

Comparing the Teaching Interaction Procedure to Social Stories: A Replication Study

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Abstract This study compared the teaching interaction procedure to social stories implemented in a group setting to teach social skills to three children diagnosed with autism spectrum disorder. The researchers taught each participant one social skill with the teaching interaction procedure, one social skill with the social story procedure, and one social skill was assigned to a no intervention condition. The teaching interaction procedure consisted of didactic questions, teacher demonstration, and role-play; the social story procedure consisted of reading a book and answering comprehension questions. The researchers measured participants' performances during probes, responses to comprehension questions, and responding during role-plays. The results indicated that the teaching interaction procedure was more efficacious than the social story procedure across all three participants.

Keywords Autism · Behavioral skills training · Social skills · Social skills groups · Social stories · Teaching interaction procedure

Introduction

Children diagnosed with autism spectrum disorder (ASD) display deficits in social behaviors, which can range from rejecting others in his or her environment to a failure to develop meaningful friendships. The lack of social skills

can result in serious negative outcomes, which can include depression (Stewart et al. 2006), problems in school (Ladd et al. 1999), and thoughts or attempts of suicide (Mayes et al. 2013). To help reduce these possible negative side effects and increase pro-social behaviors, a variety of interventions have been implemented to individuals diagnosed with ASD, which include: video modeling (Charlop-Christy et al. 2000), discrete trial teaching (Lovaas 1981), pivotal response training (Stahmer 1995), script fading (Krantz and McClannahan 1993), social skills groups (Barry et al. 2003), and comic strip conversations (Pierson and Glaeser 2007).

Another common procedure used to teach social behaviors to individuals with ASD are social stories (Gray and Garand 1993). A social story is a text that describes a targeted social behavior and consists of at least four sentence types (descriptive, perspective, affirmative, and directive). A social story should be written in the first person, can consist of either pictures or icons, and can include comprehension questions and/or role-plays after the story has been read. The procedure consists of either the teacher or the student reading the story followed by the possible implementation of the teacher asking the student comprehension questions or having the student role-play the targeted social skill. While Gray and Garand (1993) suggested the incorporation of role-plays in the social story procedure, this feature appears to be rarely implemented.

In 1993, Gray and Garand first introduced social stories as a method for teaching a wide variety of skills to individuals with ASD. Researchers have evaluated the procedure to increase statements of appreciation (Delano and Snell 2006); use of social smiles (Scattone 2008); and improving mealtime skills (Bledsoe et al. 2003). Additionally, there have been many articles published on social stories utilizing several presentation variations, including

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the use of pictures or icons (Barry and Burlew 2004), different story layouts (e.g., book format or single page format), role-plays (Thiemann and Goldstein 2001), and comprehension checks (Delano and Snell 2006).

Today, there are several studies that have utilized social stories to teach a variety of behaviors (Barry and Burlew 2004; Delano and Snell 2006; Thiemann and Goldstein 2001). Furthermore, the National Standards Report Project (The National Autism Center 2009) for evidence based practices stated that story based intervention packages is an established procedure. Although there have been several studies that have evaluated social stories and reports stating that social stories are an effective procedure, several studies on social stories consist of methodological flaws (e.g., experimental design, measurement issues, or not fully defined dependent variables), which reduces the ability to claim that social stories are effective in changing a participant's behavior. For example, one common methodological flaw found in the social story literature is participant data trending in the wrong direction during baseline immediately prior to beginning intervention (Adams et al. 2004). When data is trending in the desired direction during baseline, it is not known if the intervention resulted in the subsequent behavior change or if the behavior would have improved by itself. A second common methodological limitation found in the social story literature is social stories being combined with other procedures (e.g., video modeling) (Sansosti and Powell-Smith 2008). When procedures are combined, it makes it difficult to determine which procedure was primarily responsible for behavior change. In addition to these methodological limitations, Kokina and Kern (2010) ran an analysis of the percentage of non-overlapping data (PND) across several variables to determine the overall effectiveness of social stories. Kokina and Kern found that social stories received a mean score of a 60 % PND, which translated into social stories having minimal effectiveness.

Despite the methodological limitations found in the social story literature, and the minimal effectiveness (i.e., low PND score) of the social story procedure (Kokina and Kern 2010), social stories are widely implemented in clinical settings. Reynhout and Carter (2009) surveyed 45 teachers (special education and general education teachers); results indicated that 100 % of the teachers were currently using or had previously used social stories in their classrooms and that 93 % believed that they were an effective intervention.

The teaching interaction procedure is another intervention utilized to teach social skills to individuals diagnosed with ASD (Leaf et al. 2012). The teaching interaction procedure is a systematic and interactive form of intervention that is individualized to the learner and consists of six different components. First, the teacher labels the skill

to be taught to the learner and identifies different situations where the skill should be demonstrated. Second, the teacher and learner develop and discuss meaningful rationales for why the learner should demonstrate the social behavior; these rationales assist the learner in assessing and accessing probable contingencies for engaging in the social behavior within their natural environment. Third, the teacher describes the task analyzed skill steps involved in the target behavior. Fourth, the teacher demonstrates, or models, the social behavior described. Fifth, the learner role-plays the social behavior with the teacher and/or peers. Role-plays simulate as closely as possible the natural situations during which the learner will be expected to utilize the target skill. Finally, the teacher provides the learner with feedback regarding his or her performance during role-plays.

The teaching interaction procedure was first empirically evaluated for juvenile offenders (Phillips et al. 1971, 1974). More recently, the teaching interaction procedure has been empirically evaluated for teaching social behaviors to individuals diagnosed with ASD, including: friendship skills (Leaf et al. 2009), conversational skills (Dotson et al. 2010), game play (Oppenheim-Leaf et al. 2012), and generalization of social skills (Kassardjian et al. 2013). The majority of research on the teaching interaction procedure has been implemented in a one-to-one instructional format. In 2010, Leaf, Dotson, Oppenheim, Sheldon, and Sherman were the first to evaluate the teaching interaction procedure implemented in a group instructional format for young children diagnosed with autism. The teaching interaction procedure was implemented for five children diagnosed with autism, to whom the researchers taught four different social skills (i.e., showing appreciation, giving a compliment, making an empathetic statement, and changing the game when someone was disinterested). Results showed that participants were able to demonstrate the behaviors during role-plays and were able to generalize the skills to more natural probes.

