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RESEARCH ARTICLE

The Teaching Interaction Procedure as a Staff Training Tool

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Abstract

The teaching interaction procedure is an evidence-based procedure that has been utilized for the development of social skills. The teaching interaction procedure consists of labeling the targeted skill, providing a meaningful rationale for the importance of the skill, describing the steps of the targeted skill, modeling the skill, and providing feedback throughout the interaction. Although the teaching interaction procedure has been used to teach a variety of social skills to children and adolescents diagnosed with autism spectrum disorder (ASD) and other social and behavioral disorders, its use has not been evaluated for training staff. The purpose of this study was to evaluate the use of a teaching interaction procedure to teach 3 interventionists the skills to implement a teaching interaction procedure to target the development of social skills for children diagnosed with ASD. The results of a multiple-baseline design showed the teaching interaction procedure was effective at teaching all 3 interventionists how to implement a teaching interaction procedure.

Keywords Staff training · Teaching interaction procedure · Social skills

There are several procedures based on the science of applied behavior analysis that have been developed and researched (e.g., video modeling, discrete-trial teaching, in-situ training) to teach individuals diagnosed with autism spectrum disorder (ASD) valuable social behaviors. One of these procedures has been referred to as the teaching interaction procedure (Phillips, 1968). The teaching interaction procedure consists of six components: (a) identifying and labeling the target behavior, (b) providing a meaningful rationale, (c) describing the target behavior, (d) demonstrating the target behavior, (e) role-playing, and (f) providing feedback (Leaf et al., 2015).

The teaching interaction procedure was described in 1971 by Phillips, Phillips, Fixsen, and Wolf as part of the Achievement Place teaching family model. Subsequently, it has been described in curriculum books (e.g., Dowd, Czyz, O'Kane, & Elofson, 1994; Hazel, Schumaker, Sherman, & Sheldon, 1983; Taubman, Leaf, & McEachin, 2011) and book chapters (e.g., Cihon, Weinkauf, & Taubman, 2017). The teaching interaction procedure has been successful in teaching typically developing individuals social and language skills (e.g., Maloney et al., 1976; Minkin et al., 1976) and individuals diagnosed with ASD social skills (e.g., Dotson, Leaf, Sheldon, & Sherman, 2010; Leaf, Dotson, Oppenheim, Sheldon, & Sherman, 2010; Leaf et al., 2009; Leaf et al., 2012; Kassardjian et al., 2013; Kassardjian et al., 2014).

Leaf et al. (2009) were the first to evaluate the effectiveness of the teaching interaction procedure to teach social skills to individuals diagnosed with ASD. In this study, the teaching interaction procedure was used in combination with a token system to teach four social skills to three individuals (5 to 7 years of age) diagnosed with ASD. The targeted social skills included following a peer, greeting a peer, including a peer in an activity, choosing a peer partner, changing the topic during a conversation, going with the flow of a conversation or game, giving a compliment, sharing, and making on-topic statements. The results demonstrated that the teaching interaction procedure was effective at teaching all three participants the social behaviors in a relatively short amount of time.

Leaf et al. (2010) extended the research on the teaching interaction procedure by evaluating its effectiveness when implemented in a group format for four children (4 to 6 years of age) diagnosed with ASD. Targeted social skills for all four participants were showing appreciation, giving a compliment,

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making an empathetic statement, and changing the game when someone was disinterested. The results of a multiple-probe design showed that participants were able to demonstrate the targeted social skills following the intervention and that these skills generalized outside of the training environment.

Dotson et al. (2010) evaluated the effectiveness of the teaching interaction procedure for teaching adolescents (13 to 18 years of age) diagnosed with ASD and other disabilities a variety of social behaviors. Targeted social skills included basic conversational skills, giving feedback during conversation, and asking and answering questions. The results showed that four of the five participants reached the mastery criteria, with variable maintenance across the five participants.

The teaching interaction procedure has also been compared to other procedures commonly used to target social skills with individuals diagnosed with ASD. For example, Leaf et al. (2012) compared the relative effectiveness of the teaching interaction procedure and Social Stories to teach six children (5 to 13 years old) diagnosed with ASD social skills (e.g., winning or losing graciously, giving compliments, cheering up a friend). Targeted social skills were randomly assigned to each teaching procedure. The results of the study indicated better skill acquisition, maintenance, and generalization for skills taught using the teaching interaction procedure than for those taught using Social Stories. Kassardjian et al. (2014) extended Leaf et al. (2012) by comparing the teaching interaction procedure to Social Stories for three children diagnosed with ASD within a group setting. In this study, the researchers randomly assigned one skill to the teaching interaction procedure condition, one to the Social Stories condition, and one to a no-teaching control condition. The results, which were similar to those of Leaf et al. (2012), showed that participants reached the mastery criterion only for the skill taught with the teaching interaction procedure.

Ng, Schulze, Rudrud, and Leaf (2016) expanded the implementation of the teaching interaction procedure for individuals diagnosed with ASD who were more impacted (e.g., limited vocal-verbal repertoires, had high rates of stereotypic behavior, and demonstrated fewer social behaviors). In this study, the authors modified the teaching interaction procedure by incorporating visuals (e.g., pictures of the rationales). The results of the study indicated that the four participants (ages ranging from 8 to 14) learned the targeted social behaviors in the study.

Although the aforementioned studies evaluating the effectiveness of the teaching interaction procedure to teach social skills for individuals diagnosed with ASD have all come from the same research lab, others have begun to evaluate the teaching interaction procedure as well. For instance, Peters, Tullis, and Gallagher (2016) evaluated the effectiveness of the teaching interaction procedure to teach four children (8 to 10 years old) diagnosed with ASD a variety of social behaviors (e.g., changing a game when bored). The teaching interaction procedure was implemented in a group setting in a classroom at a school. Peters et al.'s results aligned with that of other research labs in that participants learned the targeted social skills and the skills maintained at or near the mastery criterion following completion of the intervention. Furthermore, parents of the participant indicated they were very satisfied with the intervention.

