Research in Autism Spectrum Disorders 6 (2012) 777–791

Contents lists available at SciVerse ScienceDirect

Research in Autism Spectrum Disorders

Journal homepage: http://ees.elsevier.com/RASD/default.asp

Teaching typically developing children to promote social play with their siblings with autism☆

Misty L. Oppenheim-Leaf[1,*], Justin B. Leaf[2], Claudia Dozier, Jan B. Sheldon, James A. Sherman

Applied Behavioral Science, University of Kansas, United States

ARTICLE INFO

Article history:
Received 23 September 2011
Received in revised form 21 October 2011
Accepted 21 October 2011

Keywords:
Autism
Peer interaction
Play skills
Social interaction
Peer-mediated treatment

ABSTRACT

Siblings are important "peers" for children. Unfortunately, children with autism often do not play or interact often with their typically developing siblings. The purpose of this study was to teach three typically developing children (ages 4–6) skills that were likely to increase the amount and quality of social play interactions with their brothers who have autism. A teacher used the teaching interaction procedure to teach typically developing children to provide clear instructions and prompt and reinforce appropriate play behavior such as joining into a play activity, sharing toys, and engaging in appropriate toy play. All three typically developing children learned the targeted skills during role-plays with a teacher and, to a large part, generalized the skills when they played with their brothers with autism. In addition, some children who learned these skills increased their positive interactions and decreased negative interactions during a free-play period with their sibling with autism.

Social deficits of children with autism often hinder development of appropriate relationships (DSM-IV-TR, 2000). Siblings are a special type of peer with whom children with autism may have difficulty developing appropriate relationships; the literature is mixed, however, as to how having a sibling diagnosed with autism affects the sibling relationship (Howlin, 1988; Orsmond & Seltzer, 2007). There is some evidence from comparison studies that siblings of children with autism (a) interact less with their siblings (El-Ghoroury & Romanczyk, 1999; Knott, Lewis, & Williams, 1995; Knott, Lewis, & Williams, 2007), (b) are less involved with and supportive of their siblings as adults (Orsmond & Seltzer, 2007), and (c) have more behavior problems (Hastings, 2003; Rodrigue, Geffken, & Morgan, 1993; Verte, Roeyers, & Buysse, 2003) than siblings of children with Down Syndrome or no disability. In contrast, several studies have not found significant negative effects of having a sibling with autism (Hastings, 2007; Kaminsky & Dewey, 2002).

In view of the possible negative effects of the limited appropriate social skills demonstrated by children with autism toward peers and siblings, it is not surprising that a number of studies have attempted to increase appropriate social behavior of children with autism (Weiss & Harris, 2001). One type of intervention used to increase appropriate social behavior of children with autism has been peer-mediated intervention. Peer-mediated intervention usually involves teaching peers to initiate interactions with a child with autism (Odom, Hoyson, Jamieson, & Strain, 1985; Odom & Strain, 1986; Strain & Fox, 1981; Strain, Shores, & Timm, 1977) or teaching peers to prompt and/or reinforce appropriate social behaviors from a child with autism (Gurlanick, 1976; Lancioni, 1982; Strain, Kerr, & Ragland, 1979; Wahler, 1967).

☆ This investigation was conducted to meet, in part, the requirements for a Master's of Arts degree in Behavioral Psychology at the University of Kansas. We would like to thank Kelley Gorman for her work throughout this project.

* Corresponding author at: 200 Marina Drive, Seal Beach, CA 90740, United States.
E-mail address: MLO0411@gmail.com (M.L. Oppenheim-Leaf).
[1] Present address: Great Strides Behavioral Consulting, United States.
[2] Present address: Autism Partnership and Great Strides Behavioral Consulting, United States.

1750-9467/$ – see front matter © 2011 Elsevier Ltd. All rights reserved.
doi:10.1016/j.rasd.2011.10.010

Outcomes of peer-mediated interventions have generally been positive. Peer-mediated interventions generally lead to increased positive interactions between trained peers and children with autism (Odom et al., 1985; Strain et al., 1979, 1977) and/or increased appropriate social behaviors demonstrated by the children with autism (Gurlanick, 1976; Wahler, 1967). These results, however, occurred primarily because adults prompted the trained peers to use the strategies taught to them while they played with the children with autism (Odom et al., 1985; Odom & Watts, 1991). When adult prompts were faded, social interactions between trained peers and the children with autism tended to return to baseline levels (Odom et al., 1985).

Although there have been numerous studies investigating the use of peers to increase appropriate behaviors of children with autism, relatively few studies have addressed the effects of sibling-mediated interventions. The first studies showing that typically developing siblings can be taught to use behavior modification techniques to change their siblings' behavior focused on academic tasks (Schreibman, O'Neill, & Koegel, 1983), self-help skills (Lobato & Tlaker, 1985; Swenson-Pierce, Kohl, & Egel, 1987), and arbitrary tasks such as dropping poker chips through one of three holes in a box (Cash & Evans, 1975). Celiberti and Harris (1993) suggested that play activities and social skills may be more appropriate for sibling training than academic or self-help skills, particularly when the children are younger. The authors taught three typically developing girls (ages 7–10) to use behavior modification techniques such as providing play-related instructions, prompting appropriate play behavior, and delivering reinforcement for appropriate play during play sessions with their younger sibling with autism. All three typically developing children were able to learn the behavior modification techniques and maintained the skills during follow up probes 3, 6, and 16 weeks following training. In addition, each sibling with autism showed an increase in desired responding (i.e., following their siblings instructions) following sibling training. The types of instructions that the typically developing siblings were taught to deliver, however, were toy manipulations (e.g., "Put the farmer on the horse") or play-related speech (e.g., "Make the sound of the horse"), and the children were only observed in contrived play situations (i.e., children made to play with same toys and redirected back to play area if they leave). It is still unknown whether typically developing siblings can be taught to use techniques such as instructions, prompting, and reinforcement to evoke or teach more complex, interactive social behaviors (e.g., sharing) to their siblings with autism and whether learning these skills would affect the frequency of interactive play given a less contrived, free-play situation.

Several studies examined whether sibling training generalized to more natural settings by recording sibling behaviors during free-play sessions with their brother or sister with autism before and after sibling training (James & Egel, 1986; Tsao & Odom, 2006). For example, Tsao and Odom (2006) taught four young siblings of children with autism general initiation strategies (e.g., establishing eye contact, suggesting play activities, and initiating conversations). The authors measured levels of joint attention and interaction between the children during 10-min free-play periods prior to, during, and following sibling training. Modest increases occurred in joint attention and overall levels of interaction for three out of four sibling dyads. Similar to most previous peer-mediated interventions, however, the authors found that while initiation training led to higher levels of social initiations by the typically developing child, it did not necessarily lead to higher levels of social initiations or appropriate social behaviors by the child with autism. In addition, the authors did not measure the proficiency of the typically developing siblings at using the strategies taught to them.