In 2012, Leaf and colleagues were the first to compare the teaching interaction procedure to social stories. This study included six participants, all of whom were diagnosed with ASD. Each participant was taught three skills with the teaching interaction procedure and three skills with social stories; a total of 18 skills were taught with the teaching interaction procedure and 18 skills were taught with social stories. All skills were taught in a one-to-one instructional format. Across all participants, mastery criterion was reached on 100 % of the skills taught with the teaching interaction procedure but only on 22 % of the skills taught with social stories. Although Leaf and colleagues concluded that the teaching interaction procedure was more effective than social stories, they described several limitations and recommendations to be addressed in future research, including: more emphasis on participants

displaying the social behaviors with peers, the effects of the procedures when implemented in a group instructional format, and evaluating participant responding during teaching.

Thus, the purpose of this study was to systematically replicate and expand upon the original Leaf et al. (2012) study. Expansion occurs in three ways: (1) the teaching interaction procedure and social stories were implemented in a group setting; (2) the main dependent variable is the participants' responding in probes with peers; and (3) an analysis of participant responding during teaching across both conditions was conducted.

Method

Participants and Setting

Data for the present study were collected on three children who were participants in a summer program for children with ASD at a private agency. While there were other children in the summer program, the three children included in the present study are the ones whose parents consented to participation in the research, as the other students were participating in other research studies at the time. All participants were 5 years old and independently diagnosed with autistic disorder, based upon DSM-IV R criterion (the current criterion at the time of the study), by a licensed psychologist using standard diagnostic assessments. Brandon had a Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III) FSIQ score of 99, a Vineland Adaptive Behavioral Scale (VABS-II) adaptive behavior composite score of 88, and a Gilliam Autism Rating Scale (GARS-II) autism quotient of 89. Steve had a WPPSI-III FSIQ score of 110, a VABS-II adaptive behavior composite score of 99, and a GARS-II autism quotient of 61. Claire had a WPPSI-III FSIQ score of 100, a VABS-II adaptive behavior composite score of 84, and a GARS-II autism quotient of 61.

A confederate male peer, Dylan, was also utilized in the study to help conduct performance probes (described below). Dylan was 5 years old and typically developing. Dylan participated in the social skills group as a typically developing peer and each of the three participants (i.e., Brandon, Steve, and Claire) had a history of interacting with Dylan.

The research sessions took place as part of a social skills group for individuals diagnosed with ASD. The group included the participants of this study, other children diagnosed with ASD, and typically developing children. The group took place 3 days a week. During each social skills group, the researchers conducted performance probes, the teaching interaction procedure, and a social

story. Research was incorporated as part of the social skills group's daily routine. The three participants of this study and two other students participated in the teaching.

Skills Taught

Three social skills were targeted for intervention and each one was randomly assigned to one of the treatment conditions or the control condition. The social skills were selected based upon interviews with the social skills group leader. The social skill assigned to the teaching interaction procedure was the participant changing the game when his/her peer(s) appeared bored. The social skill assigned to social stories was the participant explaining a prior "cool" event to his/her peers. The social skill assigned to the control condition, which received no intervention, was inviting a peer to join a game. Each skill taught was broken down into individual steps; each skill contained five steps (see Table 1).

General Procedure

There were three phases in the current investigation: baseline, intervention, and maintenance. During the baseline and maintenance phases each research session began with a single performance probe (described below) for the skill taught with the social story procedure, a single performance probe for the skill taught with the teaching interaction procedure, and, on randomly determined days, a single performance probe for the social skill assigned to the control condition. It took approximately 10 min for researchers to complete all performance probes for all three participants.

During the intervention phase each research session began with a single performance probe (described below) for the skill taught with the social story procedure, a single performance probe for the skill taught with the teaching interaction procedure, and, on randomly determined days, a single performance probe for the social skill assigned to the control condition. It took approximately 10 min for researchers to complete all performance probes for all three participants. Following these performance probes the participants were provided with a short break (approximately 5–10 min). Next, the researchers implemented either the teaching interaction procedure or the social story. The procedure that was first presented within each teaching session was randomly determined prior to the session. Following the first teaching condition the participants were provided with another short break (approximately 5–10 min), and then the second teaching condition was implemented. The total teaching time for both procedures was approximately 45 min.

Table 1 Skill steps across the three targeted social skills

Targeted Skill	Condition	Step one	Step two	Step three	Step four	Step five
Changing the game when bored	Teaching interaction procedure	Did the participant ask if the confederate peer wanted to play a different game	When the confederate peer said yes did the participant say okay to changing the game	Did the participant ask what game the confederate peer wanted to play	Did the participant get the game that the confederate peer wanted to play	Did the participant play the game that the confederate peer selected
Explaining a prior "cool" event	Social story	Did the participant approach a peer who did not witness the event	Did the participant face the person he or she approached	Did the participant make a statement to elicit a response (e.g., Guess What I did)?	Did the participant make a statement describing what he or she just did?	Did the participant answer a question that the peer had or moved on to a different topic if no question was asked
Inviting a peer to play	Control	Did the participant turn towards the confederate peer	Did the participant pause playing the game	Did the participant state the confederate peers name	Did the participant make an invitation to the confederate peer to join the game	Did the participant make a statement about the game when the confederate peer started playing

Teaching Interaction Procedure

The teaching interaction procedure conducted in this study contained the six components described above. First, the researcher instructed all participants to sit in a semi-circle. Second, the researcher labeled and identified the skill to be taught and then, in a random sequential order, asked each of the participants to label/identify the skill to be taught. Third, the researcher identified meaningful rationales for the participants and then, in a random sequential order, asked each of the participants to identify a meaningful rationale for why he or she should display the skill. Fourth, the researcher stated each of the five behavioral steps of the skill being taught and randomly selected one of the participants to reiterate each of the skill steps.

