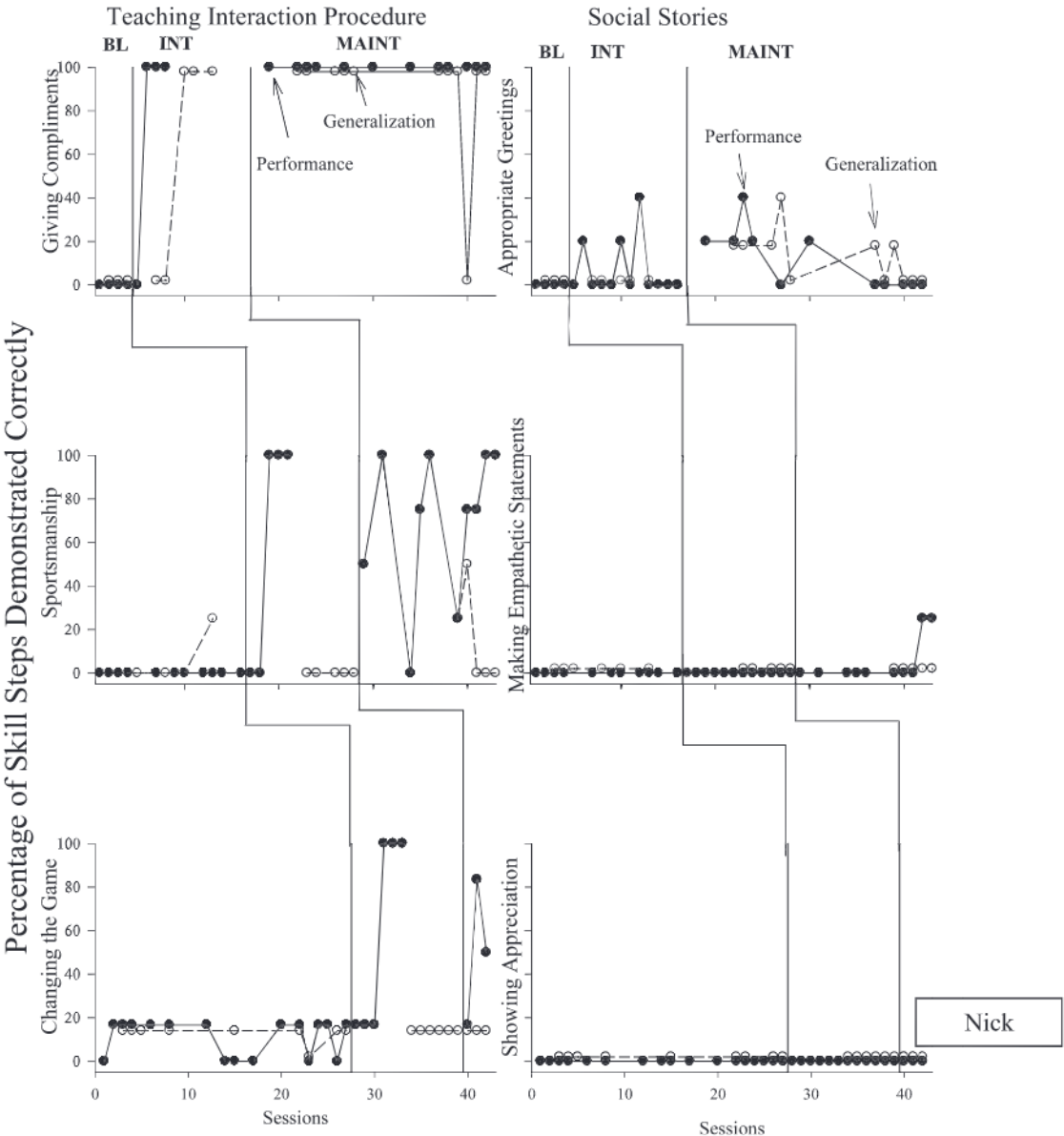


Figure 3. Percentage of skill steps performed correctly for each skill during performance and generalization probes with adults across baseline, teaching and maintenance conditions for Nick. The skills taught via the teaching interaction procedure are shown in the left panel, and the skills taught via social stories are shown in the right panel. BL = baseline; INT = intervention; MAINT = maintenance.

occasion for the participant to display the targeted social skill. Table 2 displays the average percentage of skill-specific steps displayed by participants during the pre- and postintervention generalization probes with peer across the two teaching conditions. Prior to intervention,

Apollo and Mickey displayed low levels of skill-specific steps for skills taught with both the teaching interaction procedure and social stories. After intervention, both Apollo and Mickey displayed higher levels of skill-specific steps for skills taught with the teaching

