Comparison of Social Stories and Teaching Interaction Procedures for

Teaching Social Skills to Children and Adolescents With a

Pervasive Developmental Disorder

BY



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Dedicated to the

Participants of This Study

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## Abstract

This study compared social stories to the teaching interaction procedure for teaching social skills to six children and adolescents diagnosed with an autism spectrum disorder. Using a parallel treatment design, researchers taught 18 social skills with social stories and 18 social skills with teaching interaction procedures. The teaching interaction procedure was effective in teaching all 18 skills across the six participants. Social stories, within the same amount of teaching sessions, however, were effective in teaching 4 of the 18 social skills across the six participants. Also participants had greater generalization of social skills to adults and to peers when the skills were taught with the teaching interaction procedure. When the participants were allowed to choose whether they would be taught with the teaching interaction procedure or social stories, they had a slight preference for social stories.

# Introduction

Autism and pervasive developmental disorders are marked by qualitative impairments in language and social behavior, together with increased amounts of maladaptive behaviors such as repetitive self-stimulation, self-injury, and tantrums (American Psychiatric Association, 2000). These characteristics, if not effectively treated, typically persist into adolescence and adulthood and may lead to failures to develop meaningful friendships (e.g., Bauminger & Kasari, 2000), depression (e.g., Stewart, Barnard, Pearson, Hasan, & O'Brien, 2006), and problems in school (e.g., Ladd, Birch, & Buhs, 1999).

Over the past thirty years, a number of researchers have attempted to address some of the most critical and characteristic impairments in social behavior of children and adolescents with autism such as: lack of eye contract (Taras, Matson, & Leary, 1988), limited language (Koegel, Vernon, & Koegel, 2009), failure to display empathy with others (Leaf, Dotson, Oppenheim, Sheldon, & Sherman, 2010), and little interest in and enjoyment with other people (Bauminger, 2002). A variety of methods have been used to attempt to teach social behaviors: video modeling (Charlop-Christy, Le, & Freeman, 2000; Apple, Billingsley, Schwartz, 2005); discrete trial teaching (Lovaas, 1981, 1987; McEachin, Smith, & Lovaas, 1993); pivotal response training (Stahmer, 1995; Pierce & Schreibman, 1997); behavioral skills training (Stewart, Carr, & LeBlanc, 2007); teaching interaction procedures (Leaf et al., 2008); and social stories (Thiemann & Goldstein, 2001). In all of the studies cited above, appropriate experimental designs were used and the data collected showed that the procedures were effective in teaching participants more appropriate social behaviors. Thus, it is clear that social behaviors can be taught in a variety of ways to children and adolescents with autism. There are, however, a number of unanswered questions. For example, are there differences in the effectiveness and efficiency of the different

procedures? Since many of the procedures appear to contain common elements, are the common elements responsible for the effectiveness in teaching? Are different procedures more useful for some social behaviors than others? Are some procedures preferred more by participants than others to teach social skills?

The purpose of this study was to begin to address two of the important issues listed above: Are there differences in the effectiveness and efficiency of the different procedures used to teach social skills to adolescents with autism? Are some procedures preferred more by participants than others to teach social skills? In this study, the effects of two somewhat different methods of teaching were evaluated: social stories and the teaching interaction procedure. We selected these two procedures because social stories are a commonly implemented procedure with children and adolescents diagnosed with an autism spectrum disorder, and the teaching interaction procedure contains several elements (e.g., role-playing, reinforcement, demonstrations) that are commonly implemented to teach children and adolescents with autism.

**Social Stories**

Social stories are brief texts written by the teacher that describe a behavior to be displayed by the participant, when the participant should display the desired behavior, why the participant should display the desired behavior, and how displaying the desired behavior will affect others in their environment. These stories are either read aloud to participants by the teacher or read aloud by the participant (if she or he has the ability to read). In some studies, after the story has been read, the teacher either asks the participant comprehension questions to determine whether the participant understood the story or role-plays the social skill with the participant so that the participant can practice the desired social skill.

In 1993, Gray and Garand originally described the social story procedure specifying several important guidelines for teachers to follow. First, Gray and Garand recommended that the social story procedure only be implemented with children who fell in the "trainable mentally impaired range or higher who possess basic language skills" (p. 103). Second, when writing a social story, the teacher should write the story at the participant's comprehension level. Therefore, teachers should ensure that the length of the sentences, number of words, and types of words used in the social story match the comprehension level of the participant. Third, the social story should be individualized to the participant, so that the story describes the skills, environment, and people with whom the participant will come in contact. Fourth, each social story should address one behavior at a time. Additionally, Gray and Garand recommended that, when reading a social story, the teacher and the participant sit side by side.

The guidelines provided by Gray and Garand (1993) for writing the social stories also emphasized the types of sentences that were to be used. Gray and Garand stated that four sentence types (i.e., descriptive, perspective, affirmative, and directive) should be used to comprise a basic social story. Descriptive sentences are sentences that describe to participants when and where they should display the desired behavior. For example, when writing a social story on giving compliments, the teacher might write a descriptive sentence that states "A time when I can give a compliment is during school when my friend shows me a drawing that she made." Perspective sentences describe the reactions and feelings that others may have if the participant displays or does not display the desired behavior. For example, "If I give compliments, others might feel happy." Affirmative sentences describe a shared belief of society and state why the participant should engage in the desired behavior. For example, "People like it when others give compliments, and they will think I am a nice guy if I give compliments."

Directive sentences describe to the participant how to display the behavior. For example, "When giving a compliment, I need to say something specific that I like about the drawing." Although Gray and Garand (1993) initially did not provide clinicians with guidelines about the ratios of each type of sentence to be used within a social story, Gray (1995) later recommended that for every directive sentence there should be a total of two to four descriptive, affirmative, or perspective sentences combined.

There are a number of different presentation variations that have been used with social stories. One of them is the use of pictures or icons along with the text. Gray and Garand (1993) originally recommended that pictures and icons should not be used in social stories because they might be distracting or the participant might "make inaccurate interpretations of the situations based on the illustration (p. 105)." Later, however, Gray (1995) changed this recommendation and now recommends the use of both pictures and icons within a social story. Researchers have also used social stories with icons (Brownell, 2002), photos of the actual participants (Barry & Burlew, 2004), video images (Sansosti & Powell-Smith, 2008), and social stories without any visual aids (Kalyva & Agaliotis, 2009). To date, the most common way that social stories have been used in experimental research is with icons.

In addition to the use or nonuse of pictorial items within the social story, several other presentation variations have been used. These include whether the social story is printed on one page (Adams, Gouvousis, VanLue, & Waldron, 2004) or printed in a book format (Crozier & Tincani, 2007) and whether the participant should read the story to himself or herself (Sansosti & Powell-Smith, 2008) or if the teacher should read the story aloud to the participant (Bledsoe, Myles, & Simpson, 2003). There are only a small number of examples of each of these variations

in the published literature, and there is no empirical evidence available as to whether these variations affect participant outcomes.

Finally, the use of comprehension checks or role playing is a recommended component of the social story procedure (Gray & Garand, 1993) although the use of comprehension checks or role playing is relatively rare in the published research studies. For example, there are 31 studies cited in this paper that used social stories, but only 11 stated that they used comprehension checks and only 3 stated that they used role plays. Comprehension checks may be important because they ensure that the participant understood the social story. Role plays may be important because they provide the participant with opportunities to practice the skill that is being taught. Two examples of studies that used comprehension checks are ones by Theimann and Goldstein (2001) and Delano and Snell (2006), and examples of studies that used role plays are ones by Barry and Burlew (2004) and Theimann & Goldstein (2001). Since the effects of the comprehension checks or role plays were not evaluated separately from the other parts of the intervention in either study, however, there is no direct evidence that the comprehension checks or role plays affected participant learning.

Social stories have been used to address a number of different skills with children and adolescents with a variety of diagnoses and skill excesses and deficits. Some of the skills taught were not inherently "social" although the skill deficits were highly likely to affect other people. Examples include: hand washing (Hagiwara & Myles, 1999), choice making (Barry & Burlew, 2004), reducing tantrums (Lorimer, Simpson, Myles, & Ganz, 2002; Kuttler, Myles, & Carlson, 1998), and sitting (Crozier & Tincani, 2007). Other skills taught clearly seem to be "social" in that they typically involved moment-to-moment interactions between two or more people. Examples include: engaging in peer interaction (Scattone, Tingstrom, & Wilczynski, 2006),

stating appreciation (Delano & Snell, 2006), gaining attention (Soensken & Alper, 2006), making eye contact (Scattone 2008), and smiling (Scattone, 2008). Additionally, social stories have been used to teach children and adolescents diagnosed with autism (Bledsoe, Myles, & Simpson, 2003) as well as children and adolescents diagnosed with other types of disabilities (e.g., Zimbelman, Paschal, Hawley, Molgaard, & St. Romain, 2007).

The studies that have used social stories to address deficits in social behavior of children and adolescents diagnosed with a disability on the autism spectrum are described below. Table 1 describes 31 of the social story studies which were evaluated. Three of these studies are described below.

Delano and Snell (2006) used a multiple baseline design across participants to evaluate the effects of social stories on increasing the duration of social engagement with peers and on four specific social skills (i.e., seeking attention, initiating comments, initiating requests, and making contingent responses) for three children diagnosed with an autism spectrum disorder. Participants ranged in age from 6 to 9 years old. In this study, the researchers created a social story in a book format which contained icons along with the text. Each social story contained descriptive, perspective, affirmative, and directive sentences. The social story intervention began with the researchers reading the story aloud to the participant followed by comprehension questions to ensure that the participants understood the story that was read to him or her. After the comprehension questions, the participants returned to their natural environment and the researchers implemented probes to assess skill acquisition. The results of the study indicated that all three of the participants increased their social engagement and increased the frequency of displaying the four targeted social skills after the social story procedure was implemented.

Crozier and Tincani (2007) used a reversal design to evaluate the effects of social stories with icons on increasing three social behaviors (i.e., sitting at circle time, talking to peers, and playing with peers) for three children diagnosed with autism. Participants ranged in age from 3 to 5 years old. Each social story contained descriptive, perspective, affirmative, and directive sentences and contained icons relevant to the sentences written. The social story intervention began with the researchers reading the story aloud to the participant followed by comprehension questions to ensure that the participants understood the story that was read to him or her. After the comprehension questions, the participants returned to their natural environment and the researchers implemented probes to assess skill acquisition. Two of the participants increased their ability to demonstrate appropriate social behavior after the social story procedure was implemented. One participant, however, required both the social story procedure and prompts for the participant to demonstrate the social behaviors.

Dodd, Hupp, Jewell, & Krohn (2008) used a multiple baseline design across participants and skills to evaluate social story procedures using pictures on increasing compliments and decreasing giving excessive directions to peers with two children diagnosed with autism. The first participant was 9-year-old male, and the second participant was 12-year-old male. In this study, the researchers created a social story in a book format that contained pictures along with the text. Each social story contained descriptive, perspective, affirmative, and directive sentences. The social story intervention began with the researchers reading the story aloud to the participant followed by comprehension questions to ensure that the participants understood the story that was read to him or her. After the comprehension questions, the participants returned to their natural environment and the researchers implemented probes to assess skill acquisition. The

results of the study indicated that one of the two participants made gains following the implementation of the social story procedure.

**Teaching Interaction Procedure**

The teaching interaction procedure are a systematic form of instruction in which the teacher describes a skill, provides a rationale for why the participant should display the skill, describes the cues and characteristics of situations when the participant should display the skill, and then demonstrates the skill. Finally, the participant role plays the skill with the teacher. During role plays for social skills, the teacher provides simulated "opportunities" for the participant to display the social skill, waits for the participant to respond, prompts the participant to respond (if necessary), and provides feedback (e.g., praise and corrective oral feedback or tangible consequences) about the participant's performance.

The teaching interaction procedure were first implemented and evaluated as a component of the Achievement Place Teaching Family Model (Kirigin, Braukmann, Atwater, & Wolf, 1982; Phillips, Phillips, Fixsen, & Wolf, 1971; Phillips, Phillips, Fixsen, & Wolf, 1974). Subsequently, Harchik, Sherman, Sheldon, and Strouse (1992) evaluated the teaching interaction procedure for teaching staff members in a group home for adults with severe or profound intellectual disabilities. Staff members were taught to better implement a token economy, to increase the amount of time the adults were engaged in activities, and to increase the number of teaching components used.

The procedures used in teaching interactions have a number of similarities with several other procedures that are labeled differently. For example, teaching interaction procedures, discrete trial teaching, pivotal response training, and behavior skills training all provide the following: demonstrations of the skill to be taught, opportunities for the participant to practice

the skill that has been demonstrated, teacher prompts to assist the participant if necessary, praise and oral feedback, and tangible consequences for behavior. Table 2 describes studies that evaluated teaching interaction procedures for children and adolescents diagnosed with an autism spectrum disorder.

Leaf and colleagues (2009) were the first to examine the effectiveness of the teaching interaction procedure for teaching children diagnosed with autism. In this study, the researchers used teaching interaction procedures with three children diagnosed with autism to teach a variety of social skills towards their peers. Participants ranged in age from 5 to 7 years old. The researchers evaluated whether teaching interaction procedures were effective in improving the participants' ability to display social skills in the domains of conversation (i.e., not engaging in inappropriate conversation, using appropriate greetings, and making on-topic statements), play (i.e., sharing a toy, following a peer, playing what a peer wants to play), emotional skills (i.e., giving a compliment and including a peer in ongoing activities), and choosing the same peer throughout the day when asked to do special activities (e.g., take a note up to the secretary). During teaching, the researchers used prompting and positive reinforcement (praise and tokens that could be exchanged for toys or privileges following appropriate social skills displayed by each of the three participants). By the end of the study, all three participants substantially improved in the four skill domains taught.

In a follow up study, Leaf, Dotson, Oppenheim, Sheldon, and Sherman (2010) examined the effectiveness of the teaching interaction procedure implemented in a group instructional format to teach five participants diagnosed on the autism spectrum four different social skills, (showing appreciation, giving a compliment, making an empathetic statement, and changing the game when someone is bored). In the group teaching, each of the participants was required to

role play the skill before the entire group of children. Thus, the participants not only practiced the skills but also observed other participants practice the skill. Each of the four skills was divided into four to six smaller steps, and each step in a skill was taught and linked together using forward chaining procedures (Taylor, Levin, & Jasper, 1999) until participants were able to display each of the four skills correctly during role plays. Probes for participant generalization of the skills taught were conducted with adults who had not taught social skills and who would simply present an occasion for a social behavior to occur. At the end of the study, all participants displayed the four social skills both in role-play and generalization situations.

Dotson, Leaf, Sheldon, and Sherman (2010) utilized the teaching interaction procedure in a group instructional format to teach conversational skills to four adolescents diagnosed with autism and one diagnosed with ADHD. Prior to intervention, each of the participants was unable to adequately display conversational basics (e.g., looking a person in the eyes, maintaining correct body posture, and facing the person), conversational feedback and asking and answering open-ended questions. Following intervention, all of the participants displayed substantially improved performance on all three types of conversational skills with both peers and adults.

**Purpose of the study**

Both social stories and teaching interaction procedures appear to be effective methods to teach social behaviors to children and adolescents on the autism spectrum disorder. The purposes of the this study were: (1) to assess the relative effectiveness and efficiency of social stories and the teaching interaction procedure in teaching social skills to children and adolescents with autism; (2) to assess the level of generalization of the of the social skills taught by social stories and teaching interaction procedures to known adults and to peers; (3) to assess participant

preference for the two teaching procedures; and (4) to obtain consumer (e.g., parents, teachers, college students) evaluations of the quality of the newly taught behaviors.

## Method

### Participants

Participants were selected if they were under 18 years old and had a diagnosis on the autism spectrum. Additionally, participants had to meet the following criteria: (a) communicated in full sentences; (b) had good receptive language (i.e., were able to understand over 200 words, and could answer simple close-ended and open-ended questions); (c) had no immediate history of self-injurious, aggressive, or severe disruptive behaviors; and (d) had a standard score of 65 or higher on the Peabody Picture Vocabulary Test (PPVT-III). The researcher conducted direct observations of the participants in their natural environments as well as implemented formal assessments to determine if potential participants met these criteria. Six children, ages 5 to 13 years old, who met the criteria listed above were recruited to participate in this study. Table 3 provides demographic information for all six participants, all of whom were male.

Buddy was a six-year-old boy diagnosed with autism by a school psychologist. Buddy had a PPVT-III standard score of 91 (6.1 age equivalent). Buddy attended a general education kindergarten classroom without supports. Buddy could speak in full sentences, had good play skills (e.g., engaged in parallel play, cooperative play, and pretend play), and did not engage in obvious aberrant behaviors. Buddy had a previous history of being taught with both social stories and the teaching interaction procedure prior to this study.

Hank was a five-year-old boy diagnosed with Pervasive Developmental Disorder-Not Otherwise Specified by a licensed psychologist. Hank attended an early intervention clinic. Hank had a PPVT-III standard score of 128 (8.3 age equivalent). Hank could speak in full sentences,

had moderate play skills (e.g., engaged in parallel play and pretend play), displayed some self-stimulatory behaviors (e.g., pretending to be machines), and displayed mild aggressive behaviors. Prior to this study, Hank had a previous history with of being taught with both social stories and the teaching interaction procedure.

Nick was a five-year-old boy diagnosed with autism by a licensed psychologist. Nick attended general education kindergarten classroom without any supports. Nick had a PPVT-III standard score of 79 (3.11 age equivalent). Nick could speak in full sentences although a majority of his speech was non-conversational, had limited play skills (e.g., parallel play), and displayed self-stimulatory behaviors (e.g., vocal stimulatory behaviors). Prior to this study, Nick had a previous history of being taught with social stories but not with the teaching interaction procedure.

Lang was a five-year-old boy diagnosed with Aspergers Syndrome by a licensed psychologist. Lang was placed in general education kindergarten classroom setting with supports. Lang had a PPVT-III standard score of 104 (5.11 age equivalent). Lang could speak in full sentences, had moderate play skills (e.g., cooperative play, and pretend play), but had limited interests (e.g., trains and tornados) and engaged in repetitive behaviors. Prior to this study, Lang had a previous history of being taught with both social stories and the teaching interaction procedure.

Apollo was a twelve-year-old boy diagnosed with autism by a licensed psychologist. Apollo attended a general education sixth grade classroom without supports. Apollo had a PPVT-III standard score of 99 (12.1 age equivalent). Apollo could speak in full sentences, had good play skills (e.g., engaged in parallel play, cooperative play, and pretend play), and engaged

in mild self-stimulatory behaviors (e.g., lining up items). Apollo had a previous history of being taught with social stories but not with the teaching interaction procedure.

Mickey was a thirteen-year-old boy independently diagnosed with autism, attention deficit hyperactivity disorder, and Tourette Syndrome by a licensed psychologist. Mickey attended a general education junior high school (7th grade) without supports. Mickey had a PPVT-III standard score of 109 (14.3 age equivalent). Mickey could speak in full sentences, had good play skills (e.g., engaged in parallel play, cooperative play, and pretend play), and engaged in no obvious aberrant behaviors. Mickey had a previous history of being taught with social stories but not with the teaching interaction procedure prior to this study.