Although the teaching interaction procedure has a large, and growing, empirical base for its effectiveness at teaching social skills to children and adolescents, there is a paucity of literature on its effectiveness to training staff. In the only example of its use as a staff training tool, Harchik, Sherman, Sheldon, and Strouse (1992) utilized the teaching interaction procedure to train nine staff members from a group home for developmentally disabled adults how to implement a token economy, increase engagement among group home members and staff, and increase the number of teaching components of the teaching interaction procedure utilized throughout the day. Staff training involved a mini workshop that consisted of the consultant labeling and describing general target behaviors, providing rationales emphasizing the importance of engaging in each target behavior, describing specific components of behaviors for the staff and adult residents, demonstrating the target staff behaviors, and role-playing target staff behavior. Staff were provided with specific feedback regarding their performance in the role-play. After the mini workshop, staff returned to work with the adults and the consultant would provide feedback on staff members' behavior throughout the duration of the study. The results indicated that the training package was effective for increasing staff members' accurate implementation of a token economy, staff engagement with the adult residents, and the number of teaching components of the teaching interaction procedure that were implemented when working with adults.

The authors are not aware of replications or extensions of Harchik et al.'s (1992) evaluation of the effectiveness of the teaching interaction procedure as a staff training tool. Furthermore, Harchik et al. did not provide data on the effects of the staff training on the behavior of the clients in the group home. Therefore, the purpose of the present study was to evaluate the effectiveness of the teaching interaction procedure as a staff training tool to train staff to implement a teaching interaction procedure to teach social skills for children diagnosed with ASD. In addition to staff behavior, the skill acquisition of the children was assessed during sessions with the researcher.

Method

Participants

Three interventionists served as adult participants in this study. All three participants were hired by a private, for-profit, center-based agency that provides early intensive behavioral

intervention for individuals diagnosed with ASD. All three interventionists had obtained their bachelor's degree prior to employment and had no previous experience with implementing a teaching interaction procedure. Once interventionists were hired, they were recruited by the researchers at a nonprofit organization that conducts research on behavioral interventions for individuals diagnosed with ASD. Interventionists were informed that their employers would not have access to their data during this study and that participation in this study would not affect their job status. Following their consent to participate in this study, they were each paired with a child diagnosed with ASD.

Child participants were from the for-profit, center-based agency. All children had received an independent diagnosis of ASD prior to the study. Each child participant had a previous history with behaviorally based intervention (range 1 year 4 months to 2 years 3 months). All child participants displayed social impairments and required intervention that included a focus on developing social skills. Additional children diagnosed with ASD were recruited to participate in generalization probes (described later).

Dyad 1 The first dyad consisted of interventionist Hailey and the child participant Pam. Hailey was a 23-year-old female with a bachelor's degree in psychology and a minor in human development. Prior to her employment with the agency, Hailey had 1 year of experience in an applied behavior analysis (ABA) lab as part of her college experience. However, Hailey had no experience implementing behavior-analytic interventions for individuals diagnosed with ASD or implementing the teaching interaction procedure. The child participant, Pam, was a 4-year-old female diagnosed with ASD. Pam had a Wechsler Preschool and Primary Scale of Intelligence, Third Edition (WPPSI), full-scale IQ score of 118; a Vineland Adaptive Behavior Scale (VABS) adaptive composite score of 80; an Expressive One-Word Picture Vocabulary Test, Fourth Edition (EOWPVT), standard score of 145; and a Peabody Picture Vocabulary Test (PPVT) standard score of 132. Pam also had a Social Skills Improvement Scale (SSiS) standard score of 67 (i.e., 2nd percentile) and scored in the below-average range on the majority of social skills subscales. Pam's parents and staff members reported that she never initiated conversations with peers, did not engage in reciprocal conversation, had difficulties compromising, rarely invited others to join in activities, and had difficulties staying calm when disagreeing with others.

Dyad 2 The second dyad consisted of the interventionist Izzy and the child participant Nick. Izzy was a 23-year-old female with a bachelor's degree in communications. She had 7 months of experience providing behavioral intervention for individuals diagnosed with ASD prior to her current employment. Izzy had no previous history with implementing the teaching interaction procedure. The child participant, Nick, was a 5-year-old male diagnosed with ASD. Nick had a WPPSI full-scale IQ score of 109, a VABS adaptive composite score of 91, an EOWPVT standard score of 117, and a PPVT standard score of 120. Nick also had a SSiS standard score of 108 (70th percentile), scoring in the average range for all of the social skills subscales. Nick's parents and staff members still reported social behavior deficits, including Nick reacting emotionally (e.g., crying, whining) to minor disagreements or losses in games, moving between topics in conversation, initiating conversation, staying on topic when talking with others, and taking turns during games.

Dyad 3 The third dyad consisted of the interventionist Autumn and the child participant Jeremy. Autumn was a 23-year-old female with a bachelor's degree in recreation. She had no experience or knowledge of ABA prior to her employment with the agency in this study, including the implementation of the teaching interaction procedure. The child participant, Jeremy, was a 3-year-old male diagnosed with ASD. Jeremy had a WPPSI full-scale IQ score of 105, a VABS adaptive composite score of 79, an EOWPVT standard score of 86, and a PPVT standard score of 80. Jeremy had a SSiS standard score of 84 (16th percentile), scoring in the average range for the majority of social skills subscales. Jeremy's parents and staff members reported Jeremy displaying several social skill deficits, including those related to taking turns in conversations, following other peers' ideas, initiating activities with others, compromising with others, and taking turns during games.