An intervention that has not been reported in the literature to teach social interaction techniques to peers and siblings of children with autism is the teaching interaction procedure. The teaching interaction procedure involves the teacher briefly describing the target skill, providing rationales and cues for why and when the skill should be demonstrated, role-playing the skill, the learner practicing the skill, and the teacher providing feedback to the learner based upon their performance (Hazel, Schumaker, Sherman, & Sheldon-Wildgen, 1983, Minkin et al., 1976; Phillips, Phillips, Fixsen, & Wolf, 1971). The teaching interaction procedure has been effective in teaching various skills to adolescents (Hazel et al., 1983; Minkin et al., 1976), young children with autism (Leaf, Dotson, Oppenheim, Sheldon, & Sherman, 2010; Leaf et al., 2009), and group home staff members (Harchik, Sherman, Sheldon, & Strouse, 1992). In addition, behavioral skills training, a procedure similar to the teaching interaction procedure except for the exclusion of rationales, has been used to teach various skills to adults with intellectual disabilities (Miltenberger et al., 1999), preschool and elementary school children (Himle, Miltenberger, Flessner, & Gatheridge, 2004; Johnson et al., 2006), and parents and teachers of children with disabilities (Lafasakis & Sturmey, 2007; Sarokoff & Sturmey, 2004). It is possible that components of the teaching interaction procedure could increase sibling's ability to accurately demonstrate skills taught (e.g., modeling, role-play), which has not been well reported in the previous literature, and generalize skills to the natural environment (e.g., rationales and cues and characteristics), which has been lacking in the previous literature.

In addition, most previous literature on peer- and sibling-mediated interventions involved training of the peer/sibling in vivo with the child with autism (e.g., Celiberti & Harris, 1993; James & Egel, 1986; Tsao & Odom, 2006). It may be beneficial to teach the peer/sibling skills in a more isolated and structured setting; however, it is unknown if peers/siblings will be able to generalize skills from a role-play training situation with an adult to interactions with the child with autism.

The previous research on peer- and sibling-mediated interventions to increase social skills in children with autism has shown that typically developing children are generally able to learn and use behavior change techniques to increase social interactions with children with autism. The current study extends the literature on peer and sibling mediated interventions in three ways. First, we examined whether the teaching interaction procedure would be effective at teaching young children to proficiently prompt and reinforce simple (e.g., following play related instructions) and more complex and interactive (e.g., sharing) social behaviors from their siblings with autism. Second, we examined whether the children would be able to proficiently and effectively generalize skills from a role-play situation with an adult to structured play situations with their siblings with autism, without any additional prompting or reinforcement from the teacher. Third, we examined whether this

training would lead to increased social interactions between the sibling dyads during more natural play interactions, free of adult intervention.

1. Methods

1.1. Participants

Three sibling dyads participated in this study. A sibling dyad consisted of a typically developing child (*target child*) and that child's brother with autism (*sibling*). Each of the target children were verbal, exhibited strong interaction skills, and said that they would like to increase their interactions with their sibling with autism.

The first sibling dyad was Eric, a 4-year-old boy diagnosed with autism (*sibling*), and Jared, his typically developing 5-year-old brother (*target child*). Eric displayed some conversational speech and exhibited many appropriate play skills; however, he had difficulty initiating and maintaining play with others. He often was disruptive (e.g., messing up play materials), had difficulty awaiting his turn, and engaged in high levels of self-stimulatory behavior (e.g., body rocking, hand flapping, and bouncing). Jared engaged in frequent problem behaviors, as well, including noncompliance with adult requests and aggression toward his brother, Eric.

The second sibling pair was Tanner, a 7-year-old boy diagnosed with autism (*sibling*), and Evan, his typically developing 4-year-old brother (*target child*). Tanner had almost no language, communicated mostly by gestures, and displayed very few appropriate play skills. He frequently engaged in self-stimulatory behavior (e.g., mouthing and body rocking) and crying. Evan occasionally engaged in noncompliance with adult requests (e.g., refusal to leave a preferred activity).

The third sibling dyad was Lonny, a 4-year-old boy diagnosed with autism (*sibling*), and Amanda, his typically developing 5-year-old sister (*target child*). Lonny displayed conversational speech and demonstrated some appropriate play skills; his play, however, was often repetitive and ritualistic. He frequently displayed tantrums during play and task activities. Amanda also occasionally engaged in tantrums, screaming, and noncompliant behavior.

1.2. Materials and setting

Experimental sessions always consisted of probe periods and sometimes consisted of teaching periods, depending on the phase of the study. All experimental sessions were conducted in a playroom of the home of the children. Play materials available each day were based on preferences of the children (determined by child report prior to each experimental session). Play materials may change from day to day but always included a turn taking game (e.g., Candyland), pretend play toys (e.g., Mr. Potato Head, cars), and manipulative toys (e.g., Legos). Experimental sessions were held two or three times each week and were approximately 30–45 min in duration. The length of each experimental session differed depending on the phase of the study, the number of probes to be conducted that day, and child compliance. Probe periods ranged from approximately 10–30 min in length; teaching periods ranged from approximately 20–30 min in length. Present during all sessions were the target child, the teacher (the first author), and an assistant (an undergraduate student). The sibling with autism was present only during generalization and free-play probes (see below).

1.3. Target skills

Each target child was taught three skills, and each skill was divided into several steps for purposes of teaching. Specific skill steps are listed in Table 1. Amanda and Evan were taught how to get their brothers with autism to play with them, how to get their brothers with autism to share toys with them, and how to provide play-related instructions (e.g., "roll the car"). Jared was taught how to get his brother with autism to play with him, how to get his brother to share toys with him, and how to find out what his brother wanted to play and play with him. Each skill taught involved the target child providing (a) requests to their sibling (e.g., "come play with me"), (b) physical or verbal prompts for their sibling to complete the action (e.g., physically prompting them to come to the play area), and (c) praise for appropriate behavior (e.g., "Good job" or "I like when you play with me"). All target skills involved some overlapping skill steps (e.g., face sibling, say sibling's name, appropriate voice tone) as well as specific steps (e.g., asks for toy for sharing probe). All overlapping skill steps were behaviors considered important to any successful positive interaction, regardless of what social skill was involved.

1.4. Probes and dependent measures

Probes were situations set up by the experimenter to examine the effects of training on the children's behavior without any intervention from the teachers. Three types of probes were conducted throughout the study.

1.4.1. Role-play probes of each skill (with assistant)

Daily role-play probes were used to determine mastery of skills taught to the target child; mastery criterion was set at three consecutive role-play probes with all skill steps performed at 100% accuracy. Prior to beginning any role-play probes, the target child was told that he or she should pretend that the assistant was the sibling with autism. The teacher played a game or engaged in an activity with the target child while the assistant arranged herself in a situation that should set the

Table 1
Task analysis of target skills.