**Setting and Experimental Sessions**

The researcher conducted sessions either in a research room at a midwestern university or at the participants' homes. The research room was 3 meters by 1.5 meters and contained a cabinet, two chairs, toys, and a one-way mirror that allowed the participants' parents to observe the research sessions. When the researcher conducted sessions at the participants' homes, the sessions were conducted either in a living room or in a basement. Each room had a table, two chairs, and a variety of toys. The researcher conducted sessions both at the university and at the participant's home for Buddy, Hank, and Nick and entirely at home for Lang, Apollo, and Mickey.

The researcher conducted experimental sessions 3 to 6 days a week. Each experimental session lasted approximately 45 minutes. The session began with a series of opportunities the researcher provided for participants to display each of the social skills being taught or to-be-taught (labeled naturalistic probes) and was followed by the teaching of a social skill by using social stories and by the teaching of another social skill by using the teaching interaction

procedure. In all sessions, the researcher wore one colored shirt when using social stories to teach and another colored shirt when using the teaching interaction procedure to teach. For most experimental sessions, whether social stories or the teaching interaction procedure was used first was randomly determined. In every third session, however, participants had the opportunity to choose which method of teaching was used first by selecting the color of shirt that the researcher wore first. This was done to evaluate the preferences of participants for the two different methods of teaching.

**Skills Taught**

The researcher taught each participant six social skills. The researcher selected the social skills based on parents' answers on the Social Skills Rating Scale (Gersham & Elliot, 1990), informal parental interviews, and direct observation of participants. The researcher selected social skills that the parents indicated as the most important either on the Social Skills Rating Scale or during the parental interview. The researcher also selected social skills that could be broken into smaller steps. Each social skill was broken into a set of eight basic skill steps (i.e., face the person, look the person in the eye, have a relaxed body posture, use a neutral voice tone, smile, display no aggression, use no curse or nonsense words [e.g., words without meaning or not placed in a relevant context], and engage in no crying) and a varying number of skill-specific steps (e.g., providing a negotiation statement). Table 4 provides information on the social skills taught and the number of skill-specific steps.

To try to insure that the skills assigned to each teaching condition were roughly equivalent in difficulty and length, three pairs of skills were created so that each member of a pair of skills had approximately the same number of basic and skill-specific steps. Then one member of each pair was randomly assigned (by a computer program) to be taught by social

stories and the other was assigned to be taught by teaching interaction procedures. Additionally, if a particular social skill was taught to two different participants and the other skills being taught to the two participants were equivalent in number of steps, the particular social skill was randomly assigned to be taught with one procedure for one of the participants and taught using the other procedure for the other participant. This was done to ensure that different teaching methods would be used to teach the same skills across participants.

**Teaching Procedures**

**Teaching interaction procedures**. In the first part of the first teaching session where the teaching interaction procedure was used to teach a skill, the researcher taught each participant to state the name of the skill being taught, to state why use of this skill would be of benefit to the participant, and to state when it might be appropriate to use the skill. This teaching was done in the following way. The researcher made a statement (e.g., "Today we are going to talk about saying 'hello.'") and the asked the participant to state the skill to be taught (e.g., "What skill are we going to talk about today?"). If the participant stated the name of the skill, the researcher provided positive consequences (i.e., tickets and social praise). If the participant did not state the name of the skill, the researcher repeated the sequence until the participant stated the name correctly right after the researcher's question. In a similar manner, the researcher taught the participant to provide a rationale for why he should engage in this behavior (e.g., "If I say 'hello,' friends might ask me to play") and to state times or situations when it might be appropriate to display the skill (e.g., "I should say 'hello' when I see someone for the first time"). The same procedures were used at the beginning of each teaching session, except that the researcher simply asked the question (e.g., "What skill are we going to talk about today?") without the preceding model of the correct response.

In each of the teaching sessions, after the participant had answered the questions about the name of the skill being taught, provided a reason why he should display the skill, and stated when he might use the skill, the researcher described the skill. Initially, the researcher named the basic skill steps (e.g., face the person, look them in the eyes, smile) and asked the participant to name these steps. If the participant was not able to state all of the basic skill steps, the researcher repeated the list of steps and asked the participant to name all of them. This process continued until the participant could correctly name all the of the basic skill steps. The same procedure was used to teach the participant to name all of the skill specific steps. Throughout this teaching, the researcher praised participants and provided tickets (described below) for providing correct responses.

Next, the researcher demonstrated the skill steps using either the participant or the research assistant who set the occasion for the skill to be displayed. In this demonstration, the researcher displayed either all of the steps correctly, or displayed one or more steps incorrectly, or left some steps out. During demonstrations, steps that the participants had difficulty displaying in the naturalistic probes (described below) were the steps that the researcher frequently displayed incorrectly or left out. For example, if a participant did not display a positive voice tone and correct posture during the naturalistic probe, then the researcher frequently displayed an incorrect voice tone and body posture during demonstrations. Once a participant displayed all steps in the naturalistic probes correctly, then the researcher typically did not display any steps incorrectly nor did he leave out any steps. After the first demonstration of the skill by the researcher, the researcher asked the participant to state if the researcher provided a correct or an incorrect demonstration of the social skill being taught. If the researcher demonstrated the skill correctly and the participant said it was correct, the researcher praised the participant and asked

him to name all of the steps that that the researcher demonstrated. If the researcher demonstrated the skill incorrectly and the participant said it was incorrect, the researcher praised the participant and asked him to name all of the steps that the researcher displayed and to label them as correctly or incorrectly performed or left out. If the participant did not accurately label a skill step as correctly or incorrectly preformed or being left out, the researcher gave the participant feedback and again asked the participant to label each of the demonstration steps as correct, incorrect, or not displayed. Following this, the researcher demonstrated the social skill for the second time; this time, however, the researcher displayed all of the steps correctly and followed the same procedure described above.

Immediately following the researcher's correct demonstration of the skill, the participant practiced the skill steps in role-play situations. The researcher told the participant that it was his turn to practice, and the researcher engaged in behaviors that set the occasion for the participant to display the social behavior currently being taught. If the participant correctly displayed all steps in the skill, the researcher praised the participant and gave him one or more tickets. If the participant incorrectly displayed any steps in the skill or omitted a step, the researcher named the steps that the participant displayed correctly, praised the participant, and named the steps that participant displayed incorrectly. Then the role play was repeated with the same consequences for the participant's correct and incorrect performances. If, after two role-play practices, a participant did not display correct performance of all of the skill steps, a third role play was conducted. In this role play, the researcher prompted correct performance of each step, usually by reminding the participant which step in the social skill was next. After the role-play, the participant was given a short break.

**Development of Social Stories.** According to Gray and Garand (1993), an important element of social stories is that they are individualized to the learner (e.g., story is written in first person, describes environments in which the learner comes in contact with the social situation, and is written to the learner's comprehension level). Thus, the researcher created individual social stories for each participant for each social skill taught in this study. All of the stories had four types of sentences (descriptive, perspective, affirmative, and directive) in the proportion of one directive sentence to two to four descriptive, perspective, or affirmative sentences as recommended by Gray (1995). Each social story was in a book format: one sentence was printed at the bottom of each page, center aligned, in Times New Roman 22 point font boldface. The researcher placed a relevant clip-art picture or cartoon picture (e.g., Felix the Cat smiling) right above each sentence in the center of the page and a page number on the bottom of each page. The pages were put into a three ring-binder or professionally bound. Table 5 lists information about each of the social stories. An example of one of the social stories that was implemented in this study is provided in Appendix A.

**Social Story Implementation**. The researcher read aloud the social story relevant to the skill being taught one time at the beginning of each teaching session. To start the social story, the researcher asked the participant to sit alongside the researcher, and praised the participant when he did so. Next, the researcher asked the participant if he was ready to have the social story read to him. When the participant was ready, the researcher read each page aloud to the participant. While reading each sentence aloud, the researcher used his index finger to point to the words that he was reading. When the researcher reached the end of a page, he praised the participant and gave him a ticket if he looked at the book all of the time while the researcher read the sentence and did not engage in any inappropriate behavior during that time. If, however, the participant

engaged in any inappropriate behavior or did not look at the book at the end of the page, the researcher gave corrective feedback (e.g., “Bummer, dude, you need to pay attention.”) and did not give the participant a ticket. At approximately every third or fourth page, the researcher also provided social praise to the participant for looking at the book while the researcher read the sentence.

Once the researcher read all the pages, the researcher asked the participant comprehension questions to ensure that the participant understood the social story. The first question was “What did the book talk about.” If the participant was able to answer the question correctly (e.g., “The book talked about losing graciously”), the researcher praised the participant and gave him a ticket. If the participant answered the question incorrectly or did not respond to the question, the researcher provided corrective feedback (e.g., “That’s not it” or “You need to try”) to the participant and repeated the question. If the participant answered correctly when the researcher repeated the question, the teacher provided social praise and a ticket. If, however, the participant did not answer the question correctly on the second try, the researcher provided corrective feedback and asked the question again. The third time, the researcher asked the question, immediately provided the correct answer to the participant, and waited until the participant stated the correct answer. Once the participant stated the correct answer, the researcher provided social praise only.

The procedures for the second, third, and fourth comprehension questions were the same for the first question. The second comprehension question that was asked was, “When should you display the desired social behavior?” The third comprehension question that was asked was, “Why should you display the desired social behavior?” The final question that the researcher

asked was, “What are the steps for the desired social behavior?” Once the participant was done answering questions correctly, the researcher gave him a brief 5 min break.

**Reinforcement Procedures**

The researcher used a token economy whereby participants were able to earn tickets during both teaching procedures. Tickets could be exchanged for tangible reinforcers (e.g., bouncy balls, Whoopie Cushions©, or candy) or privileges (e.g., going outside to play or visiting a professor) at the end of a research session. Participants could also save tickets across research sessions to earn larger reinforcers (e.g., fountain pen, gift card, video-game). During teaching interactions, the researcher provided tickets to participants for answering questions correctly and for role-playing correctly. During social stories, the researcher provided tickets to participants for looking at the social story book without displaying any inappropriate behaviors and for answering questions correctly. The researcher equated tickets so that a participant had the possibility of earning the same amount of tickets for both social stories and teaching interactions in a given research session.

**Probes and Dependent Measures**

**Naturalistic probes**. The researcher conducted naturalistic probes to determine mastery of each of the social skills taught to the participant. Naturalistic probes always occurred prior to a teaching session and no instruction or prompts were given to participant prior or during probes. Additionally, participants received no social or other consequences for their behaviors during probes. During naturalistic probes, the researcher simply engaged in a behavior that set the occasion for the participant to display one of the social skills taught or to be taught (see Tables 6-11). For example, if one of the social skills taught was giving a compliment, the researcher would show a picture that the researcher had drawn to the participant and wait to see if the

participant would make a response. After one minute, the teacher recorded which steps the participant displayed and which steps the participant did not display. The researchers implemented naturalistic probes prior to teaching sessions every day for each skill to be taught or that had been taught, throughout all phases of the study.

Mastery criterion was defined as the participant displaying 100% of the skill steps correctly (i.e., both basic and skill specific steps) during naturalistic probes for three consecutive sessions. If the participant reached mastery criterion for a skill taught with one of the teaching procedure but did not reach mastery criterion for a skill taught with the other teaching procedure (e.g., a participant reached mastery criterion for a skill taught with the teaching interaction procedure but did not reach mastery criterion for a skill taught with social stories), teaching continued for the non-mastered skill until (a) researchers conducted at least a total of 12 naturalistic probes and (b) there were at least five additional teaching sessions implemented for the skill using the procedure that did not produce mastery criterion.

**Generalization probes with adults**. The researcher conducted generalization probes with other adults to determine whether participants displayed the social skills to known adults (e.g., parents or research assistants) who had not taught the participants. Generalization probes with known adults took place 10 to 20 min after all teaching was implemented for that day. The researcher did not prime, reinforce, or prompt participants during generalization probes; the researcher, however, was present during these generalization probes with known adults. During generalization probes with known adults, the adult engaged in a certain behavior that should set the occasion for the participant to display a desired social skill (see Tables 6-11). The researcher implemented generalization probes with adults throughout all phases of the study depending on

the availability of a parent or research assistant. All six social skills were tested in a random order in generalization probes.

**Generalization probes with peers**. The researcher also conducted generalization probes with peers of the participants to determine whether participants displayed social skills taught to them towards their peers. The researcher implemented generalization probes with peers in the teaching area prior to beginning teaching of any social skills and after all social skills had been taught. During generalization probes with peers, the researcher was present but did not prompt or reinforce the participants. Generalization probes with peers consisted of the peer engaging in a certain behavior that should set the occasion for the participant to display a desired social skill (see Tables 6-11). For Mickey and Apollo, the researcher conducted generalization probes with peers prior to and following intervention. The researcher implemented generalization probes with peers following only intervention for Buddy, Nick, and Lang. No generalization probes with peers were implemented for Hank because his family moved before generalization probes with peers could be conducted.

**Efficiency of teaching procedures.** The researcher evaluated the efficiency of the two teaching procedures with two measures. The first measure of efficiency was the number of sessions it took each participant to learn the social skills taught with the two teaching procedures. The second measure of efficiency was the amount of time that it took participants to learn social skills with the two teaching procedures.

**Participant preference of the two teaching procedures.** A concurrent-chain arrangement (Hanley, Piazza, Fisher, Contrucci, & Maglieri, 1997; Hanley, Piazza, Fisher, & Maglieri, 2005) was used to determine participant preference for the two teaching procedures. During every third teaching session, the researcher placed three differently colored shirts (i.e.,

the shirt that represented teaching interaction procedures, the shirt that represented social stories, and the shirt that represented a control condition) on the floor and asked the participant to select the color shirt that he wanted to work with first. The researcher then put on the color shirt that the participant selected and began teaching with the procedure that corresponded with that color shirt, and that teaching procedure was recorded as the most preferred for that session. If the participant selected the control color shirt, then the researcher randomly selected what color shirt to wear and used the teaching procedure that corresponded to that color for the first teaching session for that day.

Prior to baseline, the researcher conducted a paired preference assessment (Fisher et al., 1992) to determine each of the participant's preferences among 10 different colors to ensure that the participants were selecting the colored shirts based upon preference of the procedures and not based upon a color preference. The participant's most frequent color selection was paired with a control condition while each of two colors that were selected with equal frequency during this assessment were assigned to one of the two teaching conditions (i.e., teaching interaction procedures or social stories). Thus, during teaching with social stories, the researcher wore a shirt of one color (e.g., blue), and during teaching with the teaching interaction procedure, the teacher wore a shirt of a different color (e.g., yellow).

**Social validity.** Once all of the participants were finished with the study, the researcher evaluated the social validity of the skills that were taught to participants. In order to assess social validity, the researcher randomly selected videotapes of the participants prior to and following all teaching for each of the types of probes (i.e., naturalistic, generalization with adults, and generalization with peer) that the participants were exposed to. The researcher then randomly determined the order of these videotapes and had three judges (i.e., a teacher, a retiree, and a

mother) rate on a 5- point scale how well the participant displayed the specific skill. (See Appendix B)

**General Procedures**

The research consisted of three distinctive phases: an initial baseline condition, an intervention condition, and a final maintenance condition. Due to the nature of the research design (described below), during the intervention condition some skills were being taught while other skills that already had been taught were in maintenance conditions or were in baseline conditions prior to being taught.

**Initial baseline condition.** An initial baseline occurred prior to any teaching of the social skills. Each research session in this condition began with the researcher implementing naturalistic probes (described above) for each of the six social skills to be taught to a participant. The order of the naturalistic probes for the skills was randomly determined ahead of time. The naturalistic probes were followed by a short 5-min break where the participant played with toys or other items that were in the room. Following this short break, a research assistant or the participant's parent implemented generalization probes for adults (described above) for each of the six social skills. The order of the social skills for generalization probes with adults was randomly determined ahead of time.

After all six generalization probes with adults were conducted for Buddy, Hank, Nick, and Lang, the research session ended; for Apollo and Mickey, however, they had another 5-min break where they could play with toys or other items that were in the room. Following this short break, a peer-implemented generalization probe with a peer occurred (described above). The order of the generalization probes with peers for each of the six social skills was randomly determined. After all six generalization probes with peers were conducted, the research session

was terminated for that day. The initial baseline condition was implemented until each participants performance on naturalistic probes remained stable and low for at least two of the social skills during naturalistic probes.

**Intervention condition.** During the intervention condition, at least two social skills (one assigned to the teaching interaction procedure and one assigned to social stories) were taught while the other four skills were placed either in a baseline or maintenance phase. Each research session began with the researcher implementing naturalistic probes for both social skills that were being taught and for the other social skills that were either in a baseline or maintenance phase. The order of the naturalistic probes for each skill was determined ahead of time. The naturalistic probes were followed by a short 5-min break where the participant played with toys or other items that were in the room. After this 5-min break, the researcher implemented one of the two teaching conditions (i.e., teaching interactions or social stories). This was followed by another brief 5-min break. Following this 5-min break, the researcher implemented the other teaching condition (i.e., teaching interactions or social stories). The researcher randomly selected the order of the two teaching conditions, except for every third day where participants chose which procedure was implemented first. Following the implementation of both of the teaching procedures, the participant had a longer break of approximately 10 to 20 minutes where he could play with toys in his environment and/or could interact with people (e.g., teachers or parents) within his environment.

**Final maintenance condition.** Once the participant had reached mastery criterion on all of the social skills or teaching had been terminated (using the criteria above), a final maintenance condition was implemented. Each research session began with the researcher implementing naturalistic probes (described above) for all six social skills. The order of the naturalistic probes

for the skills was randomly determined. The naturalistic probes were followed by a short 5-min break where the participant played with toys or other items that were in the room. Following this short break, a research assistant or the parents of the participant implemented generalization probes for adults (described above) for all six social skills. The order of the generalization probes with adults for the skills was randomly determined. For every participant other than Hank, generalization probes with peers were conducted during this condition. The order of the generalization probes with peers for the skills was randomly determined.

**Interobserver Agreement and Treatment Fidelity**

The researcher and a research assistant independently recorded participant behaviors (in vivo and from the video recordings during 39.7% of naturalistic probes (range, 34-49.4% across participants), 46.2% of generalization probes with other adults (range, 33-65.2% across participants), and 37.3% (range, 33.3-61.1% across participants) of generalization probes with children, across all participants. Interobserver agreement was calculated by totaling the number of times observers agreed on the scoring of each skill step (as correct or incorrect) divided by the total number of agreements and disagreements on scoring each skill step. This was converted to a percentage of agreement per each skill. Percentage agreement across all naturalistic probes was 96.9% (range, 77.7-100%), across all generalization probes with adults was 96.6% (range, 76.9-100%), and across all generalization probes with peers was 97.3% (range 83.3-100%) across all participants. Tables 12-17 provide the percentage of sessions and levels of reliability for each of the participants.