Setting

This study was conducted in research rooms in the for-profit, clinic-based center. The rooms ranged from 6 ft. × 8 ft. to 6 ft. × 29 ft (1.8 m × 2.4m to 1.8 m × 8.8 m). In each room was a table, at least two chairs, bookshelves or cabinets with books, desks with computers, toys, and/or other teaching materials. The private agency was a clinic-based model (Leaf, Leaf, McEachin, Cihon, & Ferguson, 2017). Some interventionists provided paraprofessional support in school settings, and some children enrolled in the agency receive paraprofessional support in school settings. As such, this study was similar to the experiences that both the interventionists and children diagnosed with ASD would receive on a daily basis.

Dependent Variables

Interventionist Dependent Variables The main interventionist dependent variable was the interventionists' implementation of the teaching interaction procedure. The researchers evaluated the interventionists' implementation of the teaching interaction procedure through interventionist probes and interventionist generalization probes (described later). In both

probes, the researchers evaluated the interventionists' implementation of the teaching interaction procedure based on an 11-step task analysis (see Table 1). Historically, the teaching interaction procedure has consisted of six broad steps (i.e., labeling the behavior, providing rationale, breaking down the skill, teacher modeling, learner role-playing, and providing feedback; Cihon et al., 2017). However, in an effort to better operationalize interventionist behavior, some steps were further broken down (e.g., demonstrating correct and incorrect models), resulting in 11 steps as opposed to 6 broad steps. During each probe, the researchers scored if each step of the teaching interaction procedure was implemented correctly, incorrectly, or omitted. The researchers calculated the percentage of steps completed correctly by adding the number of steps scored as correct, dividing that number by the total number of steps (i.e., 11), and multiplying by 100.

The measure used to evaluate functional control was the interventionists' performance during interventionist probes. The mastery criterion during interventionist probes was the interventionists displaying 100% of the steps of the teaching interaction procedure correctly across three consecutive interventionist probes. Two other ancillary measures included the interventionist implementing the teaching interaction procedure during interventionist generalization probes and the total amount of training time required for each interventionist to reach the mastery criterion during interventionist probes.

Child Participant Dependent Variable The main child participant dependent variable was the demonstration of the targeted social behavior during child skill probes (described later). The researchers consulted with the child participants' clinical supervisors (i.e., the people who help determine the curriculum for the children) to identify relevant social behaviors for the children (i.e., social behaviors the children were currently lacking, would benefit from learning, were important to their caregivers, and were not currently being targeted). The clinical supervisors stated that all three child participants were not changing their behavior when a peer was bored (e.g., not engaging in the same activity, yawning, not taking his or her turn). As such, changing the game being played when someone was bored was selected as the targeted social behavior for all of the child participants. A task analysis of changing the game when someone is bored was used from previous research (Kassardjian et al., 2014). The six steps for changing the game when someone was bored were (a) face the person, (b) ask the person if he or she wants to play something else within 10 s of the bored cue (e.g., sighing or looking away from the game), (c) ask the person what he or she wants to play instead, (d) respond "OK" or something equivalent, (e) get the game the person selected, and (f) play the game the other person selected.

Probes

Interventionist Probes Interventionist probes occurred during baseline, intervention, and maintenance conditions. The purpose of interventionist probes was to assess the interventionists' implementation of the teaching interaction procedure with their assigned child participant. During interventionist probes, the researcher set up the research room with four different games, a paper with the task analysis of the target skill (i.e., changing the game when someone is bored), and a pen. Next, the researcher brought the child participant to the research room and informed the child participant that he or she would be working with the adult interventionist. The researcher then brought the interventionist to the research room and provided the following instruction, ensuring the child participant could not hear:

Table 1 Teaching interaction procedure steps and definitions

Dependent measure	Operational definition
1. Label	The interventionist states the name of the targeted child participant skill.
2. Rationale	The interventionist states at least one reason why the skill is important.
3. Task analysis	The interventionist states all the steps (in order) included in the skill.
4. Model (correct)	The interventionist demonstrates each step of the skill correctly.
5. Model (incorrect)	The interventionist demonstrates each step of the skill incorrectly.
6. Model (comprehension)	The interventionist asks the child participant if the demonstration was correct or incorrect.
7. Model (comprehension)	The interventionist asks the child participant why the demonstration was correct or incorrect.
8. Role-play (start)	The interventionist asks the child participant to practice the skill at least once.
9. Role-play (feedback)	The interventionist provides behavior-specific feedback within 10 s to the child participant based on the child participant's performance on the role-play.
10. Role-play (to mastery)	The interventionist required the child participant to role-play until all steps of the targeted social skill were displayed correctly.
11. Feedback (throughout)	The interventionist provided feedback throughout the entire teaching interaction procedure.

> I would like you to teach [child's name] to change the game when someone is bored using the teaching interaction procedure. You have up to 15 minutes but can stop early if you would like. All of the necessary materials are provided. Please begin.

The interventionist then had up to 15 min to use the teaching interaction procedure to teach the child participant the target skill (i.e., changing the game when someone is bored). The researcher provided no programmed reinforcement, corrective feedback, prompting, or priming and did not answer any questions during the probe. At the end of each interventionist probe, the interventionist and the child were thanked for their participation and the teaching probe was concluded. The interventionist then took the child participant back to his or her clinical session.

Interventionist Generalization Probes Interventionist generalization probes were conducted during the baseline and maintenance conditions. The purpose of the generalization probes was to assess the interventionists' implementation of the teaching interaction procedure with a different child participant while teaching a different social behavior. The interventionist generalization probes were identical to the interventionist probes with two exceptions. First, the child that participated in generalization probes, also diagnosed with ASD, differed from the child who participated in the interventionist probes. Second, the interventionist was asked to target a different social skill (i.e., cheering up a friend). This skill was selected based on the child not displaying the skill, the steps differing from the skill targeted during intervention, and a different rationale for why the child should display the skill. A task analysis of cheering up a friend was used from previous research (Leaf et al., 2010). The five steps for cheering up a friend were (a) face the person, (b) ask a general question about if the other person is OK (e.g., "Are you OK?"), (c) make a statement that it looked like it hurt, (d) ask if there is anything that he or she can do to help, and (e) complete the action that was requested.