Fifth, the researcher demonstrated the social skill in front of the entire group. During the demonstration component, the researcher modeled the skill in its entirety for the participants. During the researcher demonstration the researcher either demonstrated the behavior both incorrectly and correctly or only demonstrated the behavior correctly; this was determined by participant responding during performance probes at the beginning of the session. If any of the participants missed any of the five skill steps during the performance probe at the beginning of that session, the researcher demonstrated the behavior incorrectly. Therefore, incorrect modeling was based upon the participants' performances during probes earlier in the session. Thus, on sessions where at least one participant displayed an incorrect step during performance probes, there was both an incorrect demonstration and a correct demonstration; the order was randomly determined ahead of time. On sessions, however, where all participants

displayed 100 % of the steps during performance probes, only a correct demonstration was provided. The demonstration component also consisted of the researcher asking each member, in a random sequential order, to verbally state whether the demonstration was appropriate or not appropriate and what made the demonstration appropriate or inappropriate.

Sixth, the researcher had each member role-play the behavior with a typically developing peer, who was not the confederate peer, in front of the entire group. The researchers randomly called each of the participants up to the front of the group and had the typically developing peer engage in a behavior that should set the occasion for the participant to display the targeted social behavior. The role-play was similar to the performance probes. Participants had to role-play the behavior until they displayed the skill with 100 % accuracy. Participants had two independent opportunities to role-play the behavior correctly; if the participant had not yet displayed the behavior correctly, the researcher prompted the participant on his third opportunity to role-play the skill. After each role-play opportunity the researcher had the rest of the participants in the group verbally rate the participant's role-play, similar to the teacher demonstration.

Throughout the teaching interaction procedure the researchers provided feedback (sixth component of the teaching interaction procedure) and prompting. The researcher provided feedback (i.e., reinforcement or corrective feedback) after each of the comprehension questions (e.g., labeling/identifying, rationale, skill steps, and rating of the researcher demonstration) and role-play components; the researcher provided the participant with a ticket and general social praise for correct responding or correct role-playing. If the participant responded incorrectly or role-

played the behavior incorrectly, the researcher provided corrective feedback (e.g., “That’s not it”) followed by informative feedback (e.g., providing the correct answer). Additionally, the researcher provided intermittent social praise and tickets (see below) throughout the teaching contingent on participants attending during the teaching interaction procedure. The researcher provided this intermittent reinforcement approximately after every other step of the teaching interaction. Finally, the researchers utilized a flexible prompt fading procedure (Soluaga et al. 2008) during comprehension questions. The flexible prompt fading procedure consisted of the researcher making in the moment assessments of whether to prompt or not to prompt and which prompt to provide. The goal of the flexible prompt fading procedure was to keep participant responding above 80 % correct (prompted or unprompted). After the first teaching session, the same procedures were used except that the experimenter simply asked the questions (e.g., “What skill are we going to talk about today?”) without providing the preceding model of the correct response.

Social Story

Social Story Development

The researcher created an individualized social story (contact author for actual social story) for the entire group (as opposed to a story from a curriculum book). All stories had descriptive, perspective, affirmative, and directive sentences. The ratio of sentences was two to four perspective, affirmative, or descriptive sentences for every one directive sentence, as specified by Gray (1994). The social story was written in a book format, using first-person language, and each page consisted of a picture or icon in the center of a page and a single sentence placed on the bottom of the page. These guidelines were the most consistent with the implementation of social stories in the empirical research during the time of the study.

Social Story Implementation

The social story procedure started with the researcher instructing the participants and other members of the social skills group to sit in a semi-circle. When the participants were ready, the researcher read each page aloud to the group. The researcher provided social praise and tickets on an intermittent schedule of reinforcement contingent upon participant attending. This intermittent schedule was provided approximately after every two pages were read. If, however, at any moment a participant engaged in any aberrant behavior or did not look at the book, the experimenter gave corrective feedback (e.g., “You need to pay attention.”) to that participant. Once the researcher read all of the pages in

the social story book, four comprehension questions were asked. The comprehension questions were: (1) “What was the book about?”; (2) “When can you display the skill?”; (3) “Where can you display the skill?”; and (4) “Why should you display the skill?” The researchers asked the participants to verbally answer the questions in a random sequential order. If the participant responded correctly, then the researcher provided a ticket and general praise to the participant. If the participant responded incorrectly, the teacher provided corrective and informative feedback. The researcher utilized a flexible prompt fading procedure (described above) throughout the comprehension questions.

Reinforcement

A token economy (Ayllon and Azrin 1968) was implemented throughout intervention across both teaching conditions. The participants received tickets for attending, participating, and answering questions correctly across both teaching conditions, and for role-playing the social skill correctly during the teaching interaction procedure. Participants received tickets both during teaching and throughout the entire social skills group. Participants could exchange tickets for tangible items at the end of each social skills group. The reinforcement was yoked across the two conditions so that the participants had a chance to receive (e.g., dependent upon their correct behaviors) the same amount of reinforcement across the two conditions.

Performance Probes

During each research session the researcher implemented a performance probe for the skill taught with the teaching interaction procedure and a performance probe for the skill taught with social stories. During some research sessions an additional performance probe was implemented for the skill assigned to the control condition. Thus, either two or three performance probes were implemented at the start of each social skills group. Participants had only one opportunity to display the behavior correctly during each of the performance probes. The three performance probes were conducted within the context of the social skills group. The researcher did not prime, prompt, or reinforce the participant during the performance probes.

For the skill of changing the game when bored (taught with the teaching interaction procedure), the performance probe began with the participant and the confederate peer playing a structured game (e.g., UNO, Candyland, Connect Four). At some point, the researcher indicated to the confederate peer (e.g., wink at the confederate peer) to look bored (e.g., looking away, responding slower in the game, or sighing). This served as the discriminative stimulus for the participant to change the game, as the peer appeared bored.