To assess reliability of the procedural implementation (treatment fidelity), an independent observer recorded planned instructor behaviors during 68.7% of the time the researcher taught with the teaching interaction procedure, and 62.1% of the time the researcher taught with social

stories. Planned researcher behaviors during the teaching interaction procedure was when the researcher (a) labeling and asking the participant to label the behavior; (b) asking the participant to provide a rationale; (c) asking the participant to state when he should engage in the behavior; (d) asking the participant to state each of the behavioral steps; (e) demonstrating the social skill; (f) asking the participant to evaluate the researchers demonstration of the behavior; (g) asking the participant to role play the social skill; (h) providing feedback on the role play; (i) providing tickets for appropriate participant behavior. Planned researcher behavior during social stories where when the researcher (a) had the participant sit by the teacher; (b) read each of the pages; (c) asked the first, second, third, and fourth comprehension questions; and ( d) the researcher providing praise and tickets for appropriate participant behaviors.

The observer recorded that the researcher implemented planned research behaviors on 100% of the occasions during both the teaching interaction procedure and social stories. Table 18 provides information on the treatment fidelity for each of the participants. A second observer independently and simultaneously recorded the researcher's planned research behaviors for 44.3% of videotapes scored by the first observer during teaching by the teaching interaction procedures and 41% of videotapes scored by the first observer during teaching by social stories. Interobserver agreement was calculated by comparing the scoring of each of the planned research behaviors by the two observers. The observers agreed on the scoring of planned research behaviors 100% of the instances during the teaching interaction procedure and 99.1% (range 87.5-100%) of the instances during social stories.

**Experimental Design**

The researcher used a parallel treatment design (Gast & Wolery, 1988) to evaluate the effectiveness of the two social skills interventions. In this study, two different procedures (social

stories and teaching interaction procedures) were used to evaluate the effects on participants' learning different social skills. Differences in the effectiveness of the two procedures would be indicated if one of the teaching procedure produced more behavioral change than the other teaching procedure. Difference in the efficiency of the two procedures would be indicated if one of the teaching procedure produced learning more rapidly than the other teaching procedure. Important features of the parallel treatment design for this study are that both interventions are started at the same time, that the skills assigned to each intervention are equal in difficulty, and that the same amount of time is assigned to each of the teaching interventions.

## Results

### Skill Acquisition, Mastery Criterion, and Maintenance

The researcher taught six social skills to each participant, three of which were taught using teaching interaction procedures and three of which were taught using social stories. Thus a total of 18 social skills were taught with each method of teaching. Across all six participants, mastery criterion (i.e., 100% correct during naturalistic probes across 3 consecutive sessions) was reached on 18 out of the 18 social skills taught with the teaching interaction procedure whereas 4 out of the 18 social skills taught using social stories reached mastery criterion. Although only 4 out of 18 social skills taught with social stories met mastery criterion, most of the other skills taught with social stories showed some increase from the baseline condition. The 18 skills that were taught to participants to the mastery criterion using the teaching interaction procedure appeared to be well maintained following initial training during the naturalistic probes. The 4 skills that were taught to participants to the mastery criterion using social stories also appeared to be well maintained once they had been taught, Figures 1 to 6 show these results.

On these graphs, the open circles represent the percent of basic skill steps performed correctly and the closed circles represent the percent of the skill specific steps preformed correctly.

Buddy reached mastery criterion (3 consecutive naturalistic probes with all skill steps correct for the skill being taught) for all skills taught using the teaching interaction procedure and for two of the social skills taught using social stories (see Figure 1). The one social skill on which he did not reach mastery criterion with social stories, however, did improve significantly. During the assessment of maintenance on naturalistic probes, Buddy maintained 100% of the basic skill and skill specific steps across the three social skills taught with the teaching interaction procedure and maintained an average of 82.9% correct (range 77.1% to 100% across skills) on skill specific steps and 99.4% correct (range 99% to 100%) on basic skill steps across the three social skills taught with social stories.

Hank reached mastery criterion for all skills taught using the teaching interaction procedure and did not reach mastery criterion for any of the social skills taught with social stories (see Figure 2). Hank, however, did improve from baseline levels for one of the social skills taught (showing his work) using social stories. During the assessment of maintenance, during naturalistic probes, Hank displayed an average of 91.4% correct (range 87.5% to 100% across skills) on skill specific steps and displayed 100% of the basic steps correctly across the three social skills taught with the teaching interaction and displayed an average of 12.1% correct (range 0% to 35% across skills) on skill specific steps and 98.3% correct (range 92.3% to 100%) on the basic skill steps across the three social skills taught with social stories.

Nick reached mastery criterion for all of the social skills taught using the teaching interaction procedure and did not reach mastery criterion for any of the social skills taught with social stories (see Figure 3). Nick showed an increase from baseline levels on one of the social

skills taught (appropriate greetings) using social stories. During the assessment of maintenance on naturalistic probes, Nick displayed an average of 82% correct (range 50% to 100% across skills) on skill specific steps across and 100% correct on basic skill steps for the three social skills taught with the teaching interaction and displayed an average of 9.2% correct (range 0% to 15% across skills) on skill specific steps and 96.5% correct (range 93.75% to 100% across skills) on skill basic steps across the three social skills taught with social stories.

Lang reached mastery criterion for all social skills taught using the teaching interaction procedure and on one of the social skills taught using social stories (see Figure 4). Lang additionally showed an improvement from baseline levels for one of the social skills (interrupting appropriately) taught with the social story procedure. During the assessment of maintenance on naturalistic probes, Lang displayed an average of 83.3% correct (range 66.7% to 92.9% across skills) on skill specific steps across and 99% (range 98.5% to 100% across skills) correct on basic skill steps across the three social skills taught with the teaching interaction and displayed an average of 32.2% correct (range 11.1% to 87.5% across skills) on skill specific steps and 90.9% (range 89.3% to 100% across skills) on basic skill steps across the three social skills taught with social stories.

Apollo reached mastery criterion for all social skills taught using the teaching interaction procedure and did not reach mastery criterion for any of the social skills taught with social stories (see Figure 5). Although none of the social skills using social stories reached mastery criterion, one of the skills (negotiation) did show a significant increase from baseline levels. During the assessment of maintenance on naturalistic probes, Apollo displayed an average of 75.4% correct (range 68.8% to 100% across skills) on skill specific steps and 98.8% correct (range 96.8% to 100% across skills) on basic skill steps across the three social skills taught with

the teaching interaction and displayed an average of 34.9% correct (range 2.2% to 60% across skills) on skill specific steps and 98.8% correct (range 96.9% to 100% across skills) on basic skill steps across the three social skills taught with social stories.

Mickey reached mastery criterion for all social skills taught using the teaching interaction procedure and for one of the social skills (providing assistance) taught using social stories (see Figure 6). Although only one social skill reached mastery criterion using social stories, the other two social skills did show a significant increase from baseline levels. During the assessment of maintenance on naturalistic probes, Mickey displayed an average of 89% correct (range 85.7% to 100% across skills) on skill specific steps and 100% correct on basic skill steps across the three social skills taught with the teaching interaction and displayed an average of 62.8% correct (range 53.2% to 77.5% across skills) on skill specific steps and 95% correct (range 90% to 100% across skills) on basic skill steps across the three social skills taught with social stories.

**Generalization with Adults**

Assessments of generalization with adults was conducted prior to intervention, during intervention, and following intervention for every social skill taught to each of the 6 participants to determine if the skills displayed in teaching and naturalistic probes generalized to other adults. Figure 7 to 12 display the results for the generalization towards adults. In general, similar amounts of social steps (basic steps and skill specific steps) that were taught to participants and displayed in the naturalistic probes also occurred in the probes for generalization with adults. The major difference was that performance of social skills taught with the teaching interaction procedure was, on the average, much higher than the performance of the social skills taught with social stories. The skill specific steps taught using the teaching interaction procedure were correctly displayed in naturalistic probes 87% of the time and in generalization probes with

adults 81% of the time following intervention. In contrast, the skill steps taught using social stories were correctly displayed in naturalistic probes 39% of the time and in generalization probes with adults 31% of the time following intervention.

Prior to intervention, Buddy displayed an average of 6.2% (range 4.8% to 11.1% across skills) on skill specific steps across the three social skills taught with the teaching interaction procedure and an average of 2.9% (range 0% to 16.7% across skills) on skill specific steps across the three social skills taught with social stories. Following intervention, Buddy displayed an average of 95% (range 90% to 100% across skills) on skill specific steps across the three social skills taught with the teaching interaction and an average of 68.8% (range 33.3% to 85.7% across skills) on skill specific steps across the three social skills taught with social stories.

Prior to intervention, Hank displayed none (0%) of the skill specific steps for each of the six social skills during generalization probes with adults. Following intervention, Hank displayed an average of 91.9% (range 84.3% to 100% across skills) on skill specific steps across the three social skills taught with the teaching interaction and an average of 5.8% (range 0% to 16.7% across skills) on skill specific steps across the three social skills taught with social stories.

Prior to intervention, Nick displayed an average of 8.8% (range 0% to 14.8% across skills) on skill specific steps across the three social skills taught with the teaching interaction procedure and an average of 1.11% (range 0% to 6.7% across skills) on skill specific steps across the three social skills taught with social stories. Following intervention, Nick displayed an average of 59.2% (range 15% to 90.9% across skills) on skill specific steps across the three social skills taught with the teaching interaction and an average of 7.3% (range 0% to 12.7% across skills) on skill specific steps across the three social skills taught with social stories.

Prior to intervention, Lang displayed an average of 1.1% (range 0% to 2.2% across skills) on skill specific steps across the three social skills taught with the teaching interaction procedure and none (0%) of the skill specific steps across the three social skills taught with social stories. Following intervention, Lang displayed an average of 98.6% (range 97.2% to 100% across skills) on skill specific steps across the three social skills taught with the teaching interaction and an average of 27.7% (range 16.7% to 33.3% across skills) on skill specific steps across the three social skills taught with social stories.

Prior to intervention, Apollo displayed an average of 8.4% (range 0% to 16.7% across skills) on skill specific steps across the three social skills taught with the teaching interaction procedure and an average of 3.7% (range 0% to 7.4% across skills) on skill specific steps across the three social skills taught with social stories. Following intervention, Apollo displayed an average of 62% (range 52.7% to 100% across skills) on skill specific steps across the three social skills taught with the teaching interaction and an average of 27.3% (range 0% to 47.2% across skills) on skill specific steps across the three social skills taught with social stories.

Prior to intervention, Mickey displayed an average of 8.4% (range 0% to 16.7% across skills) on skill specific steps across the three social skills taught with the teaching interaction procedure and an average of 0.9% (range 0% to 1.9% across skills) on skill specific steps across the three social skills taught with social stories. Following intervention, Mickey displayed an average of 77% (range 68.9% to 100% across skills) on skill specific steps across the three social skills taught with the teaching interaction and an average of 50.4% (range 37.3% to 72.2% across skills) on skill specific steps across the three social skills taught with social stories.

**Generalization with Peers**

The researcher conducted a post analysis to assess Buddy's, Nick's, and Lang's ability to display the social skills taught to them towards peers. Table 19-21 displays these results. After teaching, the social skill steps that were correctly displayed in the naturalistic probes generally were also correctly displayed in the generalization probes with peers. The overall level of correctly displayed skill specific steps in generalization probes with peers, however, was lower than in the naturalistic probes. Additionally, there was at least one instance where high levels of skill specific steps were displayed in the naturalistic probes whereas very low levels of these skill specific steps were displayed in the generalization probes with peers (e.g., Nick for skill specific steps for "sportsmanship").

Buddy generalized all social skills taught to him with teaching interaction procedures except for the first generalization probe with peers for the skill of losing graciously. Additionally, Buddy showed high levels (average of 75% across all three skills) for generalization to peers on social skills taught to him with social stories. Nick did not show any generalization towards peers with the exception of two probes (33% and 100% respectively) for giving compliments which had been taught with teaching interaction procedures. Lang displayed high levels of generalization towards peers with skills taught with the teaching interaction procedure and showed variability on social skills taught with social stories.

The researcher conducted a pre-post analysis to assess Apollo's and Mickey's ability to display the social skills taught to them towards peers. Tables 22 and 23 represent these results. Prior to intervention, Apollo displayed an average of 9.7% on skill specific steps across the three social skills taught with the teaching interaction procedure and an average of 1.9% for the three social skills taught with social stories on generalization probes with peers. Following

intervention, Apollo increased his correct responding during generalization probes with peers on all three social skills taught with the teaching interaction procedure to an average of 77.7% and increased his correct responding for skills taught with social stories to an average of 14.8%. Prior to intervention, Mickey showed zero level of responding during generalization probes with peers on five of the six social skills (i.e., compliments, losing and winning graciously, providing assistance, showing interest, and on-topic conversation) and showed correct responding on 16.7% of skill specific steps for changing the game. Following intervention, Mickey increased his correct responding to an average of 87.4% on skill specific steps across the three social skills taught with the teaching interaction and an average of 61.3% on skill specific steps across the three social skills taught with social studies during generalization probes with peers on skill specific steps all 6 social skills. No analysis with peers was completed for Hank.

**Efficiency Measure**

In order to assess the efficiency of the two interventions, the researcher determined the total number of sessions and the total amount of time that was required to teach each of the social skills. Results are shown in Tables 24-29. Across all 6 participants and across all 36 social skills, social skills that were taught using the teaching interaction procedure required less sessions and required less total time than skills taught with social stories. The 18 skills taught to mastery using teaching interaction procedures required an average of 47 minutes and 6.4 sessions per skill. The 4 skills taught to mastery using social stories required an average of 63 minutes and 11.25 sessions per skill. The 14 skills taught with social stories that did not reach mastery criterion required an average of 59 minutes and 12.8 sessions per skill.

**Preference Measure**

The participants showed mixed preferences for the two social interventions (see Table 30). Buddy selected the shirt that corresponded with the teaching interaction procedure 7 times, the shirt that corresponded with social stories 3 times, and never chose the shirt that corresponded with the control condition. Hank selected the shirt that corresponded with the social story during every opportunity to make a preference selection. Nick selected the shirt that corresponded with the teaching interaction procedure 4 times, the shirt that corresponded with social stories 4 times, and the shirt that corresponded with the control condition 4 times. Lang selected the shirt that corresponded with the teaching interaction procedure 3 times, the shirt that corresponded with social stories 7 times, and the shirt that corresponded with the control condition 5 times. Apollo selected the shirt that corresponded with the teaching interaction procedure 3 times, the shirt that corresponded with social stories 5 times, and the shirt that corresponded with the control condition 5 times. Mickey selected the shirt that corresponded with the teaching interaction procedure 4 times, the shirt that corresponded with social stories 4 times, and the shirt that corresponded with the control condition 2 times. Thus, overall, the participants demonstrated a preference for the social story procedure over the teaching interaction procedure.

**Social Validity**

Once all of the participants were finished with the study, outside raters evaluated the social validity of the skills that were taught to participants. Three consumers observed video-tapes of the participants and rated on a 5- point (from “1” indicating “not well at all” to “5” indicating “very well”) scale on how well the six participants displayed each of their social skills prior to and following intervention for naturalistic probes, generalization probes with adults, and

generalization probes with peers. Results of the social validity are displayed on Table 31. Judges rated the participants as not displaying the social skills well on any of the probes (naturalistic probes, generalization probes with adults, or generalization probes with peers) prior to intervention. Following intervention, judges rated the participants as displaying the social skills much better. The ratings for all three types of probes were higher for skills taught using teaching interaction procedures than for skills taught with social stories.

## Discussion

In this study, the researchers compared the teaching interaction procedure to the social story procedures for teaching a variety of social skills to six participants with an Autism Spectrum Disorder. The results of the study were that all participants reached a mastery criterion during naturalistic probes with researchers on all 18 social skills taught using the teaching interaction procedure. Social stories resulted in the participants reaching a mastery criterion on only four of the skills, showing an improvement on eight of the skills, and achieving minimal gains on six of the skills. Participants also showed higher levels of maintenance during naturalistic probes on social skills taught with the teaching interaction procedure as compared to social skills taught with social stories.

Across the six participants, the teaching interaction procedure showed higher levels of generalization during probes with adults as well as on probes with peers than social skills that were taught using social stories. The teaching interaction procedure also required fewer teaching sessions and less time to teach each of the 18 social skills than did social stories. Furthermore, on the social validity survey that was completed following intervention, consumers rated the participants' displays of skills that were taught using teaching interaction procedures higher than those taught with social stories. The consumers, however, also indicated that participants'

performance on skills taught with social stories improved following intervention. Results regarding participant preference for one of the procedures were mixed across the six participants, but overall there was a preference for social stories.

Previous research studies have demonstrated great variability in the effectiveness of social stories. Reported behavior change has ranged from slight behavior change (e.g., Dodd et al., 2008) to substantial behavior change (e.g., Thiemann & Goldstein, 2001) across participants and across skills. The findings of the present study also demonstrated a range of outcomes with social stories. Although participants' performance increased from baseline levels on a majority of skills (66.6%) taught to them using the social stories procedure, 14 skills taught did not reach mastery criterion. This is perhaps because we used a very stringent mastery criterion (i.e., three consecutive sessions of displaying 100% of the skill steps) whereas the previous research either looked at trends (e.g., Crozier & Tincani, 2005), had no stated mastery criterion (e.g., Barry & Burlew, 2004), or had a less stringent mastery criterion (e.g., 40% behavior change from baseline levels) (e.g., Delano & Snell, 2006). Therefore, it may have been more difficult for participants to meet mastery criterion in this study as compared to the previous research.

In contrast to the previous social story research that demonstrated some degree of effectiveness for most participants, in the present study, three participants (i.e., Hank, Nick, and Apollo) showed no improvement for six of the social skills taught to them using social stories. One possible reason for this difference may be that more complex skills were taught than in the previous research. A second possible reason may be due to the timing of the probes. In this study, probes were conducted to determine skill acquisition prior to the implementation of the social story procedure each day. In contrast, in 30 of the 31 studies reviewed using social stories to teach skills, researchers implemented probes to determine skill acquisition closely following

the implementation of the social story procedures each session. Implementing the social story procedure prior to conducting probes may increase the likelihood that participants will display the social skills, therefore, resulting in higher skill acquisition.

Results of this study are similar to previous research on the teaching interaction procedure: participants increased their social behavior using a stringent mastery criterion (e.g., three consecutive sessions of displaying 100% of the skill steps) with probes implemented probes prior to teaching. Additionally, there was substantial generalization of skills that were somewhat different than the teaching situations.

There are several factors that may be related to why the teaching interaction procedure was more effective than social stories in the present study. Perhaps the most important factor is the role-play component. In the teaching interaction procedure, participants had the opportunity to practice the desired social skills. Although Gray and Garand (1993) recommended the use of role playing in social stories, role playing is rarely implemented in the published literature on social stories and was not implemented in the present study. Role playing provides opportunities for participants to practice the social skills in conditions similar to naturalistic and generalization probes as well as allows the participants to receive both positive and corrective feedback for practicing the social skills. Thus, the practice and feedback may increase the likelihood of the participant generalizing the social skill to different settings.