Child Skill Probes Child skill probes were conducted during the prebaseline, baseline, intervention, and maintenance conditions. The purpose of the child skill probes was to assess the child's improvement with changing the game when someone is bored with the researcher. As such, these probes functioned as a generalization measure of the targeted social skill, as the child had to display changing the game when someone is bored with a different person (i.e., the researcher).

Prior to child skill probes, the researcher set up the research room with four different games. The game played each probe rotated semirandomly, and the other three games were placed on the floor in sight of the child participant. Next, the researcher brought the child participant to the research room and said he or she would be playing with the researcher. The researcher then played that game with the child participant. Within 2 min of playing the game, the researcher engaged in a bored cue (e.g., looking away, responding slower in the game, sighing) that set the occasion for the participant to engage in the targeted skill. The child participant was given up to 10 s to engage in the targeted skill. The researcher did not provide any programmed reinforcement, corrective feedback, prompting, or priming during any of the probes across all conditions. The researcher then scored the steps the participant displayed correctly, incorrectly, or omitted throughout the child skill probe.

Experimental Design

A nonconcurrent multiple-baseline design across participants (Watson & Workman, 1981) was utilized to measure the effects of the training procedure on the interventionists' implementation of the teaching interaction procedure. The multiple-baseline design consisted of four phases (i.e., prebaseline, baseline, intervention, maintenance). Generalization of the implementation of the teaching interaction procedure with another child and skill was also assessed. It should be noted that only the main dependent variable (i.e., the interventionist displaying the teaching interaction procedure during interventionist probes) was responsible for movement across the phases.

Prebaseline

Prior to baseline, child performance of the target social behavior was evaluated across two sessions of the prebaseline condition. The purpose of this condition was to ensure the child did not display the target social behavior prior to any intervention. During the prebaseline condition, sessions consisted of the researcher conducting a child skill probe with the child participant (described previously).

Baseline

The purpose of this condition was to assess the interventionists' implementation of the teaching interaction procedure through interventionist probes and interventionist generalization probes prior to any training. Additionally, it was used to evaluate child performance with the researcher during child skill probes. With the exception of the last baseline session, each baseline session started with the researcher taking the child participant into one of the rooms and conducting a child skill probe (previously described). At the conclusion of the child skill probe, the child participant received a 2–5 min break. Following this break, the researcher brought in the interventionist and conducted an interventionist probe with the interventionist and the child participant. Once the

interventionist probe had concluded, the child participants returned to their regular clinical session and the interventionists continued to their clinical session. The last session of the baseline condition consisted of the researcher conducting an interventionist generalization probe (described previously) with the interventionist and another child.

Intervention

The purpose of the intervention condition was to teach the interventionist how to implement the teaching interaction procedure and evaluate any improvements in the targeted social behavior with the child participant. Across all interventionists, the first session of the intervention condition consisted of the researcher training the interventionist in the absence of the child participant followed by an interventionist probe. All other sessions during the intervention condition began with the researcher training the interventionist in the absence of the child participant, followed by a child skill probe, and then an interventionist probe. Once an interventionist reached the mastery criterion (i.e., displaying 100% of the steps of the teaching interaction procedure correctly across three consecutive interventionist probe sessions), no training occurred following the interventionist probe.

Training Training consisted of a teaching interaction procedure outlined in a Microsoft PowerPoint presentation. The slide order, the step of the teaching interaction procedure the slide represented, and a description of each slide are outlined in Table 2. Once the researcher and the interventionist were in the research room, the researcher informed the interventionist she will be learning how to implement the teaching interaction procedure. Training started with the researcher providing a general description and history of the teaching interaction procedure (i.e., the label-and-identify step; Slides 1 and 2). Next, the researcher provided rationales for the use of the teaching interaction procedure (e.g., facilitates independence, interactive, flexible; Slide 3). Slide 4 was a supplemental slide consisting of information describing the planning required prior to conducting a teaching interaction procedure. The researcher did not ask the interventionist any comprehension questions (e.g., "So what are you going to learn about

Table 2 PowerPoint slide content description

Slide(s)	Step of the teaching interaction procedure	Description
1	N/A	Title slide
2	Label	Defined and outlined the six steps and provided some history of the teaching interaction procedure
3	Rationale	Listed some benefits of the teaching interaction procedure (e.g., evidence based)
4	N/A	Described planning required prior to conducting a teaching interaction procedure (e.g., task analysis of the skill)
5	Describing	Described the label-and-identify step of the teaching interaction procedure
6–10	Describing	Described the rationale set of the teaching interaction procedure and provided examples and nonexamples of meaningful rationales
11–12	Describing	Outlined task analyzing the behavior/skill to be taught and described how to conduct the teacher demonstration
13	Describing	Described how to conduct a role-play
14	Describing	Described how to provide feedback throughout
15	Describing	Described the use of a supplemental reinforcer following the end of the teaching interaction procedure
16	Describing	Described how to program for generalization
17–20	Demonstration	Two video demonstrations of a teaching interaction procedure and questions about whether the demonstration was correct or incorrect and why
21	Role-play	Signaled and described that the researcher and the interventionist would now role-play
22	Feedback	Checklist of the steps of the teaching interaction procedure for the interventionist to use to evaluate her or his performance on the role-play
23	Feedback	Stated "Congratulations/Reinforcement" and outlined what the interventionist will be doing next (i.e., teaching a different skill to a child)

today?") during the first four slides but would answer any questions the interventionist asked.