Step	Inviting to play	Asking to share	Play instructions	Choosing activity
1.	Approach sibling	Approach sibling	Face sibling (2 s)	Approach sibling
2.	Face sibling (2 s)	Face sibling (2 s)	Say sibling's name	Face sibling (2 s)
3.	Say sibling's name	Say sibling's name	Provide a play-related instruction	Say sibling's name
4.	Ask sibling to come play	Ask to see toy	Instruction was simple (i.e., specific, one step)	Ask what sibling wants to play
5.	Wait 2 s for response	Wait 2 s for response	Wait 2 s for response	Wait 2 s for response
6.	Provide verbal prompt (if appropriate)	Provide least intrusive prompt (usually verbal)	Provide least intrusive prompt (usually verbal)	Provide least intrusive prompt (usually verbal)
7.	Provide physical prompt if needed	Keep providing more intrusive prompts until successful	Keep providing more intrusive prompts until successful	Keep providing more intrusive prompts until successful
8.	If sibling still won't come, offer to play with him	Provide praise (must follow social behavior)	Provide praise (must follow social behavior)	Provide praise (must follow social behavior)
9.	Play with sibling	Offer sibling a different toy to play with	Appropriate voice tone throughout	Go play chosen activity
10.	Provide praise (must follow social behavior)	Attempt to return the toy		Appropriate voice tone throughout
11.	Appropriate voice tone throughout	Appropriate voice tone throughout		
12.		Refrain from grabbing toy		

occasion for the target behavior (e.g., sitting across the room playing with a preferred toy for the sharing probe). While playing, the teacher gave the child a non-specific instruction that should set the occasion for the child to engage in one of the target skills (e.g., "go play with Lonny"). The target child had to determine which target behavior to engage in based on the behaviors of the assistant (e.g., playing with preferred item vs. having difficulty with toy). No further prompting was given and no consequences were provided for the target child's behavior. In order to provide the target child with the opportunity to engage in all steps of the task analysis of each skill, the assistant always waited until after the target child provided a prompt for her to engage in the appropriate social behavior (e.g., the target child held out his or her hand as a prompt for the assistant to hand over the toy during sharing probes). In addition, the assistant was instructed to engage in behaviors similar to those observed in the sibling with autism (e.g., non-compliance, turning away, ignoring). For all role-play probes, the probe was ended if the target child had not begun to engage in the target skill within 1 min, the target child stopped engaging in the skill for 1 min, or the target child completed the target skill. At the end of the probe, the teacher simply resumed playing the game/activity with the target child. This process was repeated until all skills had been probed.

During role-play probes, observers scored whether the target child engaged in each step of the targeted skill (as determined by the task analysis; see Table 1). Accuracy was determined by dividing the number of steps that the target child displayed correctly by the total number of steps in the task analysis.

1.4.2. Generalization probes of each skill (with sibling)

Generalization probes were conducted to determine if the target child generalized skills learned during teaching to his or her sibling with autism. Generalization probes were identical to role-play probes except that the sibling with autism was present and was prompted by the research assistant to engage in behaviors that should set the occasion for behavior by the target child (e.g., the sibling sat across the room and played with a preferred toy for the sharing probe). There was always an opportunity for the target child to engage in skills taught during generalization probes, since the siblings with autism never initiated social interactions during generalization probes (e.g., handing over a toy prior to being asked by the target child).

Generalization probes were scored the same way as role-play probes. Since opportunities to engage in certain skill steps, however, were partially determined by the behavior of the sibling, accuracy was determined by dividing the number of correct steps in which the target child engaged by the total number of steps in which he or she had the opportunity to engage.

In addition, the social behavior of the children with autism was assessed during generalization probes. Following each opportunity the target child provided to his or her sibling with autism to engage in a social skill, the sibling's response was scored as a "0", "1", or "2". A "0" was scored if the sibling had an opportunity to engage to the social behavior but failed to do so (e.g., the target child asked his or her sibling to share a toy and the sibling refused to share). A "1" was scored if the sibling engaged in the social behavior only following a prompt from the target sibling (e.g., the sibling handed over his toy only after the target sibling promised to give it back in 1 min). A "2" was scored if the sibling independently engaged in the social behavior when presented with the opportunity to do so (e.g., the target child asked his or her sibling to share a toy, and the sibling independently shared).

1.4.3. Free-play probes with sibling

The purpose of the free-play probes was to determine if teaching the skills to the target children would increase levels of play and interaction between the target child and his or her sibling in naturalistic situations. Three free-play probes were conducted prior to any skills being taught and following mastery of each target skill (during each probe phase, see below).

Prior to each free-play probe, the children's play room was arranged with 3–4 preferred activities and the children were told to "go play", the teacher then sat in the corner and pretended to do work. No other instructions or prompts were provided. Free-play probes were 7 min in length and always preceded any role-play or generalization probes that were scheduled. Child behavior was only scored during the last 5 min to allow the children time to begin acting normally; any behaviors that occurred in the first 2 min were not scored.

Free-play probes were scored via videotapes using a 10-s partial interval recording system; four different types of play were scored during each interval. Independent play was scored if, for at least 3 consecutive seconds within an interval, the children were not engaging with the same play materials or if the children were playing with the same play materials but more than 3 ft away from each other. Parallel play was scored if, for at least 3 consecutive seconds within the interval, the children were within 3 ft of each other and playing with the same play materials but not interacting. Cooperative play was scored if, for at least 3 consecutive seconds within the interval, the children were within 3 ft of each other and playing with the same play materials and interacting (e.g., sharing materials, commenting on play activities, providing instructions, taking turns within the context of a game, working toward a common goal). Cooperative play was also scored if the children were interacting with each other without using any play materials (e.g., rough and tumble play, piggy back rides, chase, sitting and talking, etc.). Negative interactions were scored if one child yelled at the other (e.g., elevated voices, negative voice tone), said negative phrases or statements to the other (e.g., "get away from me," "I hate you"), or engaged in any physical aggression toward the other child (e.g., pushing, hitting, kicking). Due to the number of behaviors scored and session-by-session variations in behaviors, visual analysis of trends in session-by-session data for free-play probes was difficult to make. Thus, for purposes of visual analysis, behaviors scored during free-play probes were averaged across the three probes conducted during each phase.

1.5. Interobserver agreement

During role-play and generalization probes, interobserver agreement on the dependent measures was assessed by having two observers (the teacher and a reliability observer) record data simultaneously and independently during an average of 50% (range, 33–67%) of all probe and teaching phases. Interobserver agreement was calculated using a point-by-point agreement method. An agreement was scored if the two observers recorded the occurrence or non-occurrence of steps completed by the target sibling. Percentage agreement for skill steps displayed during role-play and generalization probes was 95.2% (range, 67–100%), averaged across all three sibling dyads and all target skills.

For types of play displayed during free-play probes, interobserver agreement was calculated using an interval agreement method. That is, the number of intervals in which the data collectors agreed on all types of play that occurred was divided by the total number of intervals and multiplied by 100. Percent agreement for free-play probes was 95% (range, 83–100%), averaged across all phases and sibling dyads.