The participant was never aware of the signal to the confederate peer.

For the skill of explaining a prior cool event (taught with social stories), the researcher pulled the participant from the social skills group and engaged in an exciting and unusual activity (i.e., throwing water balloons, setting off a car alarm, or playing an IPAD game), which was not part of the participant's daily routine. Next, the teacher returned the participant back to the social skills group and told them to go hang out with their friends. The discriminative stimulus for the participant to engage in the skill was the participant returning to the group following this "cool" event. No confederate peer was utilized during this probe.

For the skill of inviting a peer to join the game, the participant and another peer in the group played a structured game; the discriminative stimulus for the participant to engage in the skill was the confederate peer walking over and sitting in proximity (e.g., two feet) of the game and looking at the game. The researcher informed the confederate peer of when to walk over and the participant was never aware of the signal given to the confederate peer.

A confederate peer was utilized for two of the skills (i.e., changing the game when bored and inviting a peer into the game). Prior to baseline, the confederate peer and two of the researchers role-played both of the skills. Role-plays continued until the confederate peer was able to complete the performance probe accurately across two consecutive role-plays. Prior to each research session, the researcher reminded the confederate peer of his job during the performance probe.

Dependent Variable

The first dependent variable was participants reaching mastery criterion for the targeted social skills. Mastery criterion was defined as the participant displaying 100 % of all of the skill steps across three consecutive performance probes (i.e., across three consecutive sessions). Performance probes were conducted throughout all conditions of the study. Once a participant reached mastery criterion, the researcher no longer implemented performance probes for that skill nor was the participant involved in teaching for that social skill. Instead, the participant engaged in a different activity (e.g., another teaching activity as part of the social skills group). If a participant reached mastery criterion for the skill taught with one teaching procedure but did not reach mastery criterion for the skill taught with the second teaching procedure, three additional sessions were conducted to determine if the other skill would reach mastery. The second dependent variable was participants' maintenance of skills taught to them. The researchers utilized performance probes to determine maintenance for all participants.

The third dependent variable was participant responding to questions asked during the teaching interaction procedure. The questions were: (a) What is the skill being worked upon?; (b) What is a meaningful rationale of why the student should display the skill?; (c) What is a step of the targeted skill?; (d) Was the teacher demonstration appropriate or inappropriate?; and (e) Why was the teacher demonstration appropriate or inappropriate? These questions were asked and answered in the context of the teaching interaction procedure and were asked in a sequential order within the context of the group instruction. The purpose of this measure was to assess if the participants were able to comprehend the didactic portion of the teaching interaction procedure. All responses to these questions were done in front of the entire group, which could possibly lead to one participant copying the answer from another participant and slightly inflated scores.

The fourth dependent variable was participant correct responding to comprehension questions at the end of the social story. The comprehension questions included: (a) What did the social story talk about?; (b) Why is it important to display the skill described in the story?; (c) When can you display the skill described in the story?; and (e) Where can you display the skill described in the story? These questions were asked and answered once all of the pages of the social story had been read and were asked in a sequential order within the context of the group instruction. The purpose of this measure was to assess if the participants were able to comprehend the social story. All responses to these questions were done in front of the entire group, which could possibly lead to one participant copying the answer from another participant and slightly inflated scores.

The final dependent variable was if the participants were able to display all of the steps correctly of the targeted social behavior during the role-play component of the teaching interaction procedure. Only participant performance on the first opportunity to role-play was scored. This measure was taken during the teaching interaction procedure and was implemented in a sequential order within the context of the group instruction. Participants did receive reinforcement and feedback based upon their role-play (see above).

Experimental Design

An adapted alternating treatment design was used to evaluate the effectiveness of the two social skills interventions. Differences in the effectiveness of the two procedures are indicated if one of the teaching procedures reliably produces more behavioral change in a shorter time than the other teaching procedure.

IOA and Treatment Fidelity

For the primary dependent variable (performance during probes) and second dependent variable (maintenance), IOA was collected during 51.5 % of probe sessions for the skill of changing the game when a peer is bored, 44.8 % of probe sessions for the skill of explaining a cool event, and 40 % of probe sessions for the skill of inviting a peer to play. 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. Across the three participants, interobserver reliability was 98.7 % for the skill of changing the game when a peer is bored, 100 % for the skill of explaining a cool event, and 98.3 % for the skill of inviting a peer to play.

For the third and fifth dependent variables (answering questions during the teaching interaction procedure and participant role-plays during the teaching interaction procedure), IOA was collected during 37.5 % of teaching interaction sessions. For answering questions, IOA was calculated by totaling the number of times observers agreed on the scoring of the participant's answers to comprehension questions divided by the total number of agreements and disagreements. IOA for role-play was calculated similar to IOA during performance probes. Across all three participants, IOA was 100 % for both answering questions and role-plays as part of the teaching interaction procedure.

For the fourth dependent variable (comprehension questions after the social story), IOA was calculated during 36.3 % of social story sessions. IOA for comprehension questions was calculated similar to IOA for answering questions during the teaching interaction procedure. IOA was 100 % for comprehension questions as part of the social story procedure.

To assess treatment fidelity, a research assistant recorded in vivo whether instructor behaviors occurred at the planned times during teaching for 100 % of teaching sessions with the teaching interaction procedure and social stories. Planned teacher behaviors during the teaching interaction procedure were: (a) the teacher labeling and identifying the behavior and having each participant label and identify the behavior; (b) the teacher providing a rationale and having each participant provide a rationale; (c) the teacher having each participant label at least one step of the targeted behavior; (d) the teacher conducting discrimination training; (e) the teacher demonstrating the entire behavior; (f) the teacher having each participant rate the discrimination and demonstration; (g) the teacher having each participant role-play the behavior; and (h) the teacher providing reinforcement throughout the session. Planned instructor behaviors during social stories were: (a) the teacher reading all of the pages of the social story;

(b) the teacher asking each of the four comprehension questions to each participant; and (c) the teacher providing reinforcement throughout. Treatment fidelity was 100 % for both treatment conditions.