Slides 5 through 16 all involved a description of the steps of the teaching interaction procedure. For example, the researcher described the step of labeling and identifying the targeted skill on Slide 5. Following each slide or slide set (e.g., Slides 6–10), the researcher asked a follow-up/comprehension question (e.g., "So what is the first step of the teaching interaction procedure?"). Additionally, following Slide 16, the researcher asked the participants to describe all the steps of the teaching interaction procedure. Each question was asked when the slide with the relevant information was no longer visible (e.g., the comprehension question about the content on Slides 6–10 was asked when the title for Slide 11 was visible). The researcher provided general praise following correct responses (e.g., "Good job.") and corrective feedback following incorrect responses (e.g., "No, it is labeling.").

Slides 17 through 20 involved video demonstrations of the researcher implementing the teaching interaction procedure with a child. One video provided a correct demonstration, and one video provided an incorrect demonstration (i.e., not providing a rationale) of the teaching interaction procedure. The order of correct and incorrect demonstrations was randomly determined prior to each training session. Following each video, the researcher asked the participant if the video was a correct or an incorrect demonstration followed by asking why the video demonstration was a correct or an incorrect demonstration. The researcher provided general praise following correct responses (e.g., "Good job.") and corrective feedback following incorrect responses (e.g., "No, that was an incorrect demonstration because I did not provide a rationale.").

After the video demonstrations, the researcher role-played the teaching interaction procedure with the interventionist (Slide 21). Prior to starting the role-play, the interventionist was provided with a task analysis of the skill to target during the role-play with the researcher (i.e., losing graciously), as well as any necessary materials (e.g., games). It should be noted that this skill was different from the skills used throughout the rest of the study. The researcher instructed the interventionist that she had 15 min to teach the researcher how to lose graciously using the teaching interaction procedure.

Once the interventionist indicated she was finished or 15 min elapsed, the researcher advanced to the next slide (i.e., Slide 22). This slide included a checklist that the researcher went through with the interventionist to provide feedback on each component of the teaching interaction procedure. If any steps of the teaching interaction were implemented incorrectly during the role-play, the researcher provided the interventionist with another opportunity to role-play. This continued until the interventionist completed 100% of the steps of the teaching interaction procedure correctly.

The final slide (i.e., Slide 23) of the PowerPoint presentation was displayed following successful completion of the role-play. This slide consisted of a praise statement (i.e., "Congratulations/Reinforcement") and outlined what the interventionist would do next (i.e., implementing the teaching interaction procedure with a child to teach a different skill). The researcher also answered any questions from the interventionist. This sequence of training was repeated until the interventionist reached mastery criterion assessed during interventionist probes.

Maintenance The purpose of this condition was to assess the maintenance of the interventionist implementing the teaching interaction procedure after training had concluded, as well as the maintenance of the targeted social behavior for the child participant. Sessions during the maintenance condition were identical to sessions during the baseline condition. Maintenance of skills was assessed 7, 13, and 14 days after mastery for Dyad 1; 7, 12, and 13 days after mastery for Dyad 2; and 7, 9, and 20 days after mastery for Dyad 3.

Interobserver Agreement and Treatment Fidelity A second independent observer scored interventionist and child participant behavior to assess interobserver agreement (IOA) during interventionist, interventionist generalization, and child skill probes. IOA was taken during 36.2% and 100% of sessions during interventionist and interventionist generalization probes, respectively. Agreements were defined as both observers scoring the same interventionist response on a step of the teaching interaction procedure (i.e., correct, incorrect, or omitted). IOA for interventionist probes was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Across interventionist probes for all interventionists, IOA averaged 99% (range 90.9%–100%). Across interventionist generalization probes for all interventionists, IOA averaged 95% (range 81.8%–100%).

IOA was taken for 38.8% of sessions during child probes. Agreements were defined as both observers scoring the same child participant response on a step of the task analysis (i.e., as correct, incorrect, or omitted). IOA for child skill probes was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Across all child skill probes, IOA averaged 98.2% (range 83.3%–100%).

The fidelity of the researcher's implementation of the teaching interaction procedure to train the interventionists to implement the teaching interaction procedure was also assessed. A second researcher observed 33.3% of intervention sessions and scored the researcher's behavior to assess treatment fidelity. Correct researcher behavior consisted of (a) discussing each slide, (b) asking the interventionist comprehension questions following the description of the teaching

interaction procedure (i.e., Slides 2–16), (c) asking the interventionist if the model was correct or incorrect (i.e., Slides 17–20), (d) asking the interventionist why the model was correct or incorrect (i.e., Slides 17–20), (e) having the interventionist role-play the implementation of the teaching interaction procedure until the interventionist displayed 100% of the steps of the teaching interaction procedure correctly, and (f) providing feedback throughout. Treatment fidelity was calculated by taking the number of steps the researcher displayed correctly divided by the total number of steps per session. Treatment fidelity averaged 98.7% across intervention sessions for all three adult participants (range 95.5%–100%).

Social Validity

To assess social validity (Wolf, 1978), each interventionist filled out an anonymous questionnaire at the end of the study. The interventionist returned the questionnaire in a sealed envelope to the researcher's office. Only the researchers viewed the questionnaire, and the interventionists were informed that their employer could not access the information to avoid potential response bias. The questionnaire consisted of six questions about the interventionists' satisfaction with the training procedure and how useful the teaching interaction procedure was in their regular therapy sessions while teaching social skills. Each question was rated by the interventionists using a 5-point Likert scale.