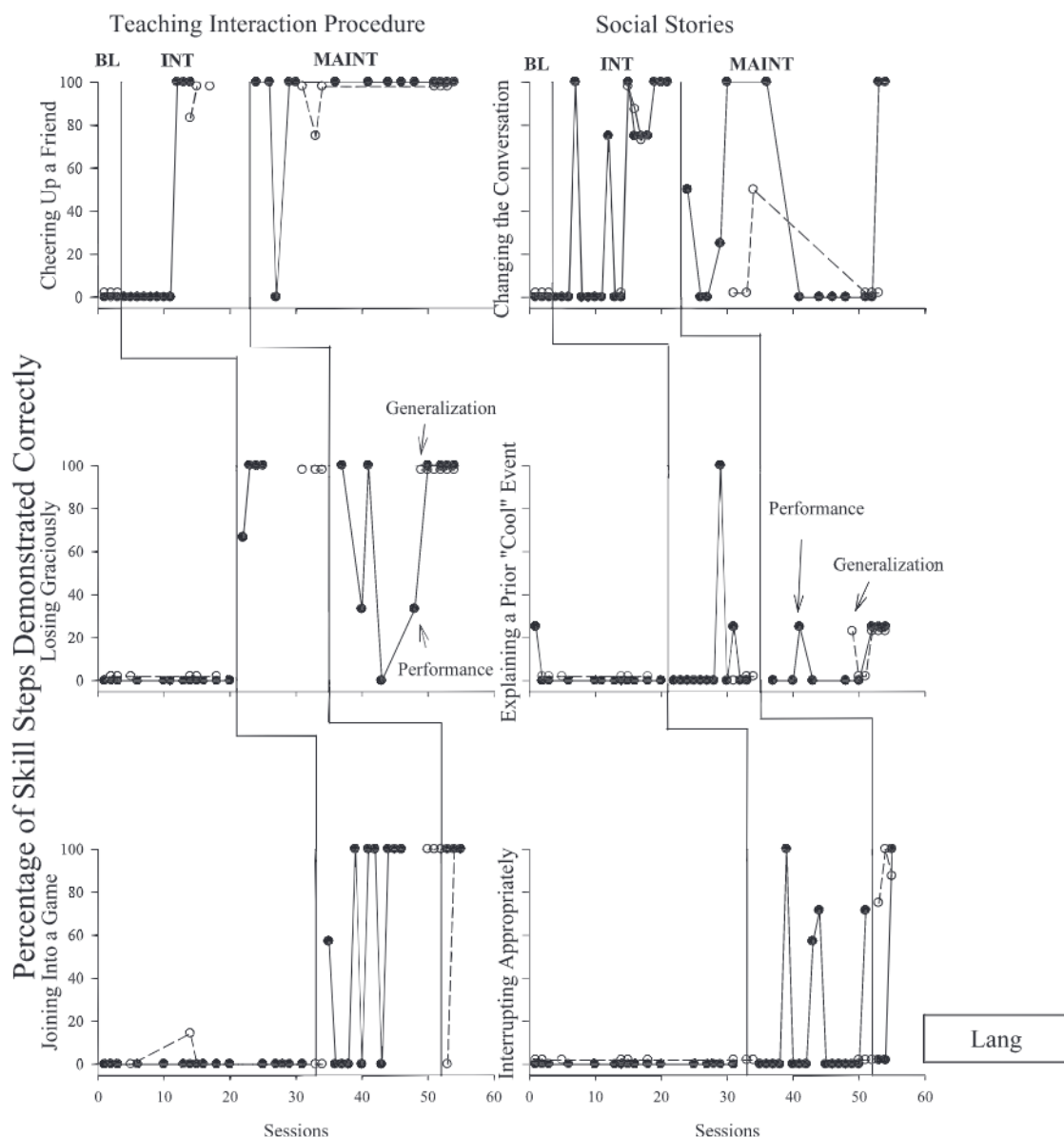


Figure 4. Percentage of skill steps performed correctly for each skill during performance and generalization probes with adults across baseline, teaching, and maintenance conditions for Lang. The skills taught via the teaching interaction procedure are shown in the left panel, and the skills taught via social stories are shown in the right panel. BL = baseline; INT = intervention; MAINT = maintenance.

interaction procedure than for skills taught with social stories. After intervention, Buddy, Nick, and Lang displayed higher levels of skill-specific steps for skills taught with the teaching interaction procedure than social skills taught with social stories.