A second reason the teaching interaction procedure may have been more effective than social stories is that the teaching interaction procedure involves the researcher demonstrating the social behavior. Demonstration of the social behavior allows the participants an opportunity to observe how to accurately perform the desired social skill. Children with Autism Spectrum Disorder may not fully understand the social skills by simply reading or listening to a

description. The teacher's demonstration may provide a more complete and clear illustration of the specific steps the participant needs to perform than is typically available in a social story. Additionally, the demonstration component of the teaching interaction procedure allows the teacher to highlight the steps that the participant may be struggling with, allowing the participant to better comprehend the steps upon which they need to improve.

Lastly, the teaching interaction procedure may have been more effective than social stories due to the fact that it lends itself to greater flexibility during teaching. Both the teaching interaction procedure and social stories describe the cues and characteristics as to when the participant should display the social skill and both procedures provide the learner with rationales of why they should display each of the social skills. In social stories, however, participants are provided with the same cues/characteristics and the same rationales throughout the entire learning process. In contrast, multiple cues/characteristics and multiple rationales may be given in the teaching interaction procedure depending on how the participant answers the various questions throughout the teaching interaction procedure. Thus, some or all of these three variables (role plays, visual demonstrations of the skills to be taught, and greater flexibility in teaching) may result in the participants understanding the social skills better and generalizing them during the various probes.

Although the results of this study indicate that the teaching interaction procedure may be more effective than social stories in teaching social skills as implemented in this study, it is difficult to draw conclusions about the general effectiveness of social stories due to the great variability as to how social stories have been implemented in the research literature. This study implemented the most common components of the social story procedure (e.g., icons, the researcher reading the story to the participant, and comprehension questions) as found in the

previous research. It is unclear whether adding certain elements such as role plays with a mastery criterion, as Gray and Garand (1993) suggested, incorporating demonstrations, or using pictures of the participants rather than icons would change outcomes found in this study. It certainly seems potentially useful for future researchers to compare the teaching interaction procedure to social stories that use some of these variations.

One limitation of the present study was that a pre- and post-test measure of generalization of social skills with peers was done only with two participants (Apollo and Mickey). For these two participants, social skills performance with peers following intervention was considerably better than during baseline tests. For three participants (Buddy, Nick, and Lang), tests of social skill performance with peers was done only during final maintenance phases. The performance of all three participants was high on these probes, but since no pre-tests with peers were conducted, it is impossible to determine what level the participants displayed the social skills with peers prior to intervention +and thus the degree of improvement following the intervention. This clearly is a limitation that needs to be addressed in future research, particularly since the goal of most social skills interventions is that the learner display the social behaviors towards other children or adolescents.

A second limitation of this study was that no data were collected on the participants' ability to answer comprehension questions during the social story procedure. It may be important for future researchers to take data on participants' abilities to respond to comprehension questions in order to ensure that the learners actually comprehend the social story. If participants do not comprehend the social story, then the likelihood of them displaying the correct social behavior seems small. In this study, the researcher prompted participants, when needed, to answer correctly the comprehension questions at the end of the social story. This, however, does

not guarantee that participants comprehended the story. It should be noted that, after the second to fourth reading of the social story, participants typically answered all comprehension questions accurately on the first time. Additionally, no data were taken on participants' abilities to answer questions during the teaching interaction procedures nor were any data taken on how many times the participants role-played the social skill as part of the teaching interaction procedure. Data of this nature may be useful in determining if there is a correspondence between a participant's ability to answer questions and role-play correctly.

A third limitation of this study was that the researcher was visible to participants during the great majority of generalization probes with adults and was present during all generalization probes with peers. Thus, the sight of the researcher may have increased the likelihood of participants displaying the social skills in the generalization probes. In the future, generalization probes might be conducted without the presence of people who taught the social skills to the participants.

A fourth limitation of this study is that no measures of generalization were taken in the participants' natural environments (e.g., school, community, little league team). In the future, researchers may evaluate how well the participants display the social skills in the environments where they spend the greatest amount of time.

In addition to these limitations, there are several questions which future researchers could address. One area that may warrant future investigation is the preference between two procedures. In this study, the majority of the participants preferred social stories to the teaching interaction procedure. Future research may replicate these findings and determine what factors are responsible for this preference. For practical reasons, future research might also conduct preference evaluations for implementers of the interventions, so that researchers can determine

why implementers select to use some interventions and not others. A third possible area of future research might be to find the most effective ways to train staff and parents to implement social stories and teaching interactions, so that they will continue to implement these procedures successfully in the absence of close supervision. Finally, researchers may compare both social stories and teaching interaction procedures to other commonly implemented social skills interventions (e.g., video modeling, discrete trial teaching, script fading) in order to determine which procedures are the most effective for children and adolescents diagnosed with an Autism Spectrum Disorder.

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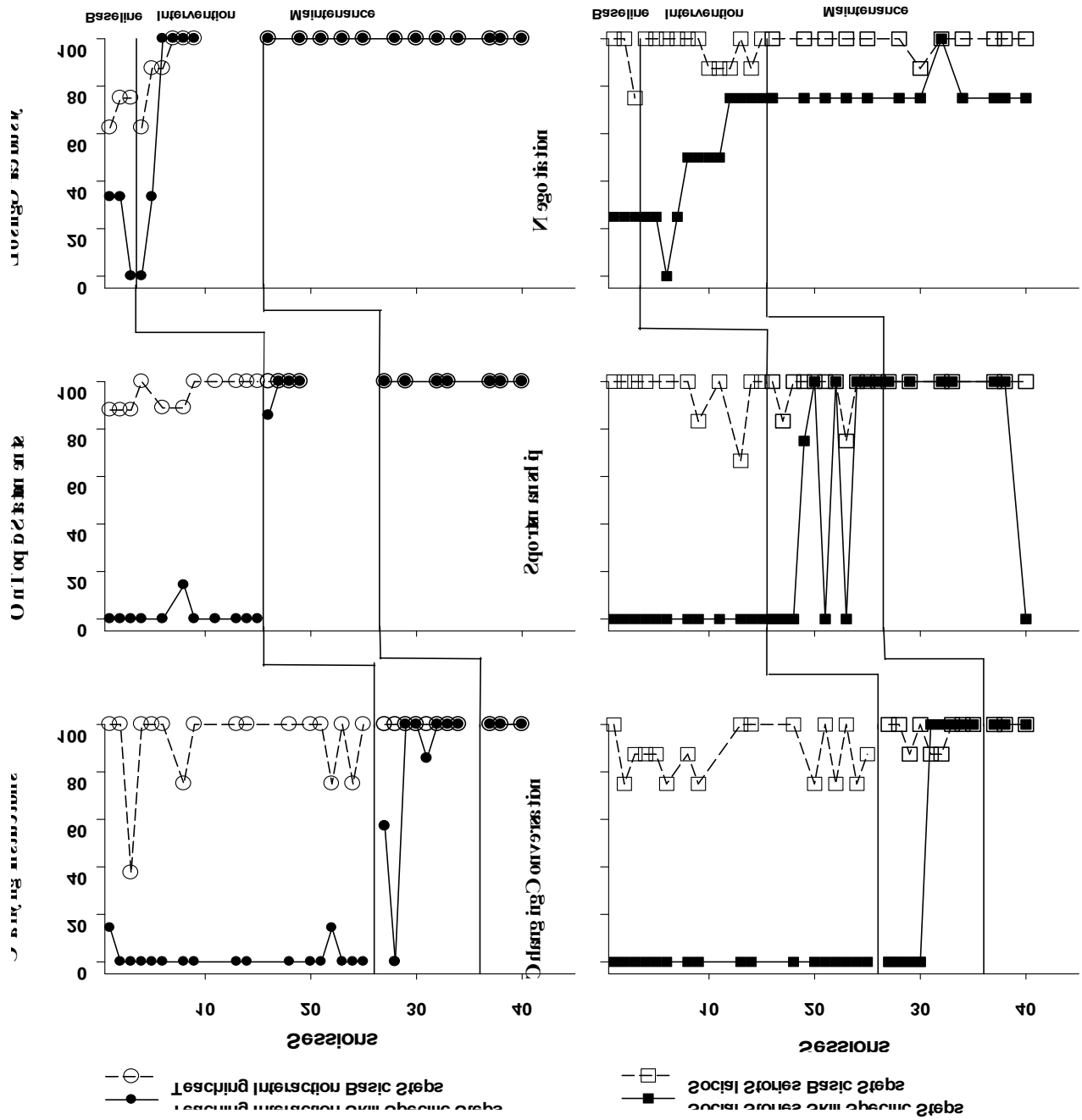