Results

Interventionist and Child Participant Performance

Figure 1 displays the interventionists' behavior during interventionist probes (closed circles), interventionist

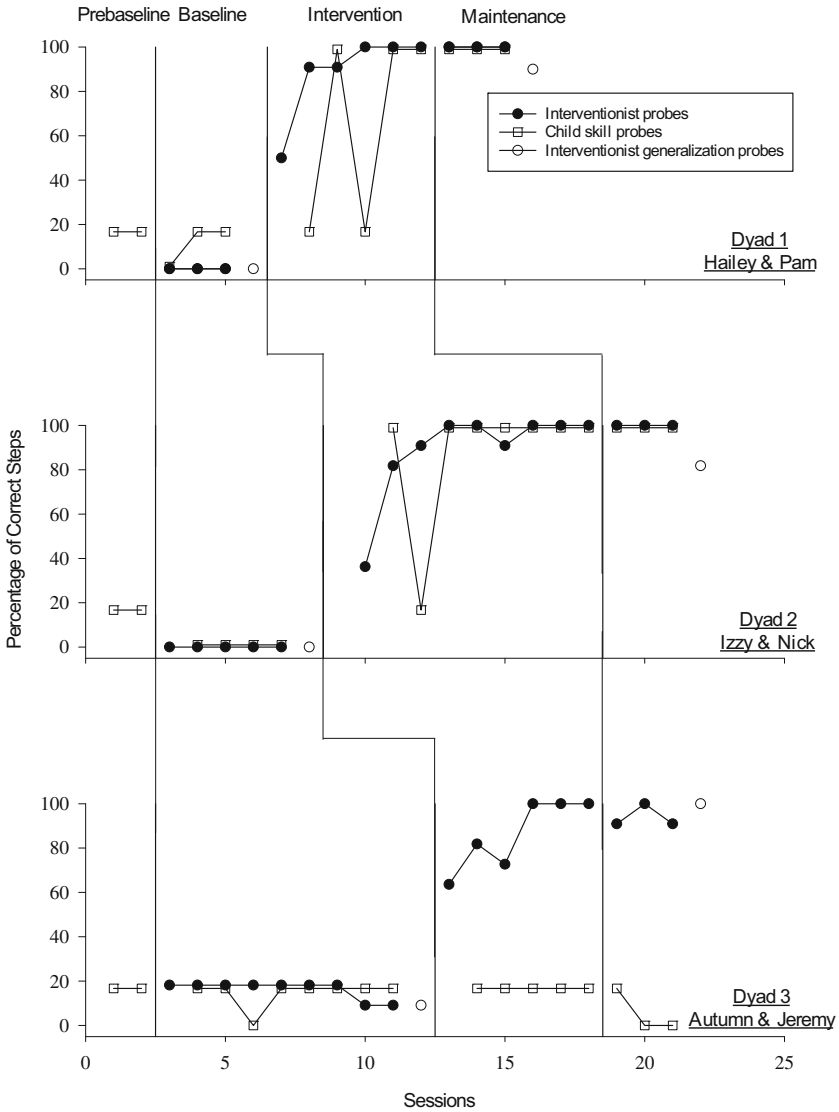

Fig. 1. Interventionist and child participant performance

generalization probes (open circles), and child skill probes (open squares) across all conditions of the study.

Dyad 1 The first dyad, Hailey and Pam, are represented in the top panel of Fig. 1. During prebaseline, Pam (i.e., the child participant) engaged in 16.7% of the steps of the targeted behavior (i.e., changing the game when someone is bored) correctly during child skill probes. Hailey (i.e., the adult interventionist) did not display any steps of the teaching interaction procedure correctly across three consecutive interventionist probes or the interventionist generalization probe during the baseline condition. During the baseline condition, Pam continued to display a low percentage of steps correct of the targeted social behavior during child skill probes.

During the intervention condition, Hailey showed an immediate increase in the number of steps completed correctly of the teaching interaction procedure during interventionist probes. On the first interventionist probe after training, Hailey displayed 54% of the steps of the teaching interaction procedure correctly and reached the mastery criterion within six sessions. Subsequently, the number of steps of changing the game when someone is bored that Pam displayed correctly during child skill probes increased. During the first and third child skill probes, Pam did not complete the steps of changing the game when someone is bored following the researcher engaging in a bored cue (e.g., the researcher not taking her turn). On all other child skill probes, Pam displayed all of the steps of changing the game when someone is bored correctly. This variability may be a result of Hailey not establishing the discriminative stimulus for Pam to engage in the targeted response.

During the maintenance condition, Hailey displayed 100% of the steps correctly of the teaching interaction procedure across all three interventionist probes and displayed 90.9% of the steps correctly during the interventionist generalization probe. During the maintenance condition, Pam displayed 100% of the steps of changing the game when someone is bored correctly across all three child skill probes.

Dyad 2 The second Dyad, Izzy and Nick, are represented in the middle panel of Fig. 1. During prebaseline Nick (i.e., the child participant) engaged in 16.7% of the steps of the targeted behavior (i.e., changing the game when someone is bored) correctly during child skill probes. Izzy (i.e., the adult interventionist) did not display any steps of the teaching interaction procedure correctly across five consecutive interventionist probes or the interventionist generalization probe during the baseline condition. During the baseline condition, Nick did not display any of the steps of the targeted social behavior correctly across all child skill probes.

During the intervention condition, Izzy showed an immediate increase in the number of steps completed correctly of the teaching interaction procedure during interventionist probes. On the first interventionist probe after training, Izzy displayed 36% of the steps of the teaching interaction procedure correctly and reached the mastery criterion within nine sessions. Subsequently, the number of steps of changing the game when someone is bored that Nick displayed correctly during child skill probes increased. During the second child skill probe, Nick did not complete the steps of changing the game when someone is bored following the researcher engaging in a bored cue (e.g., the researcher not taking her turn). On all other child skill probes, Nick displayed all of the steps of changing the game when someone is bored correctly. This variability may be a result of Izzy not establishing the discriminative stimulus for Nick to engage in the targeted response.

During the maintenance condition, Izzy demonstrated 100% of the steps correctly of the teaching interaction procedure across all three interventionist probes and 81.8% of the steps correctly during the interventionist generalization probe. During the maintenance condition, Nick displayed 100% of the steps correctly of changing the game when someone is bored across all three child skill probes.