Results

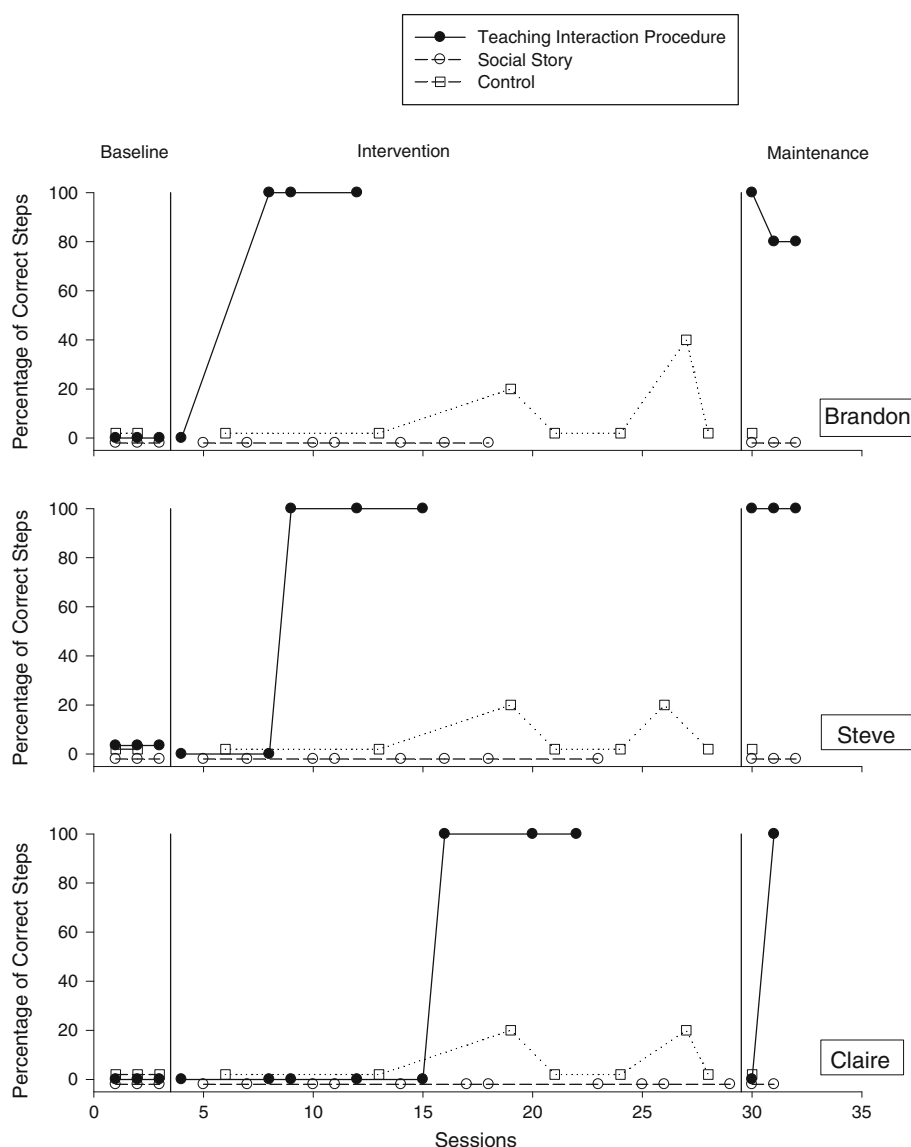
Skill Acquisition

Figure 1 displays each of the three participant's data for performance probes. The top panel represents data for Brandon, the middle panel represents data for Steve, and the bottom panel represents data for Claire. The x-axis represents the different performance probes and the y-axis represents the percentage of skill steps displayed correctly. There are three phases on each of the panels, which represent data taken during baseline, data taken during intervention, and data taken during maintenance. The closed circles with a solid line represent participant responding during performance probes for the social skill taught with the teaching interaction procedure. The open circles with a dashed line represent participant responding during performance probes for the social skill taught with social stories. The open squares with a dotted line represent participant responding during performance probes for the social skill assigned to the control condition. The data points across the three conditions (i.e., the teaching interaction procedure, social stories, and control) alternate to represent the order of teaching for that research session.

The top panel represents Brandon's performance across the two teaching conditions and the skill assigned to the control condition. During baseline, Brandon demonstrated 0 % correct responding for all three targeted social skills. Once intervention was implemented, Brandon reached mastery criterion (i.e., 100 % correct responding for three consecutive performance probes) within four performance probes for the skill assigned to the teaching interaction condition. Brandon displayed 0 % of the skill steps across all seven of the performance probes for the skill assigned to the social story condition. Throughout intervention, there were a total of seven performance probes for the skill assigned to the control condition; Brandon displayed between 0 and 40 % of skills steps during these performance probes. Thus, the results show that Brandon was able to reach mastery criterion for the social skill taught with the teaching interaction and showed no improvement for the skill taught with social stories; furthermore, Brandon showed greater improvement during performance probes for the skill that was not taught as compared to the skill that was taught with social stories.

The middle panel represents Steve's performance across the two teaching conditions and the skill assigned to the

Fig. 1 Performance during performance probes



control condition. During baseline, Steve demonstrated 0 % correct responding for all three targeted social skills. Once intervention was implemented, Steve reached mastery criterion (i.e., 100 % correct responding for three consecutive performance probes) within five performance probes for the skill assigned to the teaching interaction condition. Steve displayed 0 % of the skill steps across all eight of the performance probes for the skill assigned to the social story condition. Throughout intervention, there were a total of seven performance probes for the skill assigned to the control condition; Steve displayed between 0 and 20 % of skill steps during these performance probes. Thus, the results show that Steve was able to reach mastery criterion for the social skill taught with the teaching interaction procedure and showed no improvement for the skill taught with social stories; furthermore, Steve showed greater improvement during performance probes for the skill that

was not taught as compared to the skill that was taught with social stories.