Figure 1. Buddy Naturalistic Probes

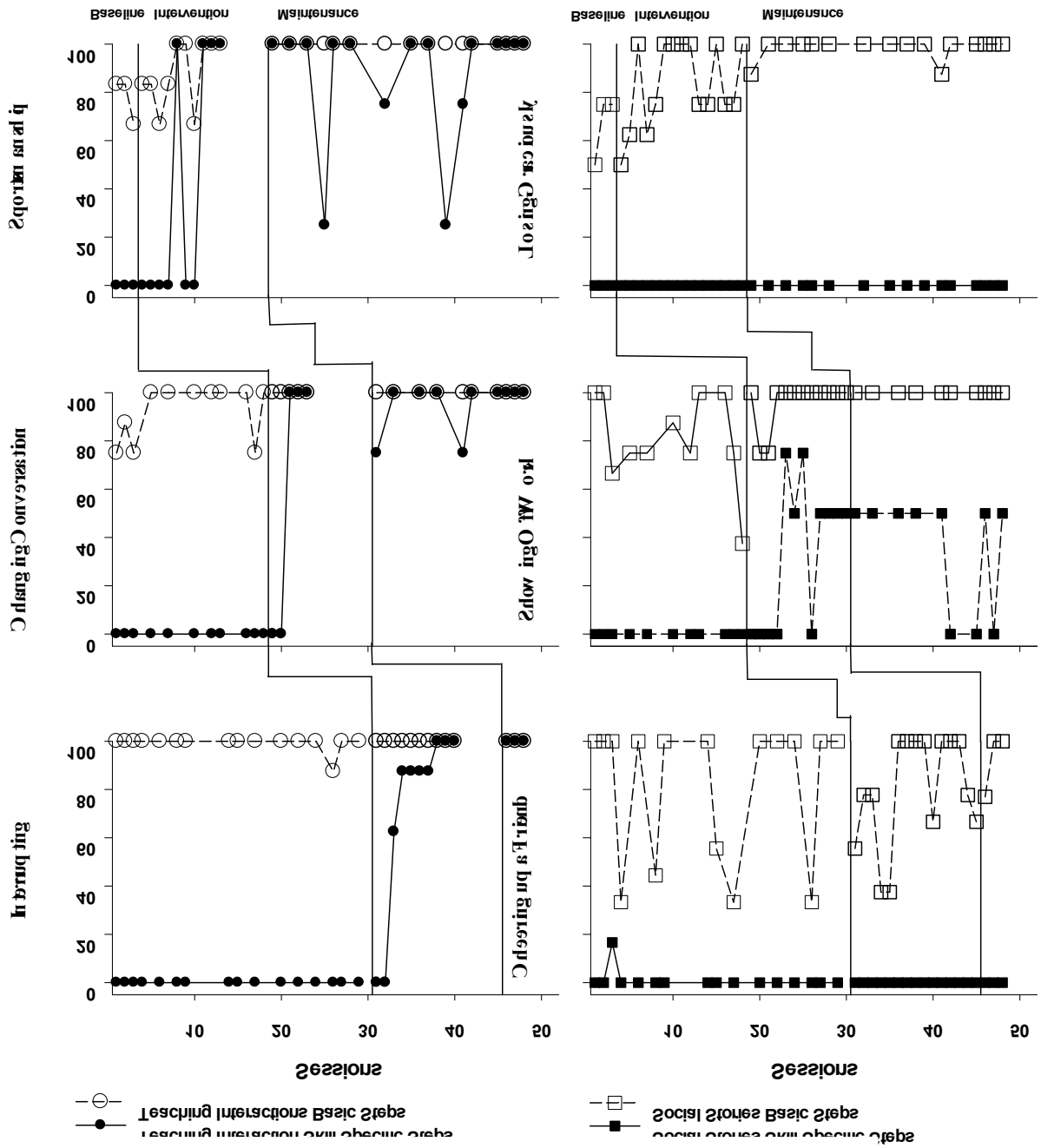


Figure 2. Hank Naturalistic Probes

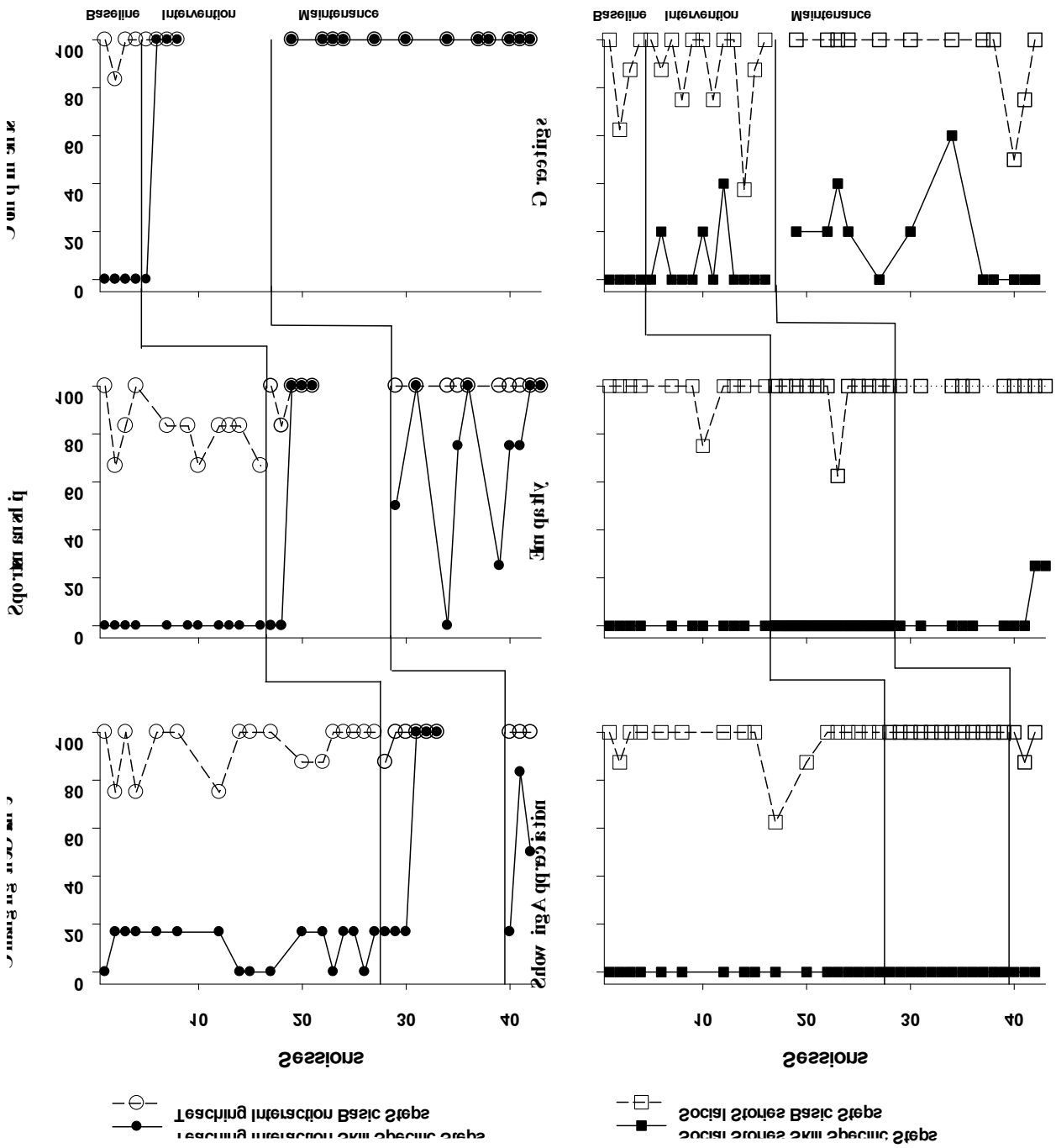


Figure 3. Nick Naturalistic Probes

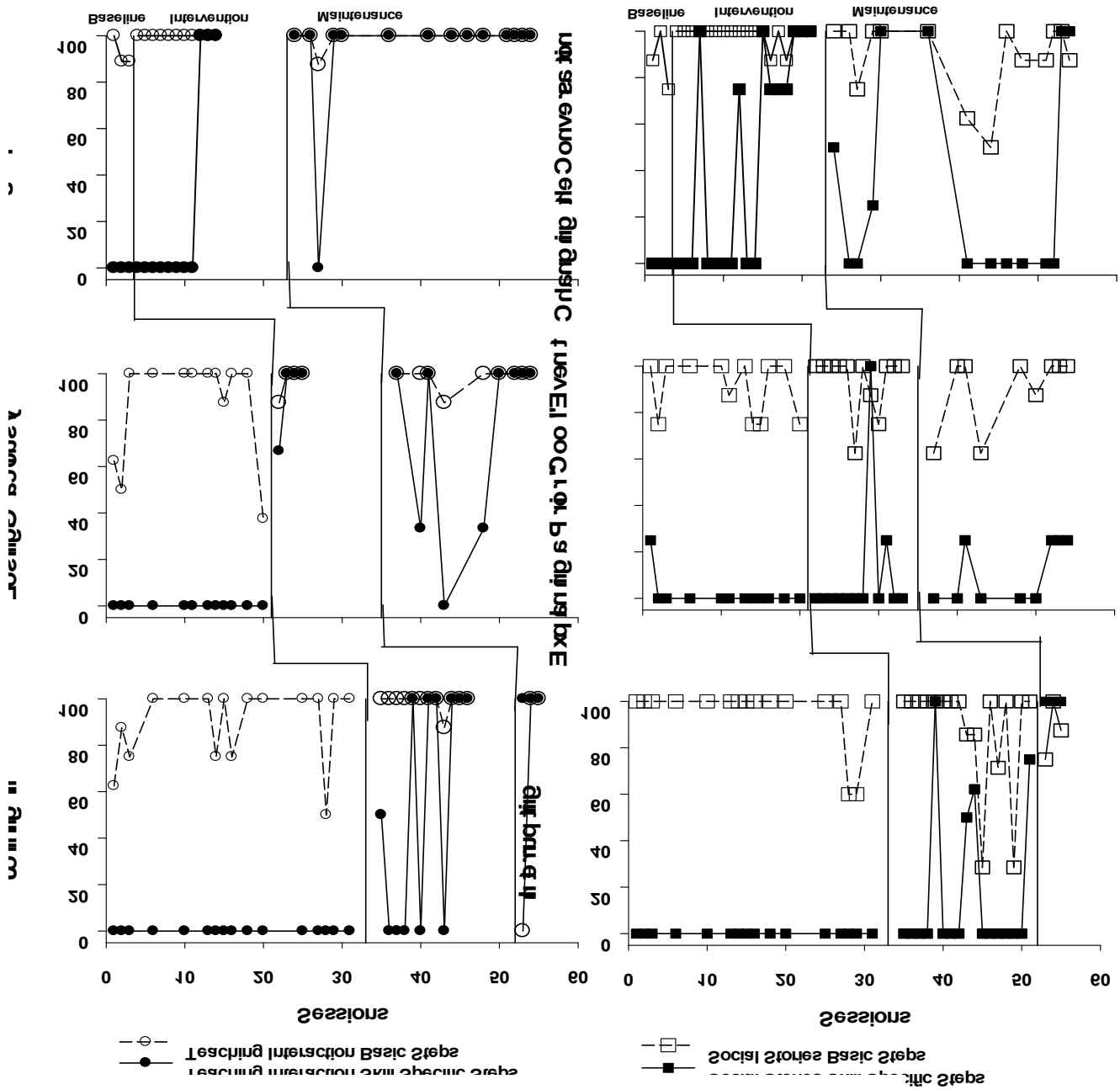


Figure 4. Lang Naturalistic Probes

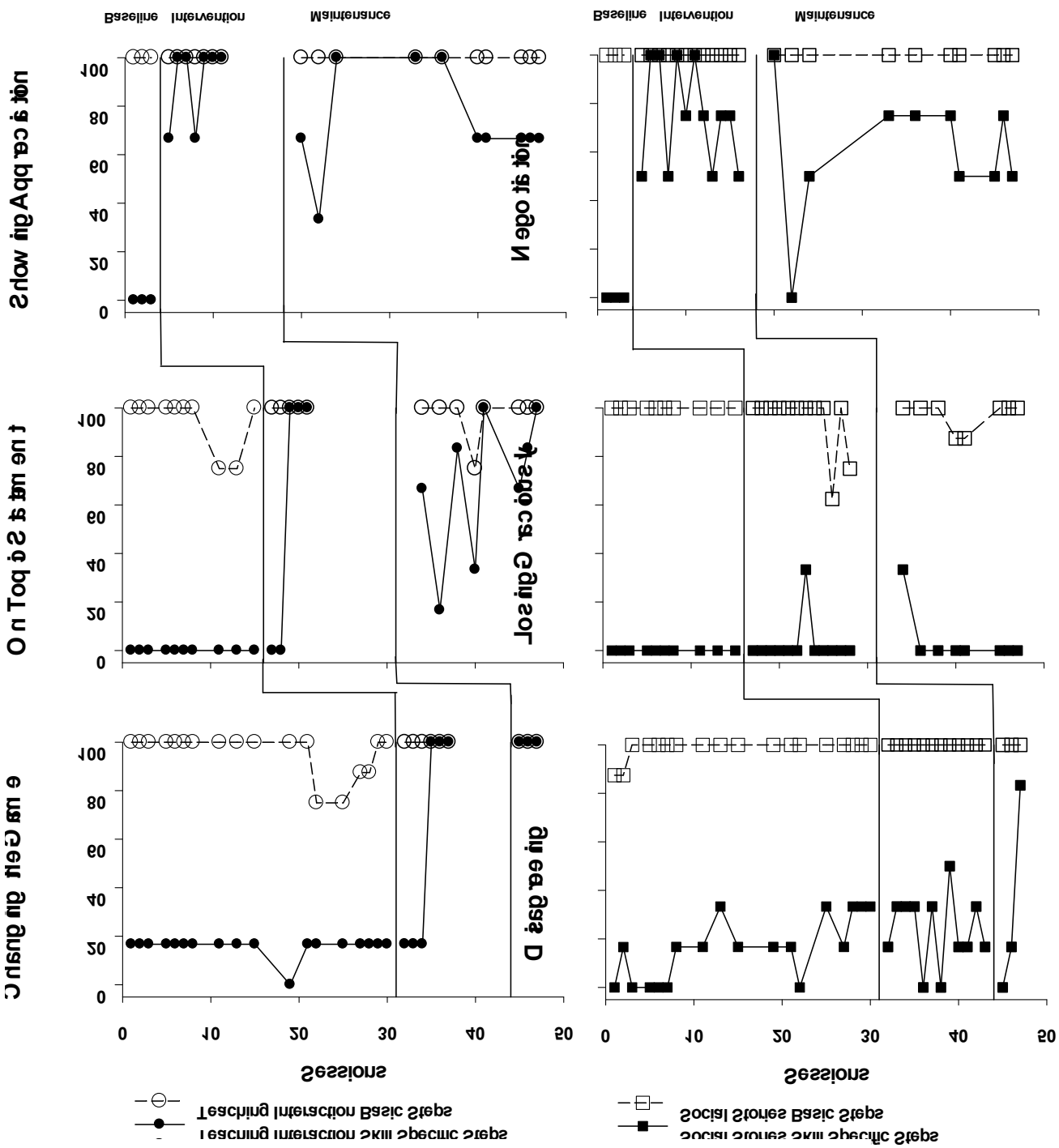


Figure 5. Apollo Naturalistic Probes

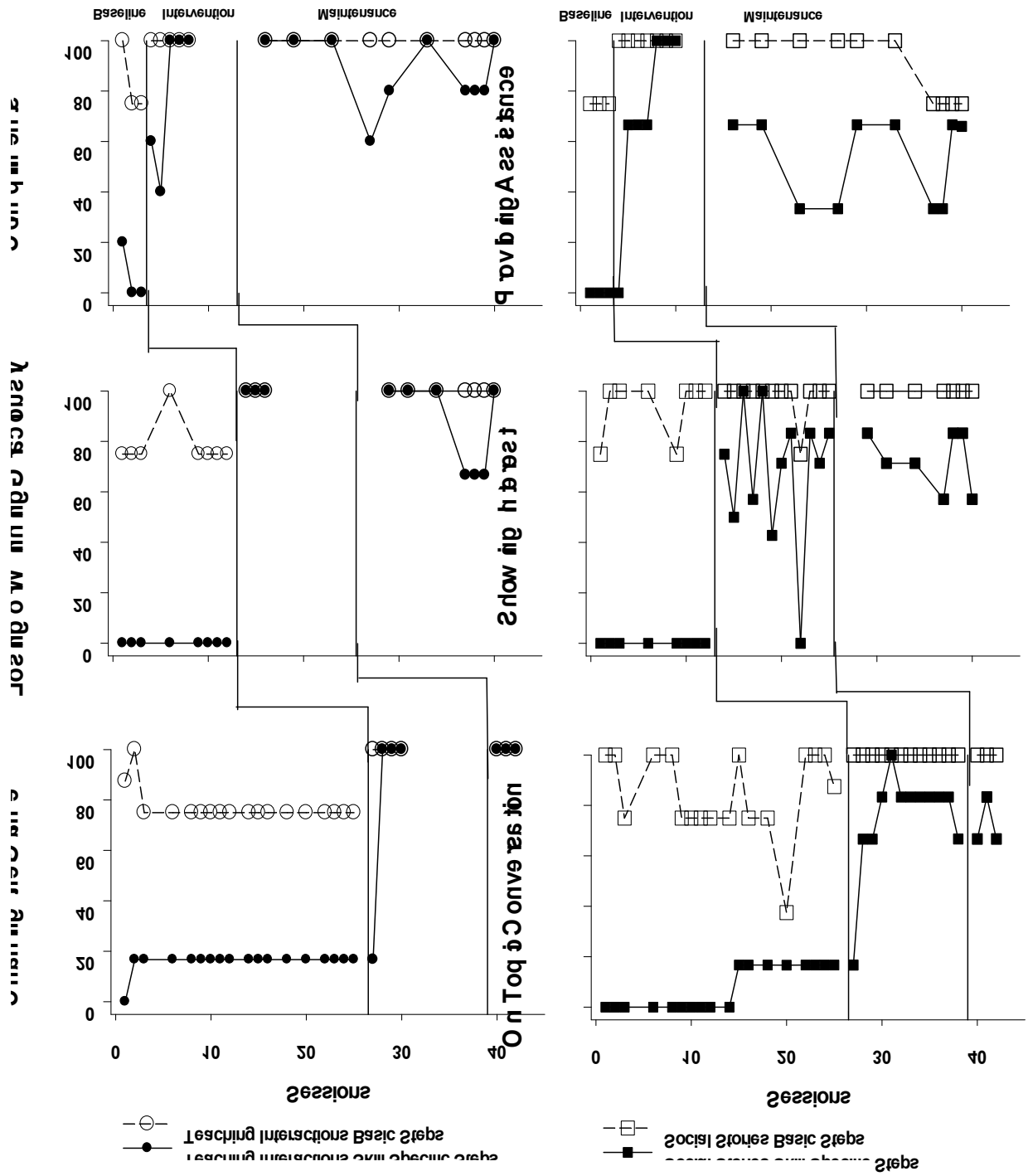


Figure 6. Mickey Naturalistic Probes

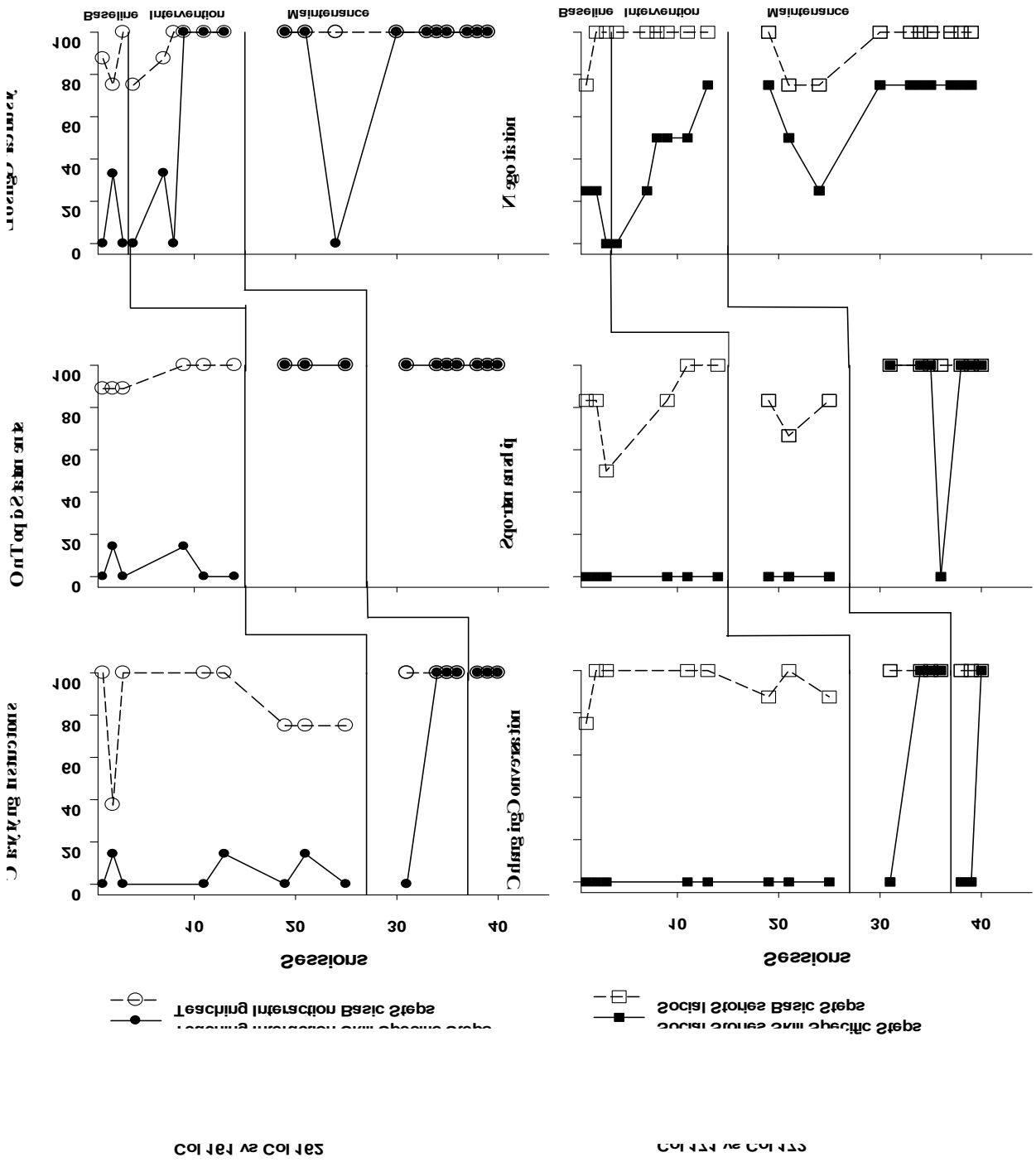


Figure 7. Buddy Generalization Probes with Adults

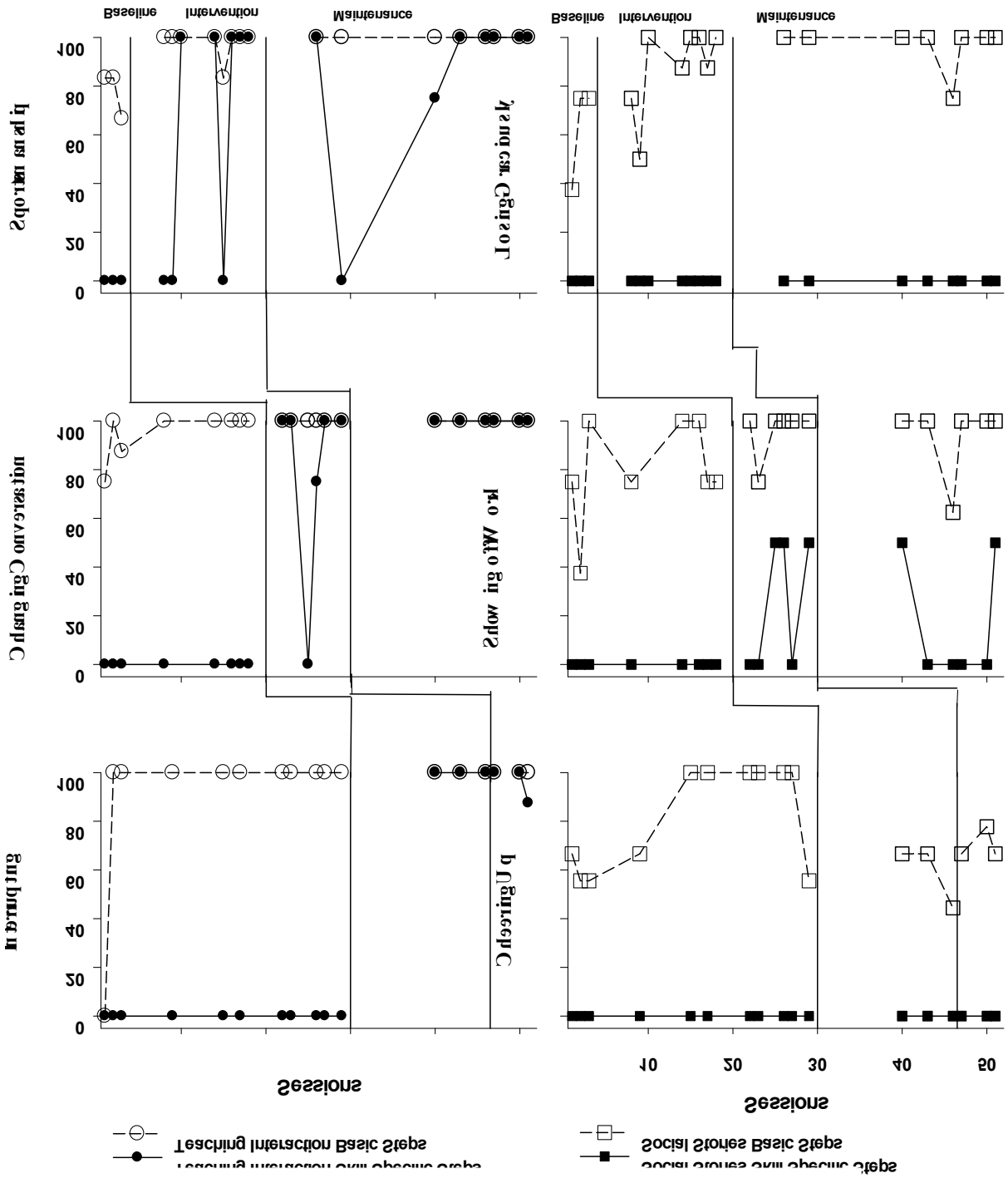


Figure 8. Hank Generalization Probes with Adults

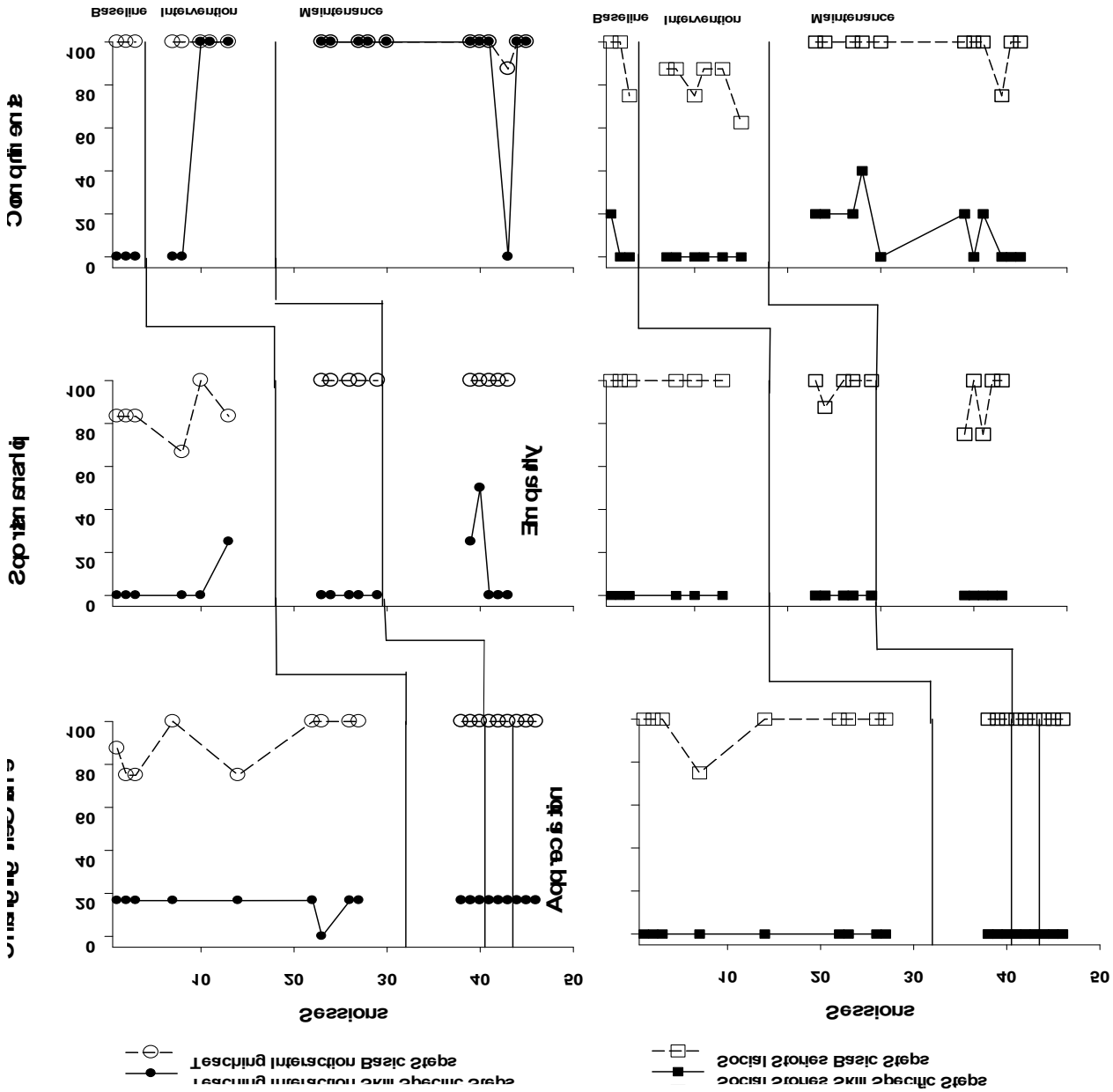


Figure 9. Nick Generalization Probes with Adults

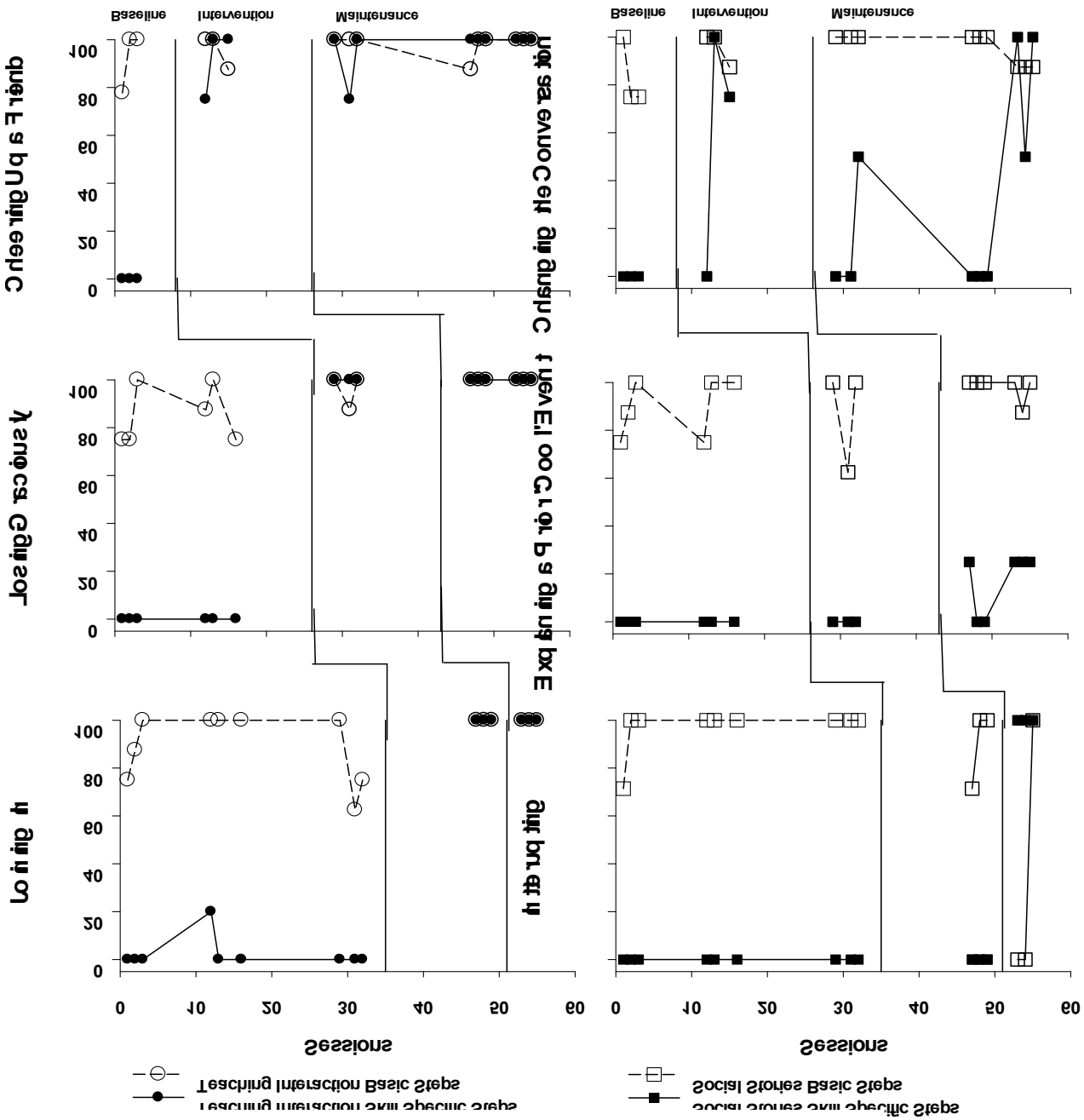


Figure 10. Lang Generalization Probes with Adults

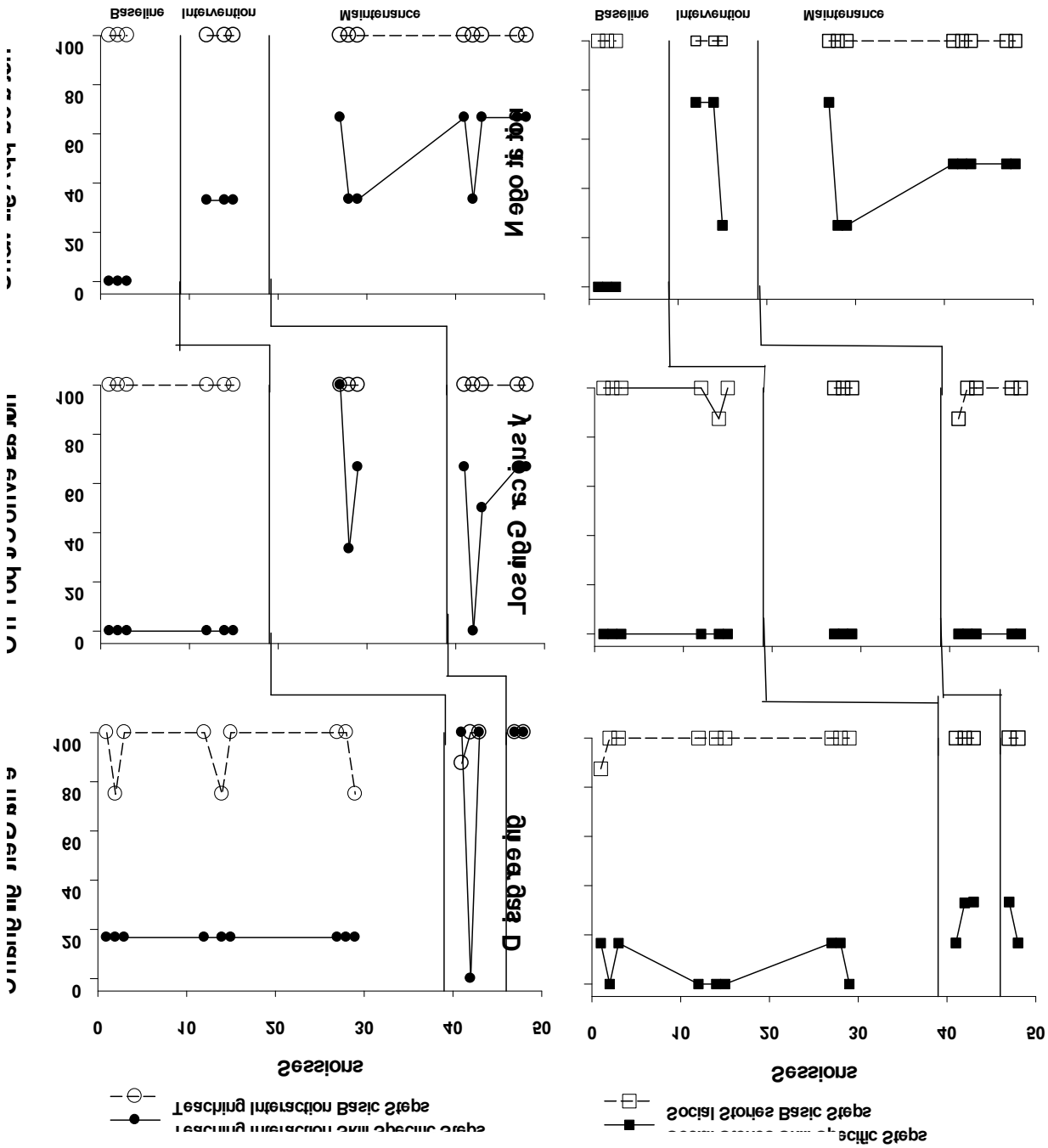


Figure 11. Apollo Generalization Probes with Adults

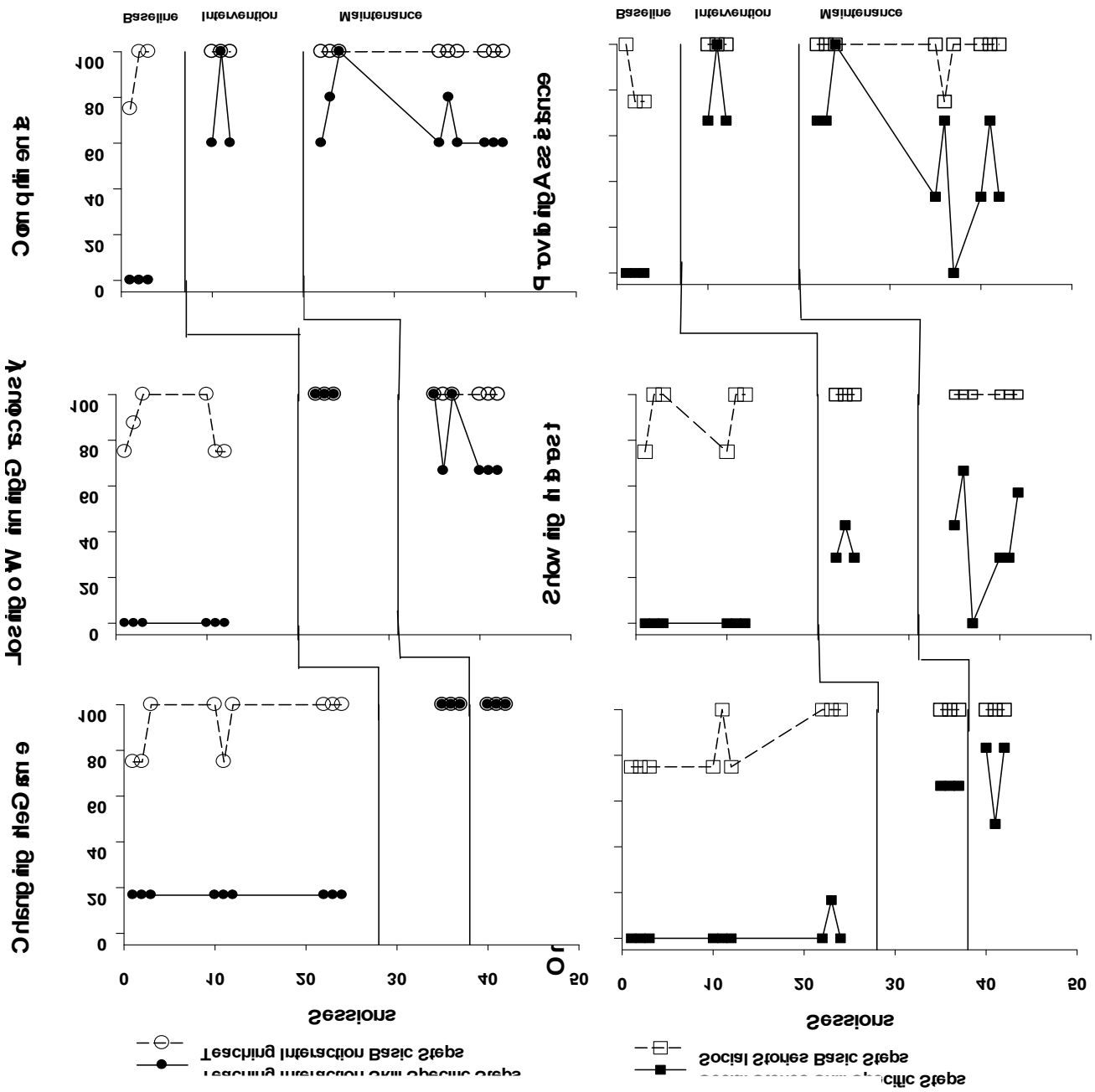


Figure 12. Mickey Generalization Probes with Adults

Table 1. Social Stories Studies

| Authors and Year | Research Design | Comprehension Checks or Role-Plays | Skills Taught |
|---|---|---|---|
| Adams, Gouvousis, VanLue, and Waldron (2004) | AB design | None | Decreasing problem behaviors |
| Barry and Burlew (2004) | Multiple baseline design with an embedded reversal design | Role-plays | Choice making<br>Play |
| Bernard-Ripoll (2007) | AB design | Comprehension checks | Labeling emotions |
| Bledose, Myles, and Simpson (2003) | Reversal design | Not stated | Eating behavior |
| Brownwell (2002) | Reversal design | Not stated | Reducing television talk<br>Following directions<br>Using a quiet voice |
| Chan and O'Reilly (2008) | Multiple probe design across behaviors | Comprehension checks and role-plays | Hand raising<br>Initiations<br>Inappropriate verbalizations |
| Crozier and Tincani (2005) | Reversal design | Comprehension checks | Interrupting |
| Crozier and Tincani (2007) | Reversal design | Comprehension checks | Sitting at circle<br>Talking with peers<br>Play with peers |
| Delano and Snell (2006) | Multiple probe across skills and participants | Comprehension checks | Appropriate social engagement<br>Seeking attention<br>Initiating comments<br>Initiating requests<br>Contingent responses |
| Dodd, Hupp, Jewell, and Krohn (2008) | Multiple baseline across skills and participants | Comprehension checks | Not giving directions<br>Compliments |

Table 1. Social Stories Studies cont.

| Authors and Year | Research Design | Comprehension Checks or Role-Plays | Skills Taught |
|---|---|---|---|
| Hagiwara and Myles (1999) | Multiple probe across settings | Not stated | Hand Washing |
| Ivey, Heflin, and Alberto (2004) | Reversal design | Not stated | Various social skills |
| Kuoch and Mirenda (2003) | Reversal design | Not stated | Reduction of maladaptive behaviors |
| Kutler, Myles, and Carlson (1998) | Reversal design | Not stated | Pre-cursor to tantrum behaviors |
| Lorimer, Simpson, Myles, and Ganz (2002) | Reversal design | Not stated | Interrupting Tantrums |
| Mancil, Haydon, and Whitby (2009) | Reversal design | Not stated | Pushing |
| Moore (2004) | AB case study | Not stated | Conversation |
| Norris and Dattilo (1999) | AB case study | Not stated | Appropriate social interaction |
| Ozdemir (2008) | Multiple baseline across participants | Not stated | Disruptive behavior |
| Quilty (2007) | Multiple probe across participants | Not stated | Inappropriate behaviors |