Dyad 3 The third dyad, Autumn and Jeremy, are represented in the bottom panel of Fig. 1. During prebaseline Jeremy (i.e., the child participant) engaged in 16.7% of the steps of the targeted behavior (i.e., changing the game when someone is bored) correctly during child skill probes. Throughout baseline, Autumn (i.e., the adult interventionist) displayed an average of 15.5% (range 9.1%–18.2%) of steps of the teaching interaction procedure correctly across nine consecutive interventionist probes and one interventionist generalization probe. Across all sessions during baseline, Jeremy engaged in the correct steps of the targeted social behavior on a low percentage of steps.

During the intervention condition, Autumn showed an immediate increase in the number of steps completed correctly of the teaching interaction procedure during interventionist probes. On the first interventionist probe after training, Autumn displayed 63% of the steps of the teaching interaction procedure correctly and reached the mastery criterion within six sessions. Subsequently, unlike the other two child participants, Jeremy continued to display a low percentage of the steps of the targeted social skill correctly during child skill probes throughout intervention.

During maintenance, Autumn displayed an average of 93.9% (range 90.9%–100%) of the steps of the teaching interaction procedure correctly across three interventionist probes and 100% of the steps correctly during the interventionist generalization probe. Jeremy continued to display a low percentage of steps of the targeted social skill correctly during child skill probes throughout intervention.

Efficiency

The duration of training required for each interventionist to reach mastery criterion was fairly consistent for two of the

three interventionists. A total of 3 hr 46 min, 5 hr 44 min, and 3 hr 23 min of training was required for Hailey, Izzy, and Autumn, respectively. Across all three participants, training took a total of 12 hr 53 min, averaging 4 hr 17 min of training per participant.

Social Validity

The results of the social validity questionnaire are summarized in Table 3. There were a total of six questions the interventionists were asked to answer following the intervention. Four questions (i.e., 1, 2, 5, and 6) were designed to measure the interventionists' satisfaction with the training. Overall, all three interventionists responded positively to these questions, indicating they enjoyed the training, saw value in the training, and would recommend the training to others. Question three was designed to evaluate the interventionists' opinion on the effectiveness of the teaching interaction procedure for skill acquisition for individuals with ASD. Only one of the three interventionists provided a response to this question; the other two interventionists responded "N/A" to this question indicating that the question was not applicable to their current clients. Question four was designed to assess if the interventionists use the teaching interaction procedure in their clinical sessions. Two of the interventionists responded positively, and one responded neutrally.

Discussion

The purpose of this study was to evaluate the effectiveness of a training that used the teaching interaction procedure to train three interventionists how to implement the teaching interaction procedure to teach social skills to young children diagnosed with ASD. The results demonstrated that the three interventionists learned to implement the teaching interaction procedure correctly within six to nine probe sessions with a maximum of 5 hr 44 min of total training. These results on efficiency, with respect to the duration of training, are similar to previous studies that have used other staff training procedures. For example, Dogan et al. (2017) trained parents to teach social skills using behavioral skills training (BST), which required up to 6 hr of training time. Lerman, Hawkins, Hillman, Shireman, and Nissen (2015) used BST and videos to teach novice staff to implement discrete-trial teaching, which required up to 8 hr of training time. Thiessen et al. (2009) also trained novice staff how to implement discrete-trial teaching using a self-instructional manual, which required up to 5 hr of training time. Taken collectively, the results of this and previous studies suggest more training time is required to train staff than suggested by credentialing bodies (e.g., 40 hr; Behavior Analyst Certification Board, 2018), as it might take longer to train novice staff on more difficult procedures (Leaf et al., 2015; Leaf et al., 2016).

This study extends the research using the teaching interaction procedure to train staff (i.e., Harchik et al., 1992) through demonstrating the teaching interaction procedure as an effective procedure to train staff to implement an effective social skills procedure with children diagnosed with ASD. In addition to the interventionists learning to implement the teaching interaction procedure to teach the targeted social skill (i.e., changing the game when someone is bored), the skill generalized with an unrelated, nontargeted social skill (i.e., cheering up a friend) with a different child diagnosed with ASD.

This study also extends previous research by evaluating child participant acquisition of the social skill the interventionists taught using the teaching interaction procedure. The results showed that in the absence of the correct implementation of the teaching interaction procedure (i.e., baseline), none of the child participants acquired the targeted social behavior. The results

Table 3 Percentage of staff participants' positive and negative responses to survey questions

Question	*n*	Positive %	Neutral %	Negative %
1. My knowledge of the teaching interaction procedure has increased after this training.	3	100.0%	0.0%	0.0%
2. My skills in the application of the teaching interaction procedure to teach social skills to children with ASD increased after the training in this study.	3	100.0%	0.0%	0.0%
3. If applicable, the children with whom I have used the teaching interaction procedure to teach a social skill have been able to learn the skill.	1	100.0%	0.0%	0.0%
4. If applicable, I utilize the teaching interaction procedure when teaching children with ASD social skills in my regular therapy sessions.	3	66.7%	33.3%	0%%
5. I am satisfied with the training I received for implementing the teaching interaction procedure.	3	100.0%	0.0%	0.0%
6. I would recommend other therapists receive this training.	3	100.0%	0.0%	0.0%

[a] Participants' responses were summarized as positive for "Agree" and "Strongly Agree"

[b] Participants' responses were summarized as negative for "Disagree" and "Strongly Disagree"

also indicated that two of the participants (i.e., Pam and Nick) acquired the targeted social skill following correct interventionist implementation of the teaching interaction procedure. These results were not replicated for one participant (i.e., Jeremy), who did not acquire the targeted social skill even after the interventionist was implementing the teaching interaction procedure correctly across several sessions. There are several variables that may have contributed to Jeremy's results.