The bottom panel represents Claire’s performance across the two teaching conditions and the skill assigned to the control condition. During baseline, Claire demonstrated 0 % correct responding across all three targeted social skills. Once intervention was implemented, Claire reached mastery criterion (i.e., 100 % correct responding for three consecutive performance probes) within eight performance probes for the skill assigned to the teaching interaction condition. Claire displayed 0 % of the skill steps across all 11 of the performance probes for the skill assigned to the social story condition. Throughout intervention, there were a total of seven performance probes for the skill assigned to the control condition; Claire displayed between 0 and 20 % of skill steps during these performance probes. Thus, the results show that Claire was able to reach mastery criterion

for the social skill taught with the teaching interaction procedure and showed no improvement for the skill taught with social stories; furthermore, Claire showed greater improvement during performance probes for the skill that was not taught as compared to the skill that was taught with social stories.

Thus, the results on our primary dependent variable (responding during performance probes) indicated that all three participants reached mastery criterion for the skill taught with the teaching interaction procedure. Even with more teaching and more performance probes, participants were unable to demonstrate any improvement from baseline levels on skills taught with social stories. Finally, participants were able to demonstrate higher levels of responding during performance probes for the skill assigned to the control condition as compared to the skill taught with social stories. However, participant responding was significantly less on performance probes for the skill assigned to the control condition as opposed to the skill assigned to the teaching interaction condition.

Maintenance

Figure 1 also displays the maintenance results for all three participants (i.e., the last phase change on each of the three panels). Both Brandon and Steve had three performance probes in the maintenance phase for skills taught with the teaching interaction procedure and skills taught with social stories. Claire had two performance probes in the maintenance phase for skills taught with the teaching interaction procedure and skills taught with social stories. All three participants had one performance probe for the skill assigned to the control condition, during which all three participants displayed 0 % of the skill steps.

We assessed Brandon's maintenance for skills taught with the teaching interaction procedure 56, 106, and 107 days after he reached mastery criterion. During the first probe, Brandon displayed 100 % of the skill steps; during the second and third performance probes, Brandon displayed 80 % of the skill steps. Thus, he was able to show high levels of long term maintenance for the skill taught with the teaching interaction procedure. We assessed Brandon's maintenance for skills taught with social stories 49, 99, and 100 days after teaching was terminated (due the fact that no improvement was displayed); Brandon displayed 0 % of the skill steps on all three performance probes.

We assessed Steve's maintenance for skills taught with the teaching interaction procedure 55, 105, and 109 days after he reached mastery criterion; Steve displayed 100 % of the skill steps across all three performance probes. We assessed Brandon's maintenance for skills taught with social stories 47, 97, and 99 days after teaching was terminated (due the fact that no improvement was displayed);

Steve displayed 0 % of the skill steps on all three performance probes.

We assessed Claire's maintenance for skills taught with the teaching interaction procedure 47 and 97 days after she reached mastery criterion. On the first performance probe, Claire displayed 0 % of the skill steps, which was due to Claire not attending to the game; on the second performance probe, Claire displayed 100 % of the skill steps. Thus, when Claire was attending, she displayed the skill correctly. We assessed Claire's maintenance for skills taught with social stories 41 and 91 days after teaching was terminated (due the fact that no improvement was displayed); Claire displayed 0 % of the skill steps on all three performance probes.

Responding During Teaching

Across all participants, the overall percentage of correct responding to comprehension questions on the first opportunity was above 80 % for both teaching conditions. Brandon's overall correct responding to questions asked during the teaching interaction procedure and the social story procedure was 83 and 91 %, respectively. Steve's overall correct responding to questions asked during the teaching interaction procedure and the social story procedure was 96 and 86 %, respectively. Claire's overall correct responding for questions asked during the teaching interaction procedure and the social story procedure was 87 and 80 %, respectively. Thus, the participants responded correctly during a high percentage of opportunities, thereby indicating that they understood that exhibiting the target skills was desirable and the reasons why it was considered important.

Performance During Role-Plays

The final component of the teaching interaction procedure was the participant role-playing the skill with a teacher. We evaluated the percentage of opportunities that each participant correctly and independently displayed the skill during their first role-play of each of the teaching sessions. Across all teaching interaction procedure sessions, Brandon role-played the skill correctly during 100 % of sessions, Steve role-played the skill correctly during 80 % of sessions, and Claire role-played the skill correctly during 50 % of sessions. Thus, there was considerable variability in correct responding across the three participants.

Discussion

This study attempted to replicate a study conducted by Leaf et al. (2012) by comparing the teaching interaction

procedure to social stories for teaching social skills to individuals diagnosed with autism. The results of this study were similar to the results found by Leaf et al. (2012); participants reached mastery criterion on 100 % of skills taught with the teaching interaction procedure and demonstrated little to no improvement on skills taught with social stories. Furthermore, participants were able to maintain the skills taught with the teaching interaction procedure up to 100 days after teaching had ended. However, the current study expands on the study conducted by Leaf et al. (2012) in three ways.

First, the teaching conducted in the current study was provided within a group instructional format. The ability to teach social skills within a group not only increases the efficiency of a teaching procedure, but also allows teachers to utilize peers in the teaching itself (i.e., in the role-play component of the teaching interaction). Using peers during the practice of a social skill greatly enhances the naturalness of teaching, better simulating a generalized situation.

Secondly, the current study collected data on accuracy of responses to comprehension questions during teaching. In both conditions, participants showed high accuracy in answering comprehension questions. However, the data demonstrates that, for the social story procedure, although the participants in this study were able to accurately identify the social skill they were being taught and the reasons why it was important to engage in the skill, this knowledge did not result in the participants demonstrating the skill during naturalistic social situations (probes). This is particularly noteworthy, as one considers that social stories are designed to change social cognition as a means to impact social competencies. The implementation of social stories resulted in the same skill acquisition rate as a skill assigned to a control condition, which received no teaching.