1.6. Procedures

1.6.1. Probe phase (baseline and maintenance)

The purpose of the probe phase was to determine the target child's baseline level of skills and, once a skill had been taught, to test for maintenance. A probe phase was conducted prior to any teaching and following mastery of each target skill. During the first three sessions in each probe phase, all three types of probes were presented in the following order: a free-play probe, generalization probes for each target skill with the sibling with autism, role-play probes for each target skill with the assistant. If the teacher was unable to conduct all of the probes scheduled in a day, due to time constraints or the children indicating that they wanted to stop, the probes were made up on a later day. The order in which skills were evaluated within generalization and role-play probes varied across session and were randomly predetermined prior to each session.

1.6.2. Teaching phase

Sessions during the teaching phase always began with role-play and generalization probes for the current skill, except for the first day of the teaching phase. Occasionally, the child with autism was not available during the teaching phase so generalization probes were not conducted. In addition, role-play and generalization probes for all skills not yet taught and skills previously taught were conducted at least once each teaching phase in order to determine continued baseline or maintenance levels. Once all probes of the day were completed the target child was taught the current target skill through the use of the teaching interaction procedure. The teaching interaction procedure involved didactic teaching, modeling, and role-plays.

1.6.3. Motivational system

The target children were each provided with a personal notebook in which they could collect stickers. Stickers were earned throughout the teaching interaction procedure for sitting appropriately, answering questions, and correctly role-playing the skill. At the end of the teaching session, the number of stickers earned was counted and the target child was allowed to "cash in" their stickers for a reward. Rewards were small toys (e.g., costing $1–$5) that the target child had said he or she preferred. The target child could exchange stickers for smaller rewards on a daily basis or "save" stickers to earn larger rewards after several days. Prior to each teaching period, the target child was reminded about the sticker system.

1.6.4. Didactic teaching

First, the teacher briefly described what skill would be taught that day (e.g., "Today we are talking about asking Tanner to play."), provided a rationale of why the target child should engage in the behavior (e.g., "We should ask Tanner to play with us because then we have someone to play with"), and prompted the child to come up with additional rationales (e.g., "We should also ask Tanner to play with us because then he will learn how to play more games"). Next, the teacher described situations when the target child should engage in the target skill (e.g., "We should ask Tanner to play with us when he is playing by himself"). Finally, the teacher described each step of the skill. After this description, the target child was asked to name and describe what he or she was expected to do for each step. During didactic teaching, the target child received praise and one sticker for each question answered correctly.

1.6.5. Modeling

After didactic teaching, the teacher modeled the skill with the assistant playing the role of the sibling with autism. During initial modeling, the teacher omitted one or more of the steps of the skill, usually based on how the target child was performing during role-play probes, and then asked the target child to evaluate the teacher's performance. If the target child stated correctly what steps of the skill were omitted, he or she was provided with a sticker. If the target child gave an incorrect response, the teacher provided the target child feedback regarding what the teacher modeled correctly and incorrectly. Finally, the teacher modeled a correct performance of the skill with the assistant. The same question and feedback as in the first model occurred. After the second teacher model, teaching moved to role-plays.

1.6.6. Role-plays

Following the teacher's model, the teacher asked the target child to role-play the skill with the assistant playing the part of the sibling. Two role-play opportunities were provided each teaching session. Prior to each role-play opportunity, the teacher played with the target child for several minutes and then gave the target child a general instruction that should set the occasion for the target child to engage in the target skill (e.g., "play with Tanner"). Following the completion of each role-play, the teacher provided praise for steps completed correctly and feedback for the steps completed incorrectly. If the target child did not perform the skill at 100% accuracy, he or she was asked to try the skill again. If the target child did not perform at 100% accuracy during the second role-play attempt, he or she was asked to practice one more time, and the teacher verbally prompted the target child through the task. Once the target child role-played the skill correctly, reinforcement was provided and the teaching ended. The target child received three stickers for correctly performing the skill on the first role-play, two stickers for correctly performing the skill on the second role-play, and one sticker for correctly performing the skill on the third role-play (whether independent or prompted by the teacher). Following the first role-play opportunity, the teacher played with the target child for 5–10 min prior to providing the second role-play opportunity, which was conducted exactly like the first role-play opportunity. After the second role-play opportunity, the session was ended and the child was allowed to cash in his or her stickers.

1.6.7. Priming

For one sibling dyad (Amanda and Lonny), after no effect of teaching was seen during the free-play probes, a priming condition was implemented. Prior to the free-play probe, the teacher and the target child quickly reviewed the three skills that were taught (e.g., "You learned about asking Lonny to play, sharing, and helping Lonny play better."), when she should use these skills (e.g., "anytime you are playing with Lonny"), and why it was important to do the skills (e.g., "so that I will have someone to play with and Lonny will get better at playing with me"). During priming, steps of the skills were not discussed, and no modeling or role-plays were implemented. Priming lasted 2–5 min, and the target child was provided stickers for correctly answering questions that the teacher asked during the priming period. Following priming, the teacher conducted free-play probes as described above. Once Amanda and Lonny showed increased levels of parallel and/or cooperative play, priming was removed and free-play probes were conducted as in baseline (Post-Priming).

1.7. Experimental design

A multiple-probe experimental design (Horner & Baer, 1978) across skills, replicated across participants, was used. Probe phases were alternated with teaching phases. Teaching phases ended when target children mastered target skills, as determined by their performance during role-play probes. Functional control is demonstrated in multiple-probe designs if participants start to display a skill after and only after teaching of the skill began.

1.8. Procedural integrity

In order to determine the teacher's accuracy of implementation of the teaching interaction procedure, procedural integrity was scored via videotapes for 45% of sessions across all participants and skills. Procedural integrity was calculated by taking the number of teacher behaviors the observer recorded divided by the number of behaviors listed in the teaching protocol. Procedural integrity across all participants and skills was an average of 98.9% (range, 80–100%).

1.9. Social validity

To determine the social validity of the intervention and outcomes, parents were surveyed regarding how happy they were with the skills their children had learned and how much change they had observed in their children's interactions since their participation in this study. Parents were asked to complete a 7-question survey using a 5-point likert scale, with a "1" denoting strong dissatisfaction and a "5" denoting strong satisfaction with procedures used, skills targeted, and behavior changes observed.

2. Results

2.1. Mastery of skills

All three target children mastered and maintained the skills taught, as determined by performance during role-play probes. In addition, all three target children generalized the skills to their sibling with autism to a fairly high degree, as determined by performance on generalization probes. Figs. 1–3 show the percent of the skill steps correctly performed on role-play and generalization probes for the target children, Jared, Amanda, and Evan, respectively.