It is possible that our methods for assessing the acquisition of the target social skill could have contributed to Jeremy's results. Although all teaching sessions occurred with the interventionist, child participant acquisition was assessed with a researcher (i.e., child skill probes). When assessing the interventionist's implementation of the teaching interaction procedure during interventionist probes, Jeremy would accurately display the targeted social behavior with the interventionist (i.e., Step 10 of teaching interaction procedure; see Table 1). Therefore, one plausible reason for Jeremy's results could be a lack of generalization. Failure to generalize from the interventionist sessions to the child skill probes could have been a result of many factors, including Jeremy's age (i.e., none of the previous literature has evaluated the use of a teaching interaction procedure for children younger than 4 years of age; see Cihon et al., 2017, for review) and the relatively short number of intervention sessions (i.e., more than five sessions are common with previous literature; Dotson et al., 2010; Kassardjian et al., 2013; Leaf et al., 2012). Child skill probes also occurred in the absence of any programmed consequences. That is, the researcher did not provide any feedback or programmed reinforcement during child skill probes. As a result, it is possible that signaled extinction (cf. Lerman & Iwata, 1996) could have contributed to Jeremy not displaying the targeted skill during these probes.

A final contribution of this study to the literature using the teaching interaction procedure as a staff training tool is the inclusion of the assessment of social validity. Overall, the results indicated that the interventionists found the training beneficial in increasing their knowledge of the teaching interaction procedure and its implementation for teaching children with ASD social skills. To extend social validity in future studies, the inclusion of a post hoc interview with the participants could help to identify the variable(s) contributing to the interventionists' opinions of the procedure (e.g., if the teaching interaction procedure was not an appropriate teaching methodology for the clients with whom the interventionists provided intervention).

When ttaken together, the favorable results of the social validity survey provide behavior analysts with more evidence for the use of a behaviorally based procedure that can be used to train staff. Despite these favorable findings, there are areas that could be addressed in future studies. One, the teaching interaction procedure is similar to BST, which has also been demonstrated to be an effective training strategy (e.g., Dogan et al., 2017; Fetherston & Sturmey, 2014; Rosales, Stone, & Rehfeldt, 2009; Seiverling, Pantelides, Ruiz, & Sturmey, 2010; Seiverling, Williams, Sturmey, & Hart, 2012; Shayne & Miltenberger, 2013). Some researchers have used treatment packages that have included BST with the addition of a rationale (e.g., Parsons, Rollyson, & Reid, 2013) and/or incorrect demonstration (Geiger, LeBlanc, Hubik, Jenkins, & Carr, 2018) while conceptualizing the package as BST; however, others have discussed that the inclusion of these components requires reconceptualizing the package as the teaching interaction procedure to align with the research (Cihon et al., 2017; Leaf et al., 2015). Nevertheless, it remains unknown if providing a rationale and correct and incorrect demonstrations are necessary inclusions for the effectiveness of the procedure, as component analyses and comparisons have yet to be conducted. Future researchers may wish to evaluate if these additions result in differential outcomes, making differentiation between the two procedures necessary, or if the additions are unnecessary, making differentiation between the two procedures unnecessary.

Another area that warrants future research is a more robust evaluation of the generalization of child participant skill acquisition. Given that the primary goal of the study was to evaluate the behavior of the interventionist, child skill generalization was only evaluated with a different teacher (i.e., the researcher) during child skill probes. In future studies, however, researchers may wish to evaluate if child participant skills generalize across a wider variety of variables (e.g., natural settings, novel staff, novel children). Along these lines, the generalization of each interventionist's behavior was assessed in at least two ways. First, interventionist implementation of the teaching interaction procedure was assessed with a different child diagnosed with ASD. Second, interventionist behavior was also assessed with a different skill. Generalization was not assessed across a wide variety of settings, because the interventionist would not be providing intervention in other locations outside of the clinic. Additionally, generalization was not assessed in other instructional formats (e.g., groups), because new interventionists at this particular clinic would not yet be implementing group instruction in the clinic in which they provided intervention. Nevertheless, future researchers may wish to assess interventionist skill generalization in novel settings (e.g., home, school, community), different instructional formats (e.g., small-group instruction, large-group instruction), and with a variety of individuals diagnosed with ASD.

In addition to the aforementioned areas of future research, there are other limitations to this study that require discussion. First, during training sessions subsequent to child skill probes in which the interventionist incorrectly performed steps of the teaching interaction procedure, they were only provided with feedback by the researcher emphasizing what the correct response/step should look like during training sessions. It is unclear whether direct and specific feedback would have

improved staff performance more efficiently than receiving indirect feedback on which steps were performed incorrectly. Future research should examine the efficiency of the teaching interaction procedure to train staff by providing performance-specific feedback as opposed to indirect feedback. Second, although this study demonstrated skill retention during the maintenance phase, no data was collected on whether the implementation of the teaching interaction procedure maintained and generalized to the interventionists' ongoing treatment sessions. Future researchers should investigate whether the training procedures led to maintenance and generalization of the teaching interaction procedure to naturalistic settings when the interventionists are not specifically directed to implement the procedure.

Although this study is not without its limitations, it provides clinicians with a training procedure that is effective for teaching staff to implement a multistep teaching procedure, with high levels of fidelity, for teaching complex social skills to individuals with ASD. Children diagnosed with ASD face higher risks for bullying, loneliness, and, in general, a lower quality of life (Leaf, 2017). Furthermore, teaching social skills to children diagnosed with ASD is complex and multifaceted, and treatment needs to be carried out with high levels of fidelity. This study provides clinicians with another behaviorally based methodology to train staff to teach social skills to help prevent risks commonly associated with a diagnosis of ASD.

Compliance with Ethical Standards

Conflict of Interest The fifth and sixth authors have commercial products (i.e., curriculum books and DVDs) for the procedures implemented and curriculum utilized.

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

Informed Consent Informed consent was obtained from the parents of all individual participants included in the study. Formal assent was also obtained from all individual participants.

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