Third, the current study evaluated each participant's ability to demonstrate the targeted social behaviors with peers; in Leaf et al. 2012, the primary measure was participant demonstration of social behaviors with adults. This addition is important, as the primary purpose of teaching social behavior is for the participants to display the behavior with people of their own age.

The results of this study have important clinical significance for professionals who work with individuals with autism and for parents who have a child diagnosed with autism. First, this study further demonstrates that the teaching interaction procedure is more efficacious than social stories. Additionally, this study showed that participants were unable to improve their social behavior from baseline levels when the skill was taught with social stories, and that participants showed slightly higher levels of responding during performance probes for skills that received no intervention. Given the results of this study, the

results of previous research that has compared social stories to the teaching interaction procedure (Leaf et al. 2012), and previous reviews on the minimal effectiveness of social stories (e.g., Kokina and Kern 2010), it may not be recommended that clinicians use the social stories procedure. One of the hallmarks of applied behavior analysis is to use data on effectiveness to guide choice of intervention strategies (Baer et al. 1968). Given this and the previous research, social stories may not be an effective strategy and may not be the most efficient manner to teach social behaviors to individuals with autism. Clinicians and parents should look for procedures that are both effective and efficient to address the numerous social deficits that an individual diagnosed with autism might face, as to not waste valuable intervention time.

Second, the study shows that the teaching interaction procedure can be an effective method for teaching social behavior to individuals diagnosed with autism. The teaching interaction procedure has been implemented for over 40 years for individuals other than those diagnosed with autism (Phillips et al. 1971); however, it is only within the past 5 years (Leaf et al. 2009) that researchers have demonstrated it to be effective for individuals diagnosed with autism. Thus, this research provides more empirical support to its effectiveness and provides teachers, parents, and clinicians with an effective strategy to teach social skills, which can possibly increase the overall quality of life for individuals diagnosed with autism.

Third, this study demonstrated that the teaching interaction procedure is an effective strategy when implemented in a group instructional format. To date, only one study (i.e., Leaf et al. 2010) has demonstrated that the teaching interaction procedure is effective in a group instructional format for young children diagnosed with autism. This is important, as group instruction has many possible benefits for individuals diagnosed with autism, which include: (a) learning observationally from peers; (b) being in closer proximity to their peers; (c) fading the intrusiveness of discrete trial; and (d) closer resembling interventions commonly found in schools. Thus, identifying interventions where children can be successful and learn in a group instructional format may be very beneficial for individuals diagnosed with autism.

This study is not without its limitations. First, all participants had an extensive previous history with the teaching interaction procedure and a relatively limited previous history with social stories. Thus, it is difficult to determine if this previous history could have influenced the results of the current investigation. Future research should evaluate the two procedures with individuals with limited history across both conditions. Second, the teachers in this study also had an extensive previous history with the teaching interaction procedure and a limited previous history with social stories.

Therefore, the teachers may have been more skilled in implementing the teaching interaction procedure as compared to social stories. It should, however, be noted that their experience with and training in social stories was comparable to what is typically found in classrooms and other community settings. Future researchers should nonetheless evaluate the two procedures with teachers who are experienced in both procedures.

A third limitation of the study was that the researchers implemented social stories based on the guidelines that were most commonly found in the research at the time of the study. Gray, however, has updated her guidelines on several occasions; it is not known if social stories would have been more effective using different guidelines. It should be noted that there has been no research that has shown one set of guidelines to be more efficacious than others. Along these lines, no role-plays were implemented as part of social stories; therefore, it is not known if adding a role-play component would increase the participants' responding during performance probes.

Fourth, the study evaluated a limited number of participants on a limited number of skills utilizing a single subject design. With only evaluating three skills it is difficult to know if the results are idiosyncratic to those specific skills and how participants would do on other skills taught with either the teaching interaction procedure or with social stories. Therefore, future researchers should evaluate the two procedures utilizing a group design and teaching different social skills. Another limitation is that both interventions contained reinforcement and the researchers did not control for possible observational effects. Therefore, it is possible that the participants could have increased their behaviors with the addition of reinforcement alone or that observational learning could have contributed to skill acquisition.

A final limitation of this study is the type of skills evaluated across the two teaching conditions and the control condition. The skill of changing a game when bored (taught with the teaching interaction procedure) and inviting a peer to play (control target) differed in two ways from the skill of explaining a prior "cool" event (taught with social stories). First, the skill taught with the teaching interaction procedure and the skill assigned to the control condition consisted of using a confederate peer, where the skill assigned to social stories did not consist of any single confederate peer. This could have resulted in a clearer discriminative stimulus for the participant to engage in the appropriate behavior during performance probes than for the skill assigned to the social story procedure. Second, the skill taught with the teaching interaction procedure and the skill assigned to the control condition could be considered a mand, where the skill assigned to the social story could be considered a tact. This may have resulted in the skill

assigned to the teaching interaction procedure not being as difficult as the skill assigned to the social story. In the future, researchers should ensure that the social skills are near equivalent in difficulty and that they are as similar as possible during probes.

Despite these limitations, the current investigation found that the teaching interaction procedure was more efficacious than social stories in teaching social skills to three individuals diagnosed with ASD. Therefore, this study was able to replicate and expand on the work conducted by Leaf et al. (2012). The research was also able to demonstrate that the social story intervention was not effective for the three participants in this study. Future researchers should continue to compare other commonly implemented social interventions (e.g., video modeling, script fading, Superhero intervention) to find the most efficacious procedures.