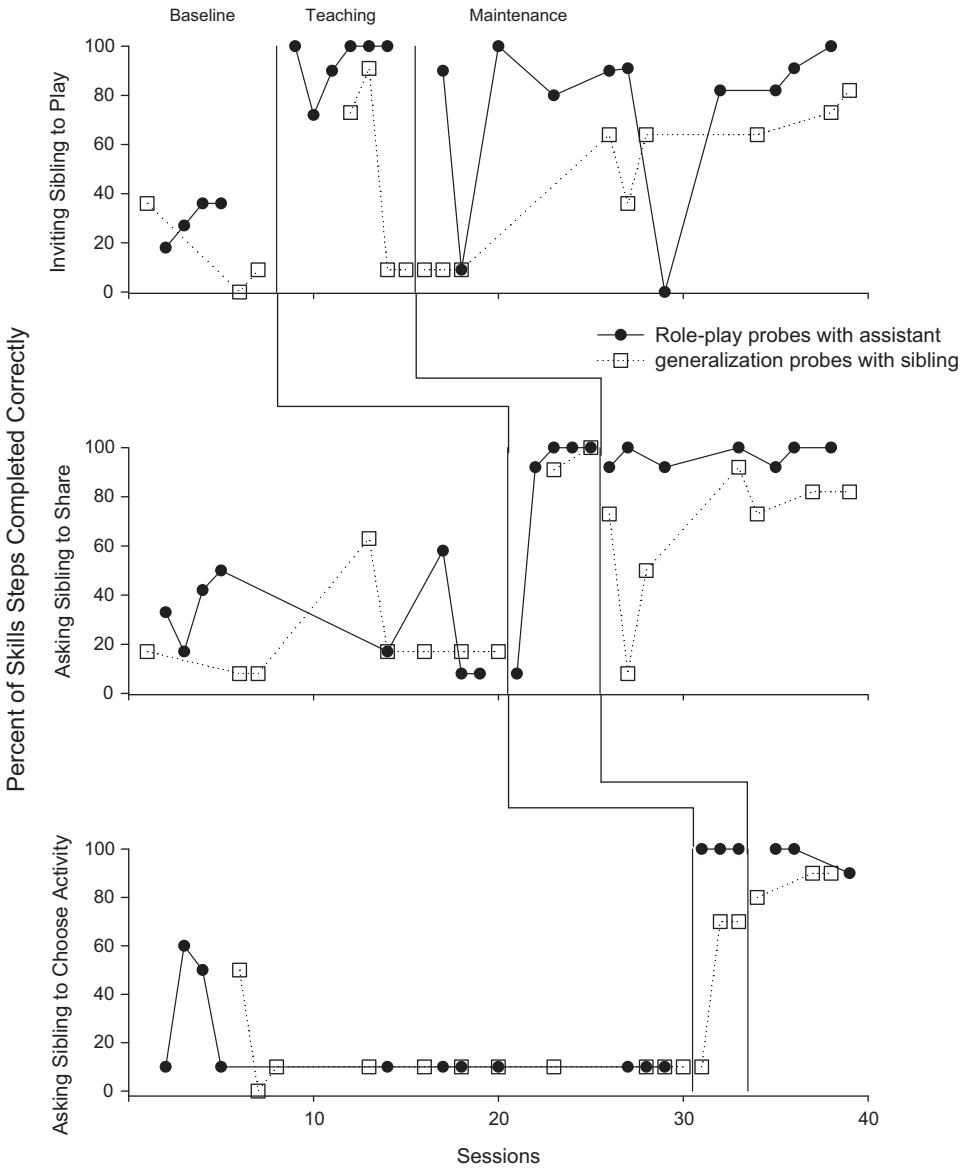

Fig. 1. Percent of steps completed correctly by Jared for role-play (closed circles) and generalization (open squares) probes for inviting your sibling to play, asking your sibling to share his toys, and asking your sibling to choose a play activity.

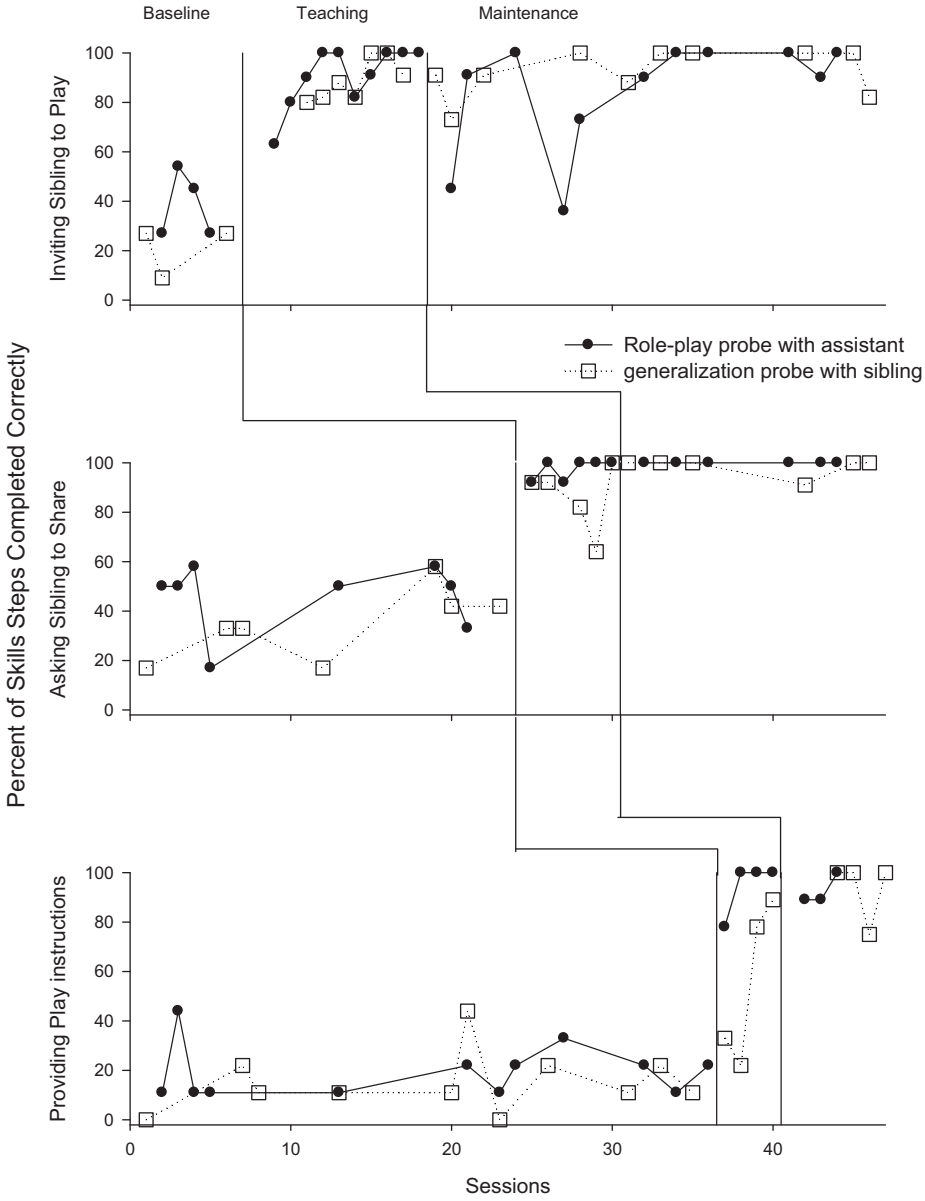

Fig. 2. Percent of steps completed correctly by Amanda for role-play (closed circles) and generalization (open squares) probes for inviting your sibling to play, asking your sibling to share his toys, and providing play related instructions.