DISCUSSION

In this study, all participants reached a mastery criterion during performance probes with the experimenter for all 18 of the social skills taught using the teaching interaction procedure. By

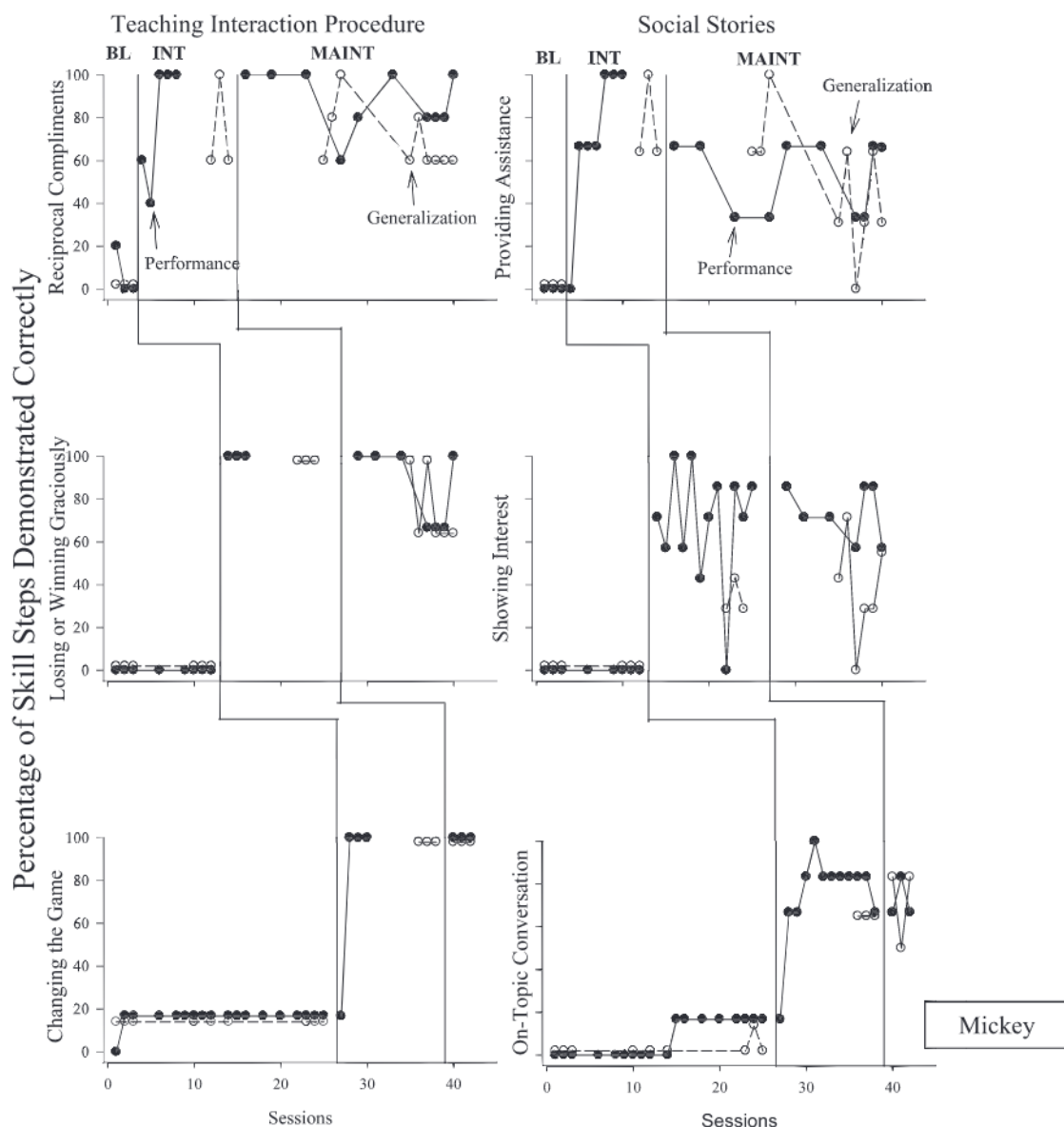


Figure 6. Percentage of skill steps performed correctly for each skill during performance and generalization probes with adults across baseline, teaching and maintenance conditions for Mickey. The skills taught via the teaching interaction procedure are shown in the left panel, and the skills taught via social stories are shown in the right panel. BL = baseline; INT = intervention; MAINT = maintenance.

addition, for several participants, there was substantial generalization of skills from probes with adults to probes with peers (Leaf et al., 2010). Results also are consistent with previous research findings on social stories. In the present study, participants displayed considerable variability in learning new skills using social stories.