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References

- Adams, L., Gouvousis, A., VanLue, M., & Waldron, C. (2004). Social story intervention: Improving communication skills in a child with an autism spectrum disorder. *Focus on Autism and Other Developmental Disabilities, 19*, 87–94.
- Ayllon, T., & Azrin, N. (1968). *The token economy: A motivational system for therapy and rehabilitation*. East Norwalk, CT: Appleton-Century-Crofts.
- Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1*, 91–97.
- Barry, L. M., & Burlew, S. B. (2004). Using social stories to teach choice and play skills to children with autism. *Focus on Autism and Other Developmental Disabilities, 19*, 45–51.
- Barry, T. D., Klinger, L. G., Lee, J. M., Palardy, N., Gilmore, T., & Bodin, S. D. (2003). Examining the effectiveness of an outpatient clinic-based social skills group for high-functioning children with autism. *Journal of Autism and Developmental Disorders, 33*, 685–701.
- Bledsoe, R., Smith-Myles, B., & Simpson, R. L. (2003). Use of a social story intervention to improve mealtime skills of an adolescent with Asperger syndrome. *Autism, 7*, 289–295.
- Charlop-Christy, M. H., Le, L., & Freeman, K. A. (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *Journal of Autism and Developmental Disorders, 30*, 537–552.
- Delano, M., & Snell, M. E. (2006). The effects of social stories on the social engagement of children with autism. *Journal of Positive Behavior Interventions, 8*, 29–42.
- Dotson, W. H., Leaf, J. B., Sheldon, J. B., & Sherman, J. A. (2010). Group teaching of conversational skills to adolescents on the autism spectrum. *Research in Autism Spectrum Disorders, 4*, 199–209.
- Gray, C. (1994). *Writing social stories with Carol Gray*. Arlington, TX: Future Horizons.

- Gray, C. A., & Garand, J. D. (1993). Social stories: Improving responses of students with autism with accurate social information. *Focus on Autistic Behavior*, 8, 1–10.
- Kassardjian, A., Taubman, M., Rudrud, E., Leaf, J. B., Edwards, A., McEachin, J., et al. (2013). Utilizing teaching interactions to facilitate social skills in the natural environment. *Education and Training in Autism and Developmental Disabilities*, 48, 245–257.
- Kokina, A., & Kern, L. (2010). Social story TM interventions for students with autism spectrum disorders: A meta-analysis. *Journal of Autism and Developmental Disorders*, 40, 812–826.
- Krantz, P. J., & McClannahan, L. E. (1993). Teaching children with autism to initiate to peers: Effects of a script-fading procedure. *Journal of Applied Behavior Analysis*, 26, 121–132.
- Ladd, G. W., Birch, S. H., & Buhs, E. S. (1999). Children's social and scholastic lives in kindergarten: Related spheres of influence? *Child Development*, 70, 1373–1400.
- Leaf, J. B., Dotson, W. H., Oppenheim, M. L., Sheldon, J. B., & Sherman, J. A. (2010). The effectiveness of a group teaching interaction procedure for teaching social skills to young children with a pervasive developmental disorder. *Research in Autism Spectrum Disorders*, 4, 186–198.
- Leaf, J. B., Oppenheim-Leaf, M. L., Call, N. A., Sheldon, J. B., Sherman, J. A., Taubman, M., et al. (2012). Comparing the teaching interaction procedure to social stories for people with autism. *Journal of Applied Behavior Analysis*, 45, 281–298.
- Leaf, J. B., Taubman, M., Bloomfield, S., Palos-Rafuse, L. I., McEachin, J. J., Leaf, R. B., et al. (2009). Increasing social skills and prosocial behavior for three children diagnosed with autism through the use of a teaching package. *Research in Autism Spectrum Disorder*, 3, 275–289.
- Lovaas, O. I. (1981). *Teaching developmentally disabled children: The me book*. Baltimore, MD: University Park Press.
- Mayes, S. D., Gorman, A. A., Hillwig-Garcia, J., & Syed, E. (2013). Suicide ideation and attempts in children with autism. *Research in Autism Spectrum Disorders*, 7, 109–119.
- National Standards Report. (2009). The national standards project—Addressing the need for evidence-based practice guidelines for autism spectrum disorders. *National Autism Center*.
- Oppenheim-Leaf, M. L., Leaf, J. B., & Call, N. (2012). Teaching board games to two children with an autism spectrum disorder. *Journal of Developmental and Physical Disabilities*, 24, 347–358.
- Phillips, E. L., Phillips, E. A., Fixsen, D. L., & Wolf, M. M. (1971). Achievement place: Modification of the behaviors of pre-delinquent boys within a token economy. *Journal of Applied Behavior Analysis*, 4, 45–59.
- Phillips, E. L., Phillips, E. A., Fixsen, D. L., & Wolf, M. M. (1974). *The teaching-family handbook* (2nd ed.). Lawrence, KS: University Press of Kansas.
- Pierson, M. R., & Glaeser, B. C. (2007). Using comic strip conversations to increase social satisfaction and decrease loneliness in students with autism spectrum disorder. *Education and Training in Developmental Disabilities*, 42, 460–466.
- Reynhout, G., & Carter, M. (2009). The use of social stories by teachers and their perceived efficacy. *Research in Autism Spectrum Disorders*, 3, 232–251.
- Sansosti, F. J., & Powell-Smith, K. A. (2008). Using computer-presented social stories and video models to increase the social communication skills of children with high-functioning autism spectrum disorders. *Journal of Positive Behavior Interventions*, 10, 162–178.
- Scattone, D. (2008). Enhancing the conversation skills of a boy with Asperger's disorder through social stories TM and video modeling. *Journal of Autism and Developmental Disorders*, 38, 395–400.
- Soluaga, D., Leaf, J. B., Taubman, M., McEachin, J., & Leaf, R. (2008). *A comparison of flexible prompt fading and constant time delay for five children with autism Research in Autism Spectrum Disorders*, 2, 753–765.
- Stahmer, A. C. (1995). Teaching symbolic play skills to children with autism using pivotal response training. *Journal of Autism and Developmental Disorders*, 25, 123–141.
- Stewart, M. E., Barnard, L., Pearson, J., Hasan, R., & O'Brien, G. (2006). Presentation of depression in autism and Asperger syndrome: A review. *Autism*, 10, 103–116.
- Thiemann, K. S., & Goldstein, H. (2001). Social stories, written text cues, and video feedback: Effects on social communication of children with autism. *Journal of Applied Behavior Analysis*, 34, 425–446.