2.2. Social behavior (children with autism)

The intervention was also effective at increasing the amount of targeted social behaviors the siblings with autism displayed with the target children during generalization probes. Figs. 4–6 display the behavior of the siblings with autism, Eric, Lonny, and Tanner, during all generalization probes. Open circles below the zero line represent probes in which the sibling with autism did not engage in any social behaviors because the target child failed to set the occasion for them to do so. While the siblings with autism still had the opportunity to initiate social behaviors during these probes, this never occurred.

All siblings with autism rarely engaged in any of the targeted social behaviors during baseline generalization probes. The target children, however, also rarely set the occasion for the siblings with autism to engage in those targeted social behaviors during baseline probes (as denoted by the open circles below the zero line). Following intervention, the siblings with autism had more opportunities to engage in social behavior and engaged in frequent appropriate social behavior. Following intervention, Eric, Tanner, and Lonny engaged in the targeted social behavior following a prompt from the target child on 33%, 62%, and 48% of probes, respectively, and independently engaged in the targeted social behavior on 42%, 28%, and 52% of all probes, respectively.

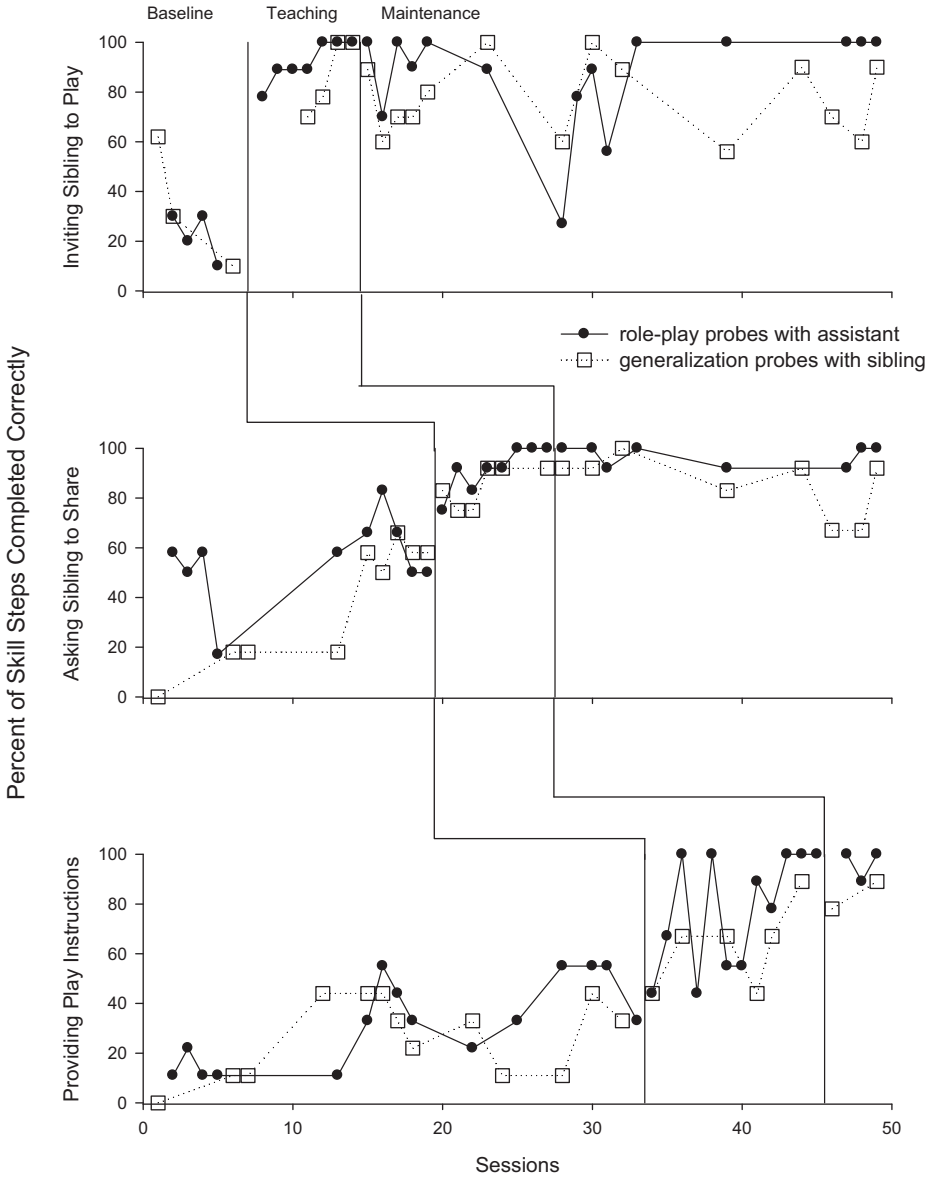

Fig. 3. Percent of steps completed correctly by Evan for role-play (closed circles) and generalization (open squares) probes for inviting your sibling to play, asking your sibling to share his toys, and providing play related instructions.

2.3. Free-play probes

The children showed different effects of the intervention in the free-play probes. Fig. 7 depicts the average level of play that each sibling dyad engaged in during free-play probes across each phase (e.g., baseline, after teaching the first skill, etc.). Results from free-play probes were idiosyncratic for each sibling dyad.

Following intervention, sibling dyad one, Jared and Eric, increased the amount of time spent in cooperative play and parallel play and decreased the amount of time spent in independent play and negative interactions from baseline levels. Unfortunately, one of the free-play probes for Jared and Eric (during the probe phase following teaching of the first skill) was unable to be scored because of technical difficulties with the video; therefore, data are only reported from two free-play probes during that phase. Sibling dyad two, Amanda and Lonny, engaged almost exclusively in independent play during baseline and following intervention. Only after a priming phase was implemented did the siblings begin to engage in high levels of cooperative and parallel play; these increases in engagement maintained once the priming was removed. Sibling dyad three, Evan and Tanner, engaged in independent play 100% of intervals across all phases of the study. At no time during the study did Evan and Tanner engage in cooperative play, parallel play, or negative interactions. Unfortunately, due to time constraints, Evan had to stop participation in the study before the priming condition could be implemented.