In the existing literature, social stories have been associated with slight behavior changes (e.g., Dodd, Hupp, Jewell, & Krohn, 2008) and substantial behavior changes (e.g., Delano & Snell, 2006) across participants and across skills. In the present study, one participant (Buddy) showed substantial improvement on all three of

Table 2
Average Percentage of Skill-Specific Steps Exhibited by Participants Across All Skills During Generalization Probes with Peers

Participant	Teaching interaction procedure preintervention	Teaching interaction procedure postintervention	Social stories preintervention	Social stories postintervention
Budd		100		75
Hank				
Nick		100		0
Lang		95		45
Apollo	10	78	2	10
Mickey	6	88	0	51

the skills taught with social stories almost as quickly as skills taught with the teaching interaction procedure. In contrast, two participants (Hank and Nick) showed little improvement in skills taught with social stories and relatively rapid improvement in skills taught with the teaching interaction procedure.

Although results of this study showed that, for our participants, the teaching interaction procedure resulted in greater learning in a shorter period of time compared to social stories, the reasons for these differences were not determined. It is possible that the timing of probes differentially affected the two procedures. We conducted probes prior to teaching. In contrast, in the majority of studies that have evaluated the effects of social stories, probes were implemented soon after social story teaching (Kokina & Kern, 2010). An additional possibility is that the stringent mastery criterion (three consecutive sessions of displaying 100 % of the skill steps in performance probes with adults) differentially affected the outcomes. In previous research on social stories, the authors looked at trends in the data (e.g., Crozier & Tincani, 2005), had no stated mastery criterion (e.g., Barry & Burlew, 2004), or had a less stringent mastery criterion (e.g., Delano & Snell, 2006). Therefore, it may have been more difficult for participants to meet the mastery criterion in this study than in the previous research with social stories.

We suggest, however, that other factors more likely influenced the outcomes of the present study. One factor was that the procedures

involved in the teaching interaction procedure more closely resembled the probe testing than did the social stories procedure. Perhaps the most important component in the teaching interaction procedure was role playing (rehearsal), in which participants had the opportunity to practice the desired social skills. The probes for learning involved displaying the skill in a similar situation, although in the absence of any explicit prompts or consequences from the researcher. Gray and Garand (1993) recommended the use of role playing with social stories. However, role playing is rarely implemented in the published literature on social stories and was not implemented in the present study.

Role playing has been well established in the research as an important component of teaching children with and without autism a variety of skills other than social skills (e.g., Kifer, Lewis, Green, & Phillips, 1974; Poche, Brouwer, & Swearingen, 1981; Schrandt, Townsend, & Poulson, 2009). Role playing provides opportunities for participants to practice the social skills in conditions similar to those in the natural environment and allows the participants to receive both positive and corrective feedback for practicing the social skills during teaching. Thus, rehearsal and feedback may increase the likelihood of participants learning the social skills and generalizing the learned skills to somewhat different situations.

Another component that has been shown to be effective in teaching children with autism is demonstration (modeling) (e.g., Charlop &

Milstein, 1989; Charlop & Walsh, 1986). Demonstration is an essential component of video modeling (e.g., Charlop & Walsh, 1986), which has been found to be effective in teaching numerous social skills to children with autism. Demonstration also was an essential component of the teaching interaction procedure but was not included with the social stories. Demonstration of the social behavior gives participants opportunities to observe how to perform the desired social skill accurately. Children with ASD may not fully understand the social skills by simply reading or listening to a description of the behavior. Thus, a teacher's demonstration may provide a more complete and clear illustration of the specific steps the participant needs to perform. In addition, the demonstration component of the teaching interaction procedure allows teachers to highlight or emphasize parts of the skill that participants may be struggling with and allows the participants to practice particular parts of a skill that need to be improved.

Results of this study raised several questions that may serve as a basis for future research. First, the teaching interaction procedure consisted of multiple components (e.g., rationales, modeling, and demonstration), and it is not known if all of these components are necessary for increasing social behavior. Component analyses should be conducted to determine which steps are needed and which steps are not needed for producing behavior change.

Second, we implemented the social stories with comprehension checks rather than with role playing. As noted earlier, role playing may be an important component in increasing social behavior. Social stories with role playing could be compared to the teaching interaction procedure to determine if role playing increases the effectiveness of social stories. If the teaching interaction procedure still is more effective than social stories with role playing, then it may indicate the importance of teacher demonstration in increasing social behavior for children and adolescents with autism.

Third, future research could further examine participants' generalization of social skills to their peers. In the present study, we measured generalization of social skills with peers pre- and postintervention for only two participants (Apollo and Mickey). The purpose of teaching social skills to children and adolescents with autism is for them to display these skills with their peers; therefore, future researchers may wish to have demonstration of social skills towards peers as their main measure.

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Received March 15, 2011

Final acceptance December 26, 2011

Action Editor: Joel Ringdahl