| Quirmbach, Lincoln, Gizzo, Ingersoll, and Andrews (2009) | Pre test-post test | Not stated | Various social skills |
| Reichow and Sabornie (2009) | Reversal design | Not stated | Verbal greetings |
| Reynhout and Carter (2007) | Reversal design | Comprehension checks | Disruptive behaviors |

Table 1. Social Stories Studies cont.

| Authors and Year | Research Design | Comprehension Checks or Role-Plays | Skills Taught |
|---|---|---|---|
| Sansosti and Powell-Smith (2008) | Multiple baseline across participants | Not stated | Joining in<br>Greeting<br>Sharing |
| Scattone, Wilczynski, Edwards, and Rabian (2002) | Multiple baseline across participants | Comprehension Checks | Disruptive behavior |
| Scattone, Tingstrom, and Wilczynski (2006) | Multiple baseline across participants | Comprehension checks | Social interaction |
| Scattone (2008) | Multiple baseline across skills | Comprehension Checks | Eye contact<br>Smiling<br>Greeting |
| Smith (2001) | B Design | Not stated | Variety of social skills |
| Soensksen and Alper (2006) | Multiple baseline across skills | Not stated | Obtain peers attention<br>Looking at a peers face |
| Swaggart and Gagnon (1995) | Pre-post | Not stated | Greeting<br>Sharing<br>Encouragement |
| Theimann and Goldstein (2001) | Multiple baseline across skills replicated across participants | Comprehension checks and role plays | Social communication |

Table 2. Teaching Interaction Studies

| Authors and Year | Research Design | Skills Taught |
|---|---|---|
| Dotson, Leaf, Sheldon, and Sherman (2010) | Multiple probe design across skills | Eye contact<br>Conversation skills<br>Head nodding |
| Leaf, Taubman, Bloomfield, Palos-Rafuse, Leaf, Mceachin, and Oppenheim (2008) | Multiple baseline across skills | Various social skills |
| Leaf, Dotson, Oppenheim, Sheldon, and Sherman (2010) | Multiple probe design across skills | Empathy<br>Giving Compliments<br>Changing the game when someone is bored<br>Showing appreciation |

Table 3. Participant Demographics

| Category | Participant 1 | Participant 2 | Participant 3 | Participant 4 | Participant 5 | Participant 6 |
|---|---|---|---|---|---|---|
| Name | Buddy | Hank | Nick | Lang | Apollo | Mickey |
| Age | 6.7 | 5.9 | 5.8 | 4.6 | 12.3 | 13.6 |
| Primary Diagnosis | Autism | PDD-NOS | Autism | Asperger Syndrome | Autism | Asperger Syndrome |
| IQ Score (Test) | 87 (Mullens) | 117 (WISC) | 65 (Kaufman) | 89 (WPPSI-3) | 80 (WISC) | 82 (WISC) |
| Peabody Standard Score | 91 | 128 | 79 | 104 | 99 | 109 |
| Peabody Age Equivalent | 6.1 | 8.3 | 3.11 | 5.11 | 12.1 | 14.3 |
| SSRS Standard Score | 69 | 91 | 70 | 106 | 73 | 96 |
| SSRS Percentile | 2% | 27% | 2% | 66% | 4% | 39% |
| GARS Autism Quotient | 98 | N/A | N/A | N/A | 79 | N/A |
| CARS Standard Score | N/A | N/A | 34 | 27.5 | 26 | 31 |
| Vineland Social Domain Score | N/A | 87 | 68 | 85 | N/A | N/A |
| Previous History with TI'S | Yes | Yes | No | Yes | No | No |

Table 3. Participant Demographic

| Category | Participant 1 | Participant 2 | Participant 3 | Participant 4 | Participant 5 | Participant 6 |
|---|---|---|---|---|---|---|
| Previous History with Social Stories | Yes | Yes | Yes | Yes | Yes | Yes |
| School Placement | General Education with no Supports | Autism Intervention Clinic | General Education with no supports | General education with supports | General education with no supports | General education with no supports |
| Setting | Home and University | Home and University | Home and University | Home | Home | Home |