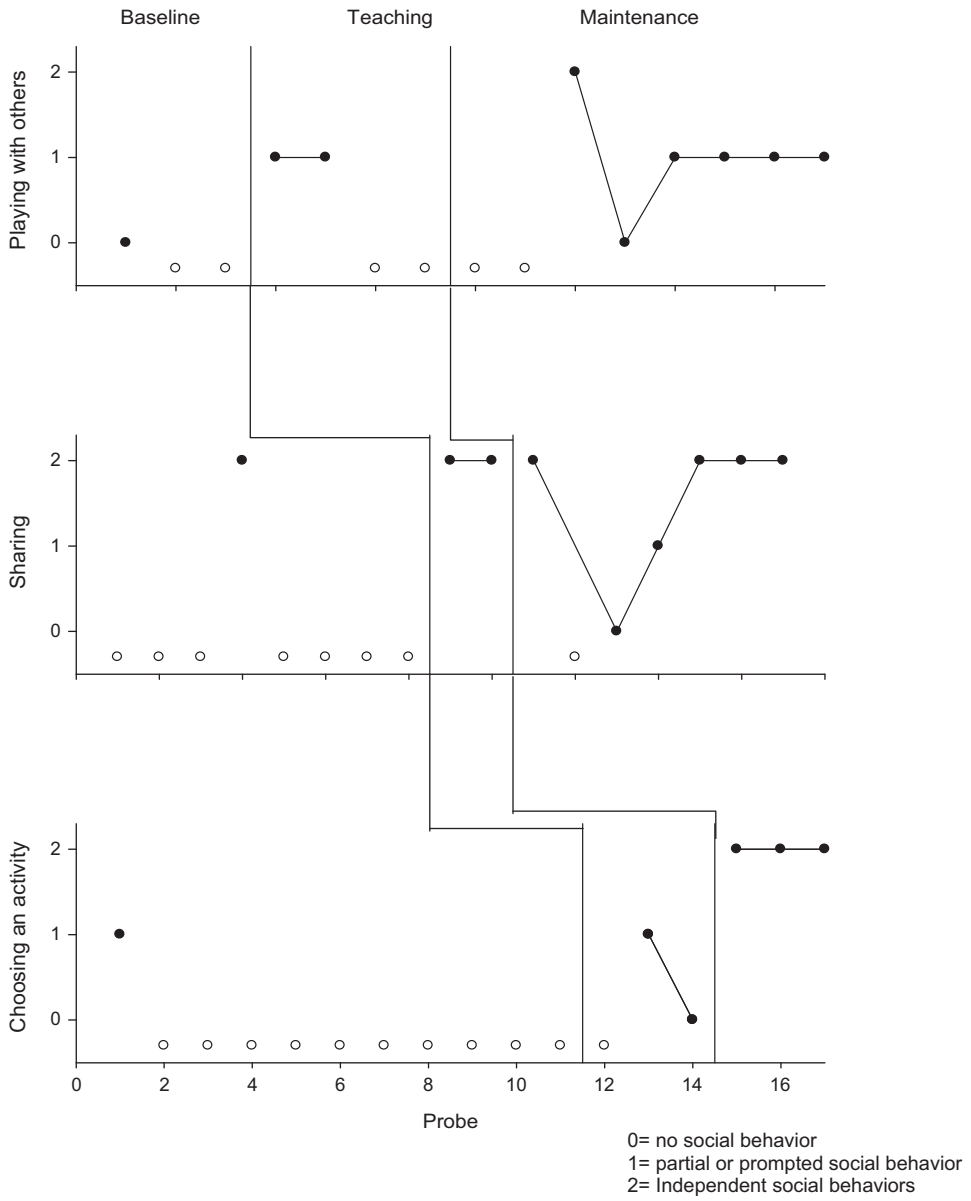

Fig. 4. Social behaviors exhibited by Jared's sibling with autism, Eric, on generalization probes for playing with others, sharing toys, and choosing a play activity. Open circles below zero represent probes in which Jared failed to set the occasion for Eric to engage in appropriate social behaviors.

2.4. Social validity

Only two of the three parents returned the social validity questionnaire. Overall, parents were very satisfied with the changes in their children's behavior following intervention; average satisfaction for both parents was a 4.71 (range, 4–5) on a 5-point Likert scale. Parental surveys returned expressed high satisfaction with children's general behavior changes outside of sessions, target skills taught, and target sibling's use of target skills outside of sessions. Both parents reported that, since beginning participation in the study, they noticed their children playing more together and playing better together. In addition, anecdotal reports by the participant's mothers were very positive. Jared's mother reported that she had noticed Jared and his older brother, Tommy, including Eric more in their play activities; Amanda's mother reported that Amanda was spending a lot more time not only trying to include Lonny in her play activities, but also trying to teach him how to play appropriately.

3. Discussion

Three target children were taught skills to encourage their siblings with autism to engage in specific social behaviors (e.g., sharing). Following implementation of the teaching interaction procedure, each target child was able to demonstrate all

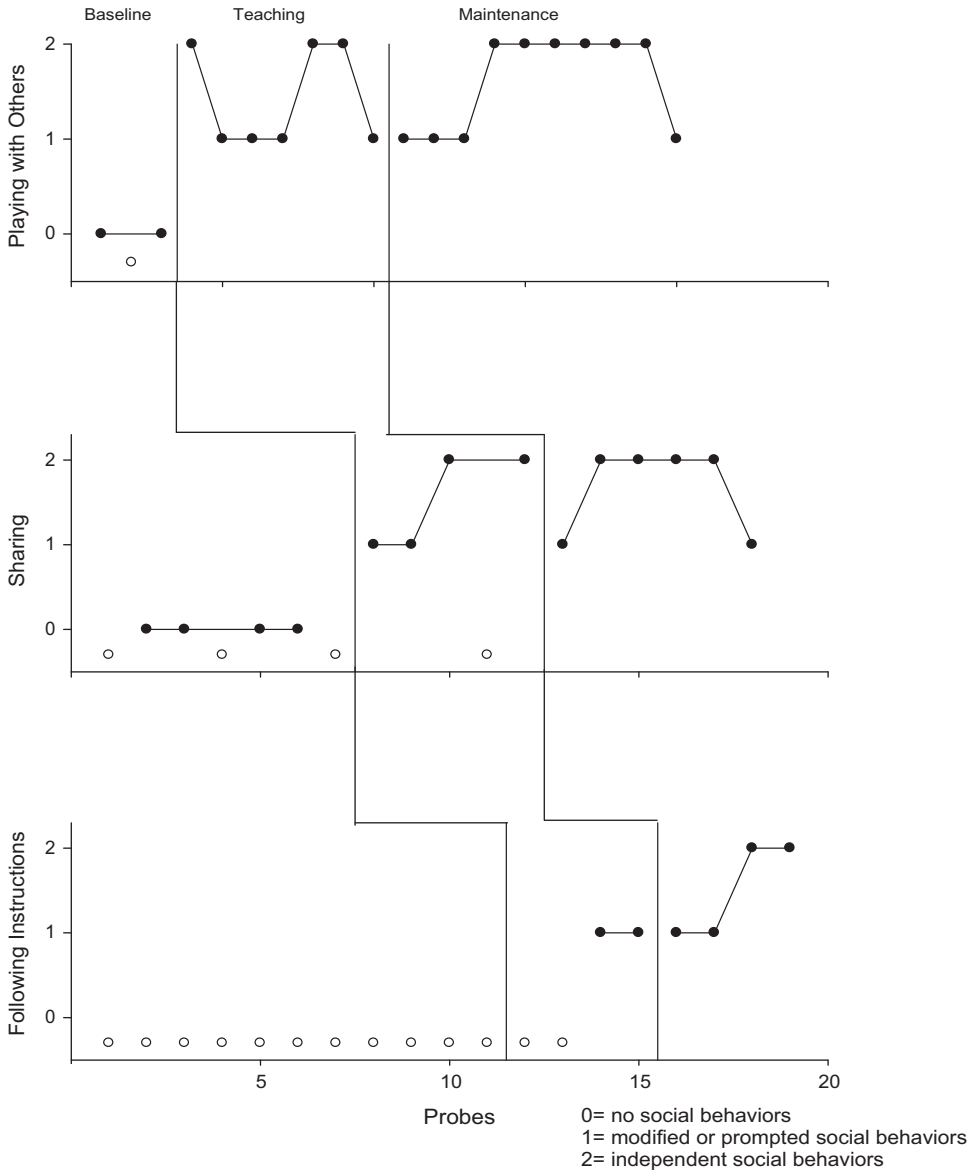

Fig. 5. Social behaviors exhibited by Amanda's brother with autism, Lonny, on generalization probes for playing with others, sharing toys, and following play related instructions. Open circles below zero represent probes in which Amanda failed to set the occasion for Lonny to engage in appropriate social behaviors.