Table 4. Skills Taught

| Participant | Teaching Interaction Skill 1 | Social Story Skill 1 | Teaching Interaction Skill 2 | Social Story Skill 2 | Teaching Interaction Skill 3 | Social Story Skill 3 |
|---|---|---|---|---|---|---|
| Buddy | Losing Graciously (3 steps) | Negotiation ( 4 steps) | On-Topic Conversation (7 steps) | Sportsmanship (4 steps) | Clarifying Instructions (7 steps) | Changing the Conversation ( 4 steps) |
| Hank | Sportsmanship (4 steps) | Losing Graciously (3 steps) | Changing the Conversation (4 steps) | Showing off Work (4 steps) | Interrupting Appropriately (7 steps) | Cheering up a Person (6 steps) |
| Nick | Giving Compliments (2 steps) | Appropriate Greetings (5 steps) | Sportsmanship (4 steps) | Making Empathetic Statements (3 steps) | Changing the Game (4 steps) | Showing Appreciation (3 steps) |
| Lang | Cheering up a Friend (6 steps) | Changing the Conversation (4 steps) | Losing Graciously (3 steps) | Explaining a Prior “Cool” Event (4 steps) | Joining into a Game (7 steps) | Interrupting (7 steps) |
| Apollo | Showing Appreciation (3 steps) | Negotiation (4 steps) | On Topic Conversation (3 steps) | Losing or Winning Graciously (3 steps) | Changing the Game (4 steps) | Disagreeing (6 steps) |
| Mickey | Reciprocal Compliments (5 steps) | Providing Assistance (3 steps) | Losing or Wining Graciously (3 steps) | Showing Interest (6 steps) | Changing the Game (4 steps) | On Topic Conversation (3 steps) |

Table 5. Social Stories

| Participant | Story 1 (Ratio) | Story 1 (Total Pages) | Story 1 (Total Words) | Story 2 (Ratio) | Story 2 (Total Pages) | Story 2 (Total Words) | Story 3 (Ratio) | Story 3 (Total Pages) | Story 3 (Total Words) |
|---|---|---|---|---|---|---|---|---|---|
| Buddy | 2.2 to 1 | 29 | 331 | 2 to 1 | 22 | 322 | 2.1 to 1 | 25 | 223 |
| Hank | 3.1 to 1 | 22 | 265 | 2.6 to 1 | 25 | 280 | 3.1 to 1 | 34 | 387 |
| Nick | 2 to 1 | 33 | 225 | 2 to 1 | 21 | 207 | 2.5 to 1 | 21 | 198 |
| Lang | 2.6 to 1 | 25 | 231 | 2 to 1 | 21 | 221 | 2.3 to 1 | 23 | 275 |
| Apollo | 2 to 1 | 18 | 244 | 2 to 1 | 18 | 219 | 2.2 to 1 | 19 | 241 |
| Mickey | 2 to 1 | 21 | 236 | 2.2 to 1 | 16 | 248 | 2 to 1 | 18 | 247 |

Table 6. Buddy Probes

| Skill Number | Target Skill | How Probed in Naturalistic Probes | How Probed in Generalization Probes with Adults | How Probed in Generalization Probes with Peers |
|---|---|---|---|---|
| Teaching Interaction Skill 1 | Losing Graciously | Lead researcher and participant play a game and lead researcher wins | Adult and participant play a game and adult wins | Peer and participant play a game and peer wins |
| Teaching Interaction Skill 2 | On Topic Statement | Lead researcher states a topic (e.g., the beach) and waits for the participant to make a statement about the topic. Teacher makes additional statements when participant asks them on-topic questions | Adult states a topic (e.g., the beach) and waits for the participant to make a statement about the topic. Adult makes additional statements when participant asks them on-topic questions | Peer states a topic (e.g., the beach) and waits for the participant to make a statement about the topic. The peer makes additional statements when participant asks them on-topic questions |
| Teaching Interaction Skill 3 | Clarifying and Following Instructions | Lead researcher tells participant to clean up. The lead researcher provides more specific instructions if the participant asks | Adult tells participant to clean up. The adult provides more specific instructions if the participant asks | Peer tells participant to clean up. The peer provides more specific instructions if the participant asks |
| Social Story Skill 1 | Negotiation | Lead researcher asks the participant which game they should play and states opposite of what participant selects | Adult asks the participant which game they should play and states opposite of what participant selects | Peers asks the participant which game they should play and states opposite of what participant selects |

Table 6. Buddy Probes cont.

| Skill Number | Target Skill | How Probed in Naturalistic Probes | How Probed in Generalization Probes with Adults | How Probed in Generalization Probes with Peers |
|---|---|---|---|---|
| Social Story Skill 2 | Sportsmanship | Lead researcher plays a portable pinball game while participant watches | Adult plays a portable pinball game while participant watches | Peer plays a portable pinball game while participant watches |
| Social Story Skill 3 | Changing Conversation | Lead researcher and participant are engaged in a conversation at some point the lead researcher puts his head in his hand, gives a sigh, and looks away. | Adult and participant are engaged in a conversation at some point the adult puts her head in her hand, gives a sigh, and looks away. | Peer and participant are engaged in a conversation at some point the peer puts her head in her hand, gives a sigh, and looks away. |

Table 7. Hank Probes

| Skill Number | Target Skill | How Probed in Naturalistic Probes | How Probed in Generalization Probes with Adults | How Probed in Generalization Probes with Peers |
|---|---|---|---|---|
| Teaching Interaction Skill 1 | Sportsmanship | Lead researcher plays a portable pinball game while participant watches | Adult plays a portable pinball game while participant watches | N/A |
| Teaching Interaction Skill 2 | Changing Conversation | Lead researcher and participant are engaged in a conversation at some point the lead researcher puts his head in his hand, gives a sigh, and looks away | Adult and participant are engaged in a conversation at some point the adult puts his head in his hand, gives a sigh, and looks away | N/A |
| Teaching Interaction Skill 3 | Interrupting Appropriately | Two adults are talking and the participant approaches with a question to ask | Two adults are talking and the participant approaches with a question to ask | N/A |
| Social Story Skill 1 | Losing Graciously | Lead researcher and participant play a game that the lead researcher wins | Adult and participant play a game that the adult wins | N/A |
| Social Story Skill 2 | Showing off Work | Participant draws and the lead researcher walks into the room | Participant draws a picture and a adult walks into the room | N/A |
| Social Story Skill 3 | Cheering up a Friend | Lead researcher is in the room with head in hands, looking down, and weeping Participant enters the room unaware of the antecedent event | Adult is in the room with head in hands, looking down, and weeping Participant enters the room unaware of the antecedent event | N/A |

Table 8. Nick Probes

| Skill Number | Target Skill | How Probed in Naturalistic Probes | How Probed in Generalization Probes with Adults | How Probed in Generalization Probes with Peers |
|---|---|---|---|---|
| Teaching Interaction Skill 1 | Giving Compliments | Lead researcher shows participant a picture they made | Adult shows participant a picture they made | Peer shows participant a picture they made |
| Teaching Interaction Skill 2 | Sportsmanship | Lead researcher plays a portable pinball game while participant watches | Adult plays a portable pinball game while participant watches | Peer plays a portable pinball game while participant watches |
| Teaching Interaction Skill 3 | Changing the Game when someone is bored | Lead researcher plays a game and then puts their head in their hands, sighs, and looks away | Adult plays a game and then puts their head in their hands, sighs, and looks away | Peers plays a game and then puts their head in their hands, sighs, and looks away |
| Social Story Skill 1 | Greeting | Lead researcher stands by entrance and waits 10 s prior to saying hello | Adult stands by entrance and waits 10 s prior to saying hello | Peer stands by entrance and waits 10 s prior to saying hello |
| Social Story Skill 2 | Empathy | Lead researcher engages in an action that results in them saying ooh | Adult engages in an action that results in them saying ooh | Peer engages in an action that results in them saying ooh |
| Social Story Skill 3 | Showing Appreciation | Lead researcher gives participant a small toy or candy | Adult gives participant a small toy or candy | Peer gives participant a small toy or candy |

Table 9. Lang Probes

| Skill Number | Target Skill | How Probed in Naturalistic Probes | How Probed in Generalization Probes with Adults | How Probed in Generalization Probes with Peers |
|---|---|---|---|---|
| Teaching Interaction Skill 1 | Cheering up a friend | Lead researcher is in the room with head in hands, looking down, and weeping. Participant enters the room unaware of the antecedent event | Adult is in the room with head in hands, looking down, and weeping. Participant enters the room unaware of the antecedent event | Peer is in the room with head in hands, looking down, and weeping. Participant enters the room unaware of the antecedent event |
| Teaching Interaction Skill 2 | Losing Graciously | Lead researcher and participant play a game and the lead researcher wins | Adult and participant play a game and the adult wins | Peer and participant play a game and the peer wins |
| Teaching Interaction Skill 3 | Joining into a game | Lead researcher is playing a game and participant enters room | Adult is playing a game and participant enters room | Peer is playing a game and participant enters room |
| Social Story Skill 1 | Changing the conversation | Lead researcher and participant are engaged in a conversation at some point the lead researcher puts his head in his hand, gives a sigh, and looks away | Adult and participant are engaged in a conversation at some point the adult puts her head in her hand, gives a sigh, and looks away | Peer and participant are engaged in a conversation at some point the peer puts her head in her hand, gives a sigh, and looks away |
| Social Story Skill 2 | Describing a prior “cool” event | Adult and participant are in a different room playing with the solar system game or with star wars. Participant re-enters the room where the lead researcher is waiting | Lead researcher and participant are in a different room playing with the solar system game or with star wars. Participant re-enters the room with where the adult is waiting | Adult and participant are in a different room playing with the solar system game or with star wars. Participant re-enters the room with where the peer is waiting |

Table 9. Lang Probes cont.

| Skill Number | Target Skill | How Probed in Naturalistic Probes | How Probed in Generalization Probes with Adults | How Probed in Generalization Probes with Peers |
|---|---|---|---|---|
| Social Story Skill 3 | Interrupting Appropriately | Lead researcher is talking on the phone and participant approaches with a question to ask | Adult is talking on the phone and participant approaches with a question to ask | Peer is talking on the phone and participant approaches with a question to ask |

Table 10. Apollo Probes

| Skill Number | Target Skill | How Probed in Naturalistic Probes | How Probed in Generalization Probes with Adults | How Probed in Generalization Probes with Peers |
|---|---|---|---|---|
| Teaching Interaction Skill 1 | Showing Appreciation | Lead researcher gives participant a small toy or candy | Adult gives participant a small toy or candy | Peer gives participant a small toy or candy |
| Teaching Interaction Skill 2 | On Topic Statements | Lead researcher asks how was your day and waits for response | Adult asks how was your day and waits for response | Peer asks how was your day and waits for response |
| Teaching Interaction Skill 3 | Changing the game when someone is bored. | Lead researcher plays a game and then puts their head in their hands, sighs, and looks away | Lead researcher plays a game and then puts their head in their hands, sighs, and looks away | Peers plays a game and then puts their head in their hands, sighs, and looks away |
| Social Story Skill 1 | Negotiation | Lead researcher asks who should go first and then continuously state that he wants to go first | Adult asks who should go first and then continuously state that she wants to go first | Peer asks who should go first and then continuously state that she wants to go first |
| Social Story Skill 2 | Winning or Losing Graciously | Lead researcher and participant play a game and the researcher wins or loses | Adult and participant play a game and the adult wins or loses | Peer and participant play a game and the participant wins or loses |
| Social Story Skill 3 | Disagreeing Appropriately | Lead researcher makes a wrong move while playing chess and claims that it is correct | Adult makes a wrong move while playing chess and claims that it is correct | Peer makes a wrong move while playing chess and claims that it is correct |

Table 11. Mickey Probes

| Skill Number | Target Skill | How Probed in Naturalistic Probes | How Probed in Generalization Probes with Adults | How Probed in Generalization Probes with Peers |
|---|---|---|---|---|
| Teaching Interaction Skill 1 | Reciprocal Compliments | Lead researcher says they like the participants shirt and responds to any compliments that the participant might make | Adult says they like the participants shirt and responds to any compliments that the participant might make | Peer says they like the participants shirt and responds to any compliments that the participant might make |
| Teaching Interaction Skill 2 | Winning or Losing Graciously | Lead researcher and participant play a game and the researcher wins or loses | Adult and participant play a game and the adult wins or loses | Peer and participant play a game and the peers wins or loses |
| Teaching Interaction Skill 3 | Changing the Game when someone is bored | Lead researcher plays a game and then puts their head in their hands, sighs, and looks away | Adult plays a game and then puts their head in their hands, sighs, and looks away | Peer plays a game and then puts their head in their hands, sighs, and looks away |
| Social Story Skill 1 | Providing Assistance | Lead researcher visibly struggles to do a task | Adult visibly struggles to do a task | Peer visibly struggles to do a task |
| Social Story Skill 2 | Showing Interest | Lead researcher looks at pictures on a phone and says cool | Adult looks at pictures on a phone and says cool | Peer looks at pictures on a phone and says cool |
| Social Story Skill 3 | On Topic Conversation | Lead researcher asks how was your day and waits for response | Adult asks how was your day and waits for response | Peer asks how was your day and waits for response |

Table 12. Percentage of Naturalistic Probes where Reliability was Taken

| Skill | Buddy | Hank | Nick | Lang | Apollo | Mickey |
|---|---|---|---|---|---|---|
| Skill 1 (Teaching Interaction) | 38.1% | 48.3% | 45% | 39.3% | 35% | 33.3% |
| Skill 2 (Teaching Interaction) | 36.4% | 40.7% | 42.3% | 36% | 33.3% | 33.3% |
| Skill 3 (Teaching Interaction) | 35.7% | 58.6% | 38.4% | 43.3% | 39% | 36% |
| Skill 1 (Social Story) | 37% | 47.1% | 37.9% | 40% | 33.3% | 35% |
| Skill 2 (Social Story) | 34.5% | 42.4% | 40.7% | 39.4% | 33% | 33% |
| Skill 3 (Social Story) | 41.3% | 55.8% | 39.3% | 40% | 33% | 37% |
| Total Probes where IOA was taken | 37.1% | 49.4% | 40.6% | 39.8% | 34.3% | 34.7% |

Table 13. Percentage of Generalization Probes with Adults where Reliability was Taken

| Skill | Buddy | Hank | Nick | Lang | Apollo | Mickey |
|---|---|---|---|---|---|---|
| Skill 1 (Teaching Interaction) | 70.5% | 61.5% | 57.9% | 33.3% | 33.3% | 33.3% |
| Skill 2 (Teaching Interaction) | 64.3% | 64.3% | 38.9% | 33.3% | 33.3% | 33.3% |
| Skill 3 (Teaching Interaction) | 61.5% | 81.8% | 43.8% | 33.3% | 33.3% | 33.3% |
| Skill 1 (Social Story) | 58.3% | 61.5% | 36.8% | 33.3% | 33.3% | 33.3% |
| Skill 2 (Social Story) | 71.4% | 57.1% | 33.33% | 40% | 33.3% | 33.3% |
| Skill 3 (Social Story) | 68.2% | 72.3% | 37.5% | 33.3% | 33.3% | 33.3% |
| Total Probes where IOA was taken | 63.6% | 65.2% | 41.5% | 34.4% | 33.3% | 33.3% |

Table 14. Percentage of Generalization Probes with Children where Reliability was Taken

| Skill | Buddy | Hank | Nick | Lang | Apollo | Mickey |
|---|---|---|---|---|---|---|
| Skill 1 (Teaching Interaction) | 33.3% | N/A | 66.6% | 33.3% | 33.3% | 33.3% |
| Skill 2 (Teaching Interaction) | 33.3% | N/A | 66.6% | 33.3% | 33.3% | 33.3% |
| Skill 3 (Teaching Interaction) | 33.3% | N/A | 66.% | 33.3% | 33.3% | 33.3% |
| Skill 1 (Social Story) | 33.3% | N/A | 33.3% | 33.3% | 33.3% | 33.3% |
| Skill 2 (Social Story) | 33.3% | N/A | 66.6% | 33.3% | 33.3% | 33.3% |
| Skill 3 (Social Story) | 33.3% | N/A | 66.6% | 33.3% | 33.3% | 33.3% |
| Total Probes where IOA was taken | 33.3% | N/A | 61.1% | 33.3% | 33.3% | 33.3% |

Table 15. Reliability on Naturalistic Probes

| Skill | Buddy | Hank | Nick | Lang | Apollo | Mickey |
|---|---|---|---|---|---|---|
| Skill 1 (Teaching Interaction) | 97.7% | 96.4% | 98.9% | 98% | 96.8% | 90.9% |
| Skill 2 (Teaching Interaction) | 97.7% | 98.5% | 98.8% | 96.8% | 99.1% | 95.4% |
| Skill 3 (Teaching Interaction) | 98.12% | 99.3% | 94.9% | 97% | 96.9% | 100% |
| Skill 1 (Social Story) | 92.3% | 98.3% | 97.8% | 95.7% | 94.6% | 96.3% |
| Skill 2 (Social Story) | 92% | 99.2% | 99.3% | 93.5% | 97.2% | 94.4% |
| Skill 3 (Social Story) | 94.4% | 98.2% | 97.1% | 95.7% | 97.4% | 94.7% |
| Range Across all Skills with IOA | 80-100% | 81.8-100% | 77.7-100% | 83.3-100% | 79.6-100% | 81.8-100% |
| Total | 95.4% | 98.5% | 97.9% | 96.1% | 96.9% | 95.9% |

Table 16. Reliability on Generalization Probes with Adults

| Skill | Buddy | Hank | Nick | Lang | Apollo | Mickey |
|---|---|---|---|---|---|---|
| Skill 1 (Teaching Interaction) | 97.9% | 97.5% | 96.4% | 93.3% | 96.8% | 90.7% |
| Skill 2 (Teaching Interaction) | 97.5% | 98.7% | 95.7% | 94.5% | 99.1% | 94.2% |
| Skill 3 (Teaching Interaction) | 97.1% | 98.5% | 97% | 98.4% | 96.9% | 97.1% |
| Skill 1 (Social Story) | 96.5% | 93.9% | 95.6% | 100% | 94.6% | 92.9% |
| Skill 2 (Social Story) | 96.4% | 98.5% | 93.9% | 95.5% | 97.2% | 98.6% |
| Skill 3 (Social Story) | 96.7% | 95.5% | 96.9% | 94.6% | 97.4% | 94.1% |
| Range Across all Skills with IOA | 76.9-100% | 81.8-100% | 81.8-100% | 80-100% | 79.6-100% | 80-100% |
| Total | 97% | 97.3% | 96% | 96.7% | 96.9% | 94.8% |

Table 17. Reliability on Generalization Probes with Peers

| Skill | Buddy | Hank | Nick | Lang | Apollo | Mickey |
|---|---|---|---|---|---|---|
| Skill 1 (Teaching Interaction) | 100% | N/A | 100% | 92.3% | 100% | 100% |
| Skill 2 (Teaching Interaction) | 100% | N/A | 100% | 100% | 96% | 95.4% |
| Skill 3 (Teaching Interaction) | 100% | N/A | 96.3% | 92.3% | 96.4% | 96.3% |
| Skill 1 (Social Story) | 92.8% | N/A | 100% | 91.7% | 91.7% | 100% |
| Skill 2 (Social Story) | 100% | N/A | 100% | 100% | 100% | 100% |
| Skill 3 (Social Story) | 100% | N/A | 100% | 93.3% | 100% | 93.8% |
| Range Across all Skills with IOA | 92.8-100% | N/A | 92.3-100% | 91.7-100% | 83.3-100% | 87.5-100% |
| Total | 98.8% | N/A | 98.8% | 94.7% | 96.9% | 97.5% |

Table 18. Treatment Fidelity

| Participant | Percentage of Teaching Interaction Sessions where Treatment Fidelity was Measured | Percentage of Teaching Interaction Session where IOA was taken on the Treatment Fidelity | Percentage of Social Story Sessions where Treatment Fidelity was Measured | Percentage of Social Story Session where IOA was taken on the Treatment Fidelity |
|---|---|---|---|---|
| Buddy | 83.3% | 66.7% | 81.3% | 48.7% |
| Hank | 92% | 52.2% | 92.8% | 61.5% |
| Nick | 100% | 26.7% | 77.7% | 25% |
| Lang | 48.1% | 30% | 38.2% | 33.3% |
| Apollo | 44.4% | 40% | 41.7% | 33.3% |
| Mickey | 41.7% | 37.5% | 41.9% | 30.7% |
| Total | 68.7% | 44.3% | 62.1% | 41% |

Table 19. Buddy Generalization Probes with Peers

- All Data is Presented with % of Basic Steps Correct / % of Skill Specific Steps Correct

| Teaching Procedure | Skill | Pre 1 | Pre 2 | Pre 3 | Post 1 | Post 2 | Post 3 |
|---|---|---|---|---|---|---|---|
| Teaching Interactions | Losing Graciously | Not Taken | Not Taken | Not Taken | (a)100% (b) 0% | (a)100% (b)100% | (a)100% (b)100% |
| Teaching Interactions | On Topic Conversation | Not Taken | Not Taken | Not Taken | (a)100% (b)100% | (a)100% (b)100% | (a)100% (b)100% |
| Teaching Interactions | Following Instructions | Not Taken | Not Taken | Not Taken | (a)100% (b)100% | (a)100% (b)100% | (a)100% (b)100% |
| Social Stories | Negotiation | Not Taken | Not Taken | Not Taken | (a)100% (b)25% | (a)100% (b)50% | (a)100% (b)50% |
| Social Stories | Sportsmanship | Not Taken | Not Taken | Not Taken | (a)100% (b)100% | (a)100% (b)100% | (a)100% (b)100% |
| Social Stories | Changing the Conversation | Not Taken | Not Taken | Not Taken | (a)100% (b)100% | (a)100% (b)75% | (a)100% (b)75% |

(a) Basic skill steps correct
(b) Skill Specific Steps Correct

Table 20. Nick Generalization Probes with Peers

- All Data is Presented with % of Basic Steps Correct / % of Skill Specific Steps Correct

| Teaching Procedure | Skill | Pre 1 | Pre 2 | Pre 3 | Post 1 | Post 2 | Post 3 |
|---|---|---|---|---|---|---|---|
| Teaching Interactions | Compliments | Not Taken | Not Taken | Not Taken | (a)100% (b) 0% | (a)100% (b) 33% | (a)100% (b)100% |
| Teaching Interactions | Sportsmanship | Not Taken | Not Taken | Not Taken | (a)100% (b) 0% | (a)100% (b)0% | (a)100% (b) 0% |
| Teaching Interactions | Changing the game | Not Taken | Not Taken | Not Taken | (a)100% (b)0% | (a)100% (b)0% | (a)100% (b)0% |
| Social Stories | Greetings | Not Taken | Not Taken | Not Taken | (a)100% (b) 0% | (a)100% (b)0% | (a)100% (b)0% |
| Social Stories | Empathy | Not Taken | Not Taken | Not Taken | (a)100% (b)0% | (a)100% (b)0% | (a)100% (b)0% |
| Social Stories | Showing Appreciation | Not Taken | Not Taken | Not Taken | (a)100% (b)0% | (a)100% (b)0% | (a)100% (b)0% |

(a) Basic skill steps correct
(b) Skill Specific Steps Correct

Table 21. Lang Generalization Probes with Peers

- All Data is Presented with % of Basic Steps Correct / % of Skill Specific Steps Correct

| Teaching Procedure | Skill | Pre 1 | Pre 2 | Pre 3 | Post 1 | Post 2 | Post 3 |
|---|---|---|---|---|---|---|---|
| Teaching Interactions | Cheering Person Up | Not Taken | Not Taken | Not Taken | (a)100% (b)83.33% | (a)100% (b)83.33% | (a)100% (b)100% |
| Teaching Interactions | Losing Graciously | Not Taken | Not Taken | Not Taken | (a)100% (b)100% | (a)100% (b)100% | (a)100% (b)100% |
| Teaching Interactions | Joining In | Not Taken | Not Taken | Not Taken | (a)100% (b)100% | (a)100% (b)80% | (a)100% (b)100% |
| Social Stories | Changing Conversation | Not Taken | Not Taken | Not Taken | (a)100% (b)0% | (a)100% (b)100% | (a)100% (b)0% |
| Social Stories | Explaining a Prior Cool Event | Not Taken | Not Taken | Not Taken | (a)100% (b)0% | (a)100% (b)0% | (a)62.5% (b)0% |
| Social Stories | Interrupting | Not Taken | Not Taken | Not Taken | (a)100% (b)100% | (a)87.5% (b)100% | (a)87.5% (b)100% |

(a) Basic skill steps correct
(b) Skill Specific Steps Correct

Table 22. Apollo Generalization Probes with Peers

- All Data is Presented with % of Basic Steps Correct / % of Skill Specific Steps Correct

| Teaching Procedure | Skill | Pre 1 | Pre 2 | Pre 3 | Post 1 | Post 2 | Post 3 |
|---|---|---|---|---|---|---|---|
| Teaching Interaction | Showing Appreciation | (a)100% (b)33.3% | (a)100% (b)0% | (a)100% (b)0% | (a)100% (b)66% | (a)100% (b)66% | (a)100% (b)66% |
| Teaching Interaction | On Topic Conversation | (a)100% (b) 0% | (a)100% (b)0% | (a)75% (b)0% | (a)100% (b)50% | (a)100% (b)83.3% | (a)100% (b)66.6% |
| Teaching Interaction | Change the Game | (a)100% (b)16.7% | (a)100% (b)16.7% | (a)87.5% (b)16.7% | (a)100% (b)100% | (a)100% (b)100% | (a)100% (b)100% |
| Social Stories | Negotiation | (a)100% (b) 0% | (a)100% (b) 0% | (a)100% (b)0% | (a)100% (b)50% | (a)100% (b)50% | (a)100% (b) 0% |
| Social Stories | Losing and Winning Graciously | (a)100% (b) 0% | (a)100% (b)0% | (a)100% (b)0% | (a)100% (b)0% | (a)100% (b)0% | (a)100% (b)0% |
| Social Stories | Disagreeing Appropriately | (a)100% (b)16.7% | (a)100% (b)0% | (a)87.5% (b)0% | (a)100% (b) 0% | (a)100% (b)0% | (a)100% (b)33.3% |

(a) Basic skill steps correct
(b) Skill Specific Steps Correct

Table 23. Mickey Generalization Probes with Peers

- All Data is Presented with % of Basic Steps Correct / % of Skill Specific Steps Correct

| Teaching Procedure | Skill | Pre 1 | Pre 2 | Pre 3 | Post 1 | Post 2 | Post 3 |
|---|---|---|---|---|---|---|---|
| Teaching Interaction | Compliments | (a)75% (b)0% | (a)75% (b)0% | (a)75% (b)0% | (a)100% (b)40% | (a)100% (b)100% | (a)100% (b)80% |
| Teaching Interaction | Losing/Winning Graciously | (a)75% (b)0% | (a)75% (b)0% | (a)75% (b)0% | (a)100% (b)66% | (a)100% (b)100% | (a)100% (b)100% |
| Teaching Interaction | Change the Game | (a)75% (b)16.7% | (a)100% (b)16.7% | (a)75% (b)16.7% | (a)100% (b)100% | (a)100% (b)100% | (a)100% (b)100% |
| Social Stories | Providing Assistance | (a)75% (b)0% | (a)75% (b)0% | (a)75% (b) 0% | (a)100% (b) 0% | (a)75% (b)100% | (a)100% (b)66% |
| Social Stories | Showing Interest | (a)75% (b)0% | (a)75% (b)0% | (a)75% (b)0% | (a)100% (b)0% | (a)75% (b)0% | (a)100% (b)85.7% |
| Social Stories | On Topic Conversation | (a)75% (b)0% | (a)75% (b)0% | (a)75% (b)0% | (a)100% (b)33% | (a)100% (b)83.3% | (a)100% (b)83.3% |

(a) Basic skill steps correct
(b) Skill Specific Steps Correct

Table 24. Buddy Efficiency

| Target Pair | Did Skill Reach Mastery Criterion with Teaching Interaction? | Did Skill Reach Mastery Criterion with Social Story? | Number of Teaching Interaction Sessions | Number of Social Story Sessions | Total Time for Teaching Interaction Sessions | Total Time for Social Story Sessions |
|---|---|---|---|---|---|---|
| Pair One | Yes | No | 6 | 12 | 47 m 51 s | 76 m 53 s |
| Pair Two | Yes | Yes | 4 | 11 | 31 m 20 s | 63 m 26 s |
| Pair Three | Yes | Yes | 8 | 9 | 51 m 45 s | 54 m 36 s |
| Total | N/A | N/A | 18 | 32 | 130 m 56 s | 194 m 55 s |

Table 25. Hank Efficiency

| Target Pair | Did Skill Reach Mastery Criterion with Teaching Interaction? | Did Skill Reach Mastery Criterion with Social Story? | Number of Teaching Interaction Sessions | Number of Social Story Sessions | Total Time for Teaching Interaction Sessions | Total Time for Social Story Sessions |
|---|---|---|---|---|---|---|
| Pair One | Yes | No | 10 | 15 | 76 m 13 s | 92 m 06 s |
| Pair Two | Yes | No | 5 | 12 | 46 m 30 s | 73 m 51 s |
| Pair Three | Yes | No | 10 | 15 | 97 m 43 s | 110 m 34 s |
| Total | N/A | N/A | 25 | 42 | 220 m 26 s | 276 m 31 s |

Table 26. Nick Efficiency

| Target Pair | Did Skill Reach Mastery Criterion with Teaching Interaction? | Did Skill Reach Mastery Criterion with Social Story? | Number of Teaching Interaction Sessions | Number of Social Story Sessions | Total Time for Teaching Interaction Sessions | Total Time for Social Story Sessions |
|---|---|---|---|---|---|---|
| Pair One | Yes | No | 4 | 12 | 27 m 46 s | 79 min 35 s |
| Pair Two | Yes | No | 5 | 12 | 34 m 49 s | 68 min 24 s |
| Pair Three | Yes | No | 6 | 12 | 51 m 39 s | 57 min 23 s |
| Total | N/A | N/A | 15 | 36 | 124 m 14 s | 204 m 22 s |

Table 27. Lang Efficiency

| Target Pair | Did Skill Reach Mastery Criterion with Teaching Interaction? | Did Skill Reach Mastery Criterion with Social Story? | Number of Teaching Interaction Sessions | Number of Social Story Sessions | Total Time for Teaching Interaction Sessions | Total Time for Social Story Sessions |
|---|---|---|---|---|---|---|
| Pair One | Yes | Yes | 11 | 18 | 108 m 57 s | 112 m 36 s |
| Pair Two | Yes | No | 4 | 12 | 25 m 19 s | 62 m and 06 s |
| Pair Three | Yes | No | 12 | 17 | 56 m 48 s | 95 min and 52 s |
| Total | N/A | N/A | 27 | 47 | 191 m 4 s | 269 m 34 s |

Table 28. Apollo Efficiency

| Target Pair | Did Skill Reach Mastery Criterion with Teaching Interaction? | Did Skill Reach Mastery Criterion with Social Story? | Number of Teaching Interaction Sessions | Number of Social Story Sessions | Total Time for Teaching Interaction Sessions | Total Time for Social Story Sessions |
|---|---|---|---|---|---|---|
| Pair One | Yes | No | 7 | 12 | 20 m 40 s | 35 m 54 s |
| Pair Two | Yes | No | 5 | 12 | 24 m 7 s | 37 m 6 s |
| Pair Three | Yes | No | 6 | 12 | 22 m 41 s | 43 m 23 s |
| Total | N/A | N/A | 18 | 36 | 67 m 27 s | 116 m 23 s |

Table 29. Mickey Efficiency

| Target Pair | Did Skill Reach Mastery Criterion with Teaching Interaction? | Did Skill Reach Mastery Criterion with Social Story? | Number of Teaching Interaction Sessions | Number of Social Story Sessions | Total Time for Teaching Interaction Sessions | Total Time for Social Story Sessions |
|---|---|---|---|---|---|---|
| Pair One | Yes | Yes | 5 | 7 | 17 m 22 s | 19 m 44 s |
| Pair Two | Yes | No | 3 | 12 | 9 m 40 s | 33 m 9 s |
| Pair Three | Yes | No | 4 | 12 | 11 m 44 s | 33 m 1 s |
| Total | N/A | N/A | 12 | 31 | 38 m 46 s | 85 m 54 s |

Table 30. Participant Preference

| Participant | Number of Opportunities to Select | Number of Teaching Interaction Selections | Number of Social Story Selections | Number of Control Selections |
|---|---|---|---|---|
| Buddy | 10 | 7 | 3 | 0 |
| Hank | 14 | 0 | 14 | 0 |
| Nick | 12 | 4 | 4 | 4 |
| Lang | 15 | 3 | 7 | 5 |
| Apollo | 13 | 3 | 5 | 5 |
| Mickey | 10 | 4 | 4 | 2 |
| Total | 74 | 21 (28.37%) | 37 (50%) | 16 (21.6%) |

Table 31. Social Validity Results (Average Rating of Social Skill Performance)

| Skill | Naturalistic Probes Pre | Naturalistic Probes Post | Gen. with Adults Pre | Gen. with Adults Post | Gen. with Peers Pre | Gen. with Peers Post |
|---|---|---|---|---|---|---|
| Buddy Teaching Interactions | 1 | 5 | 1.22 | 5 | N/A | 5 |
| Hank Teaching Interactions | 1 | 5 | 1 | 5 | N/A | N/A |
| Nick Teaching Interactions | 1.44 | 3.33 | 1 | 2.22 | N/A | 1.11 |
| Lang Teaching Interactions | 1.11 | 5 | 1 | 5 | N/A | 5 |
| Apollo Teaching Interactions | 1.11 | 5 | 1 | 5 | 1.66 | 5 |
| Mickey Teaching Interactions | 1.11 | 5 | 1 | 3.88 | 1 | 4.23 |
| Average Rating Teaching Interaction | 1.12 | 4.83 | 1.03 | 4.35 | 1.33 | 4.08 |
| Buddy Social Stories | 1 | 3.77 | 1 | 3.66 | N/A | 3.66 |
| Hank Social Stories | 1.22 | 4.33 | 1.11 | 3.11 | N/A | N/A |
| Nick Social Stories | 1 | 1.88 | 1 | 1 | N/A | 1.88 |
| Lang Social Stories | 1 | 3.55 | 1 | 3.66 | N/A | 2.33 |
| Apollo Social Stories | 1.11 | 4.55 | 1.44 | 3.66 | 1 | 4.77 |
| Mickey Social Stories | 1.11 | 4.88 | 1 | 4.11 | 1.44 | 4.77 |
| Average Rating Social Stories | 1.07 | 3.83 | 1.09 | 3.3 | 1 | 3.51 |

**Appendix A (Example Social Story without Icons)**

1. Helping people is a nice thing to do.
2. When I help people they will be happy with me.
3. When people are happy with me they might do nice things for me.
4. They might buy me new games or help me out
5. There are many times when I can help someone
6. I can help someone when I see them struggling with doing something such as opening a bottle or moving a couch.
7. When I see someone struggling with a task or saying they can not do something I should help them.
8. This will make them happy.
9. I first should face the person, look them in the eye, have a cool body, voice, and a smile.
10. I first should ask if I could help by saying “Can I help you?”
11. This way they know that you are wanting to help
12. The person will probably say that I can help them
13. I then should ask what do they need help with by saying “What do you need help with?”
14. This way I can find out what they need help with
15. I should then go over and help the person out
16. The person will probably say thank you
17. If the person says thank you I need to say your welcome
18. I should never cry, hit, or be silly when helping.
19. This is how I can help out people.
20. This will make people happy with me
21. This will make me feel proud.

**Appendix B (Example of Social Validity Questionnaire)**

1. How well does Apollo disagree with a teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

2. How well does Apollo disagree with a peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

3. How well does Apollo change a game when the teacher appears bored?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

4. How well does Apollo stay on-topic during a conversation with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

5. How well does Apollo win or lose graciously with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

6. How well does Apollo negotiate who should go first with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

7. How well does Apollo win or lose graciously with a peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

8. How well does Apollo win or lose graciously with a teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

9. How well does Apollo show appreciation to the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

10. How well does Apollo show appreciation to the peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

11. How well does Apollo negotiate who should go first with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

12. How well does Apollo show appreciation to the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

13. How well does Apollo win or lose graciously with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

14. How well does Apollo stay on-topic during a conversation with the peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

15. How well does Apollo stay on-topic during a conversation with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

16. How well does Apollo disagree with a peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

17. How well does Apollo negotiate who should go first with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

18. How well does Apollo disagree with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

19. How well does Apollo change the game when the teacher appears bored?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

20. How well does Apollo stay on-topic during a conversation with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

21. How well does Apollo show appreciation to the peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

22. How well does Apollo disagree with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

23. How well does Apollo change the game when the peer appears bored?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

24. How well does Apollo disagree with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

25. How well does Apollo stay on-topic during conversation with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

26. How well does Apollo change the game when the teacher appears bored?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

27. How well does Apollo negotiate who should go first with the peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

28. How well does Apollo win or lose graciously with the peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

29. How well does Apollo show appreciation to the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

30. How well does Apollo change the game when the teacher appears bored?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

31. How well does Apollo show win or lose graciously with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

32. How well does Apollo stay on-topic during conversation with the peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

33. How well does Apollo negotiate who should go first with the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

34. How well does Apollo show appreciation to the teacher?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

35. How well does Apollo negotiate who should go first with the peer?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |

36. How well does Apollo change the game when the peer appears bored?

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Very poorly or Did Not Display the Skill at All | | | | Very Well |