skills taught with a teacher and with his or her brother with autism. In addition, the performance of the siblings with autism during generalization probes suggests that the target children were effective at encouraging their siblings to engage in the targeted social behaviors. Prior to intervention, the siblings with autism rarely had the opportunity to engage in appropriate social behavior and rarely engaged in social behavior when they did have the opportunity to do so. Following intervention, however, the siblings with autism frequently engaged in the targeted social behavior, either independently or following a prompt from the target child. Furthermore, for two participants, play interactions between the target child and his or her sibling with autism increased during free-play situations. Generalization of training to the free-play situation, however, was idiosyncratic in that one sibling dyad demonstrated increased interactions following the teaching intervention, one sibling dyad demonstrated increased interactions only following the teaching intervention plus a priming phase, and one sibling dyad demonstrated no increases in interactions.

In the current study, the target children were taught to give instructions, prompt appropriate social behavior, and reinforce correct social behavior. The teaching procedure, however, was implemented in the absence of the sibling with autism. Teaching in the absence of the sibling with autism has several possible advantages and at least one possible disadvantage. One advantage is that if the sibling with autism engages in frequent noncompliant or maladaptive behaviors

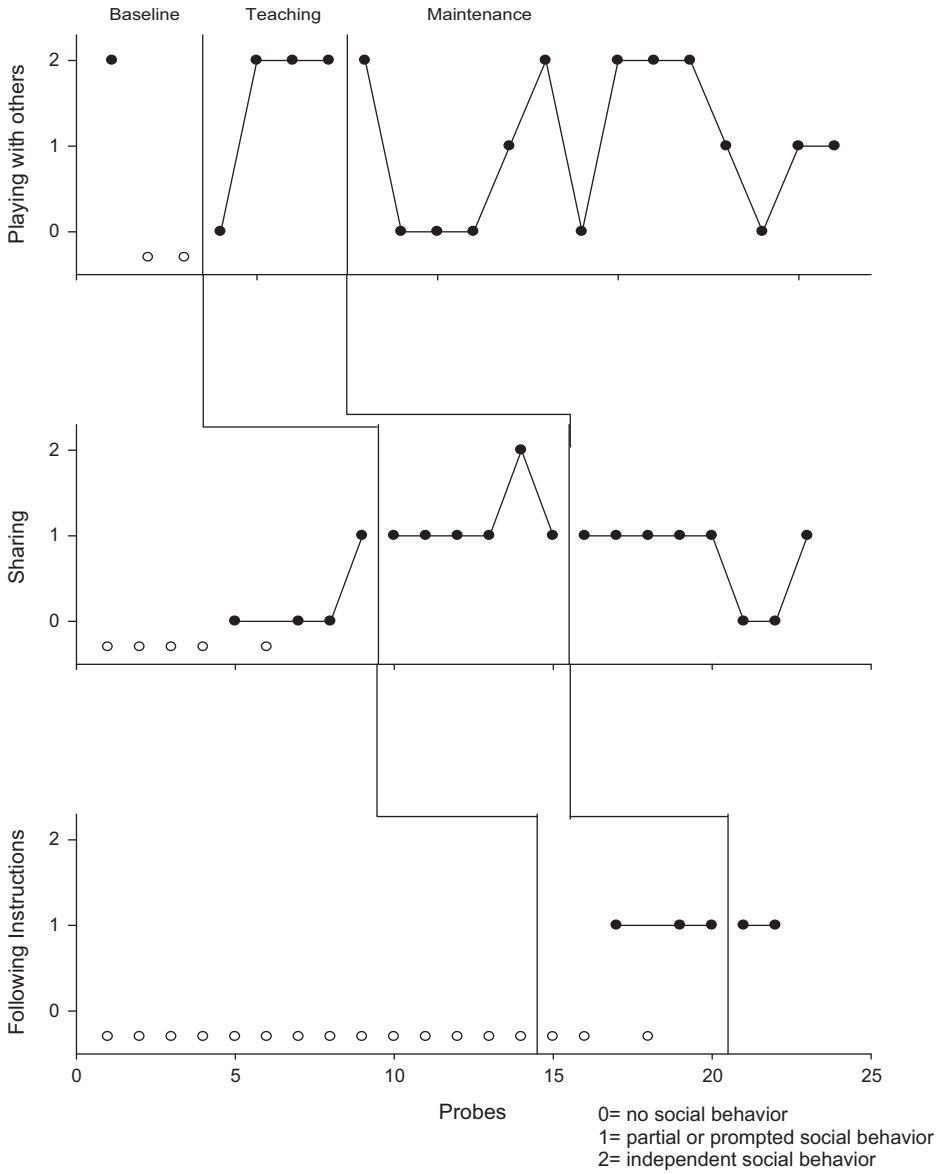

Fig. 6. Social behaviors exhibited by Evan's brother with autism, Tanner, on generalization probes for playing with others, sharing toys, and following play related instructions. Open circles below zero represent probes in which Evan failed to set the occasion for Tanner to engage in appropriate social behaviors.

(e.g., tantrums, aggression), involving them in the training sessions may be counterproductive to the purpose of the training sessions and lead to further negative interactions between the siblings (Celiberti & Harris, 1993). A second advantage is that training the target child in role-play situations allows the teacher to gradually increase the difficulty of the situation for the target child as well as design situations that the target child may encounter with his or her sibling with autism. Third, if the target child is more confident and competent in the strategies being taught to him/her prior to implementation with his or her sibling with autism, he or she may be more likely to encounter initial success and continue to use the strategies. Finally, teaching the target child in isolation gives the target child a time for individualized attention, which is often difficult to provide when a child in the household has a disability (Howlin, 1988). The possible disadvantage is that the target children's usage of skills with their siblings with autism may have been less complete than might have been the case if the target children had been directly taught instructions, prompting, and reinforcement skills with their sibling with autism. The high levels of generalization, however, indicate that teaching in the absence of the sibling with autism may substantially improve performance of the target child.

Target children were taught skills to increase the likelihood that their siblings with autism would demonstrate appropriate social behaviors. Due to the low frequency of opportunities to engage in social behavior provided by the target children during baseline probes, we were unable to determine whether the siblings with autism already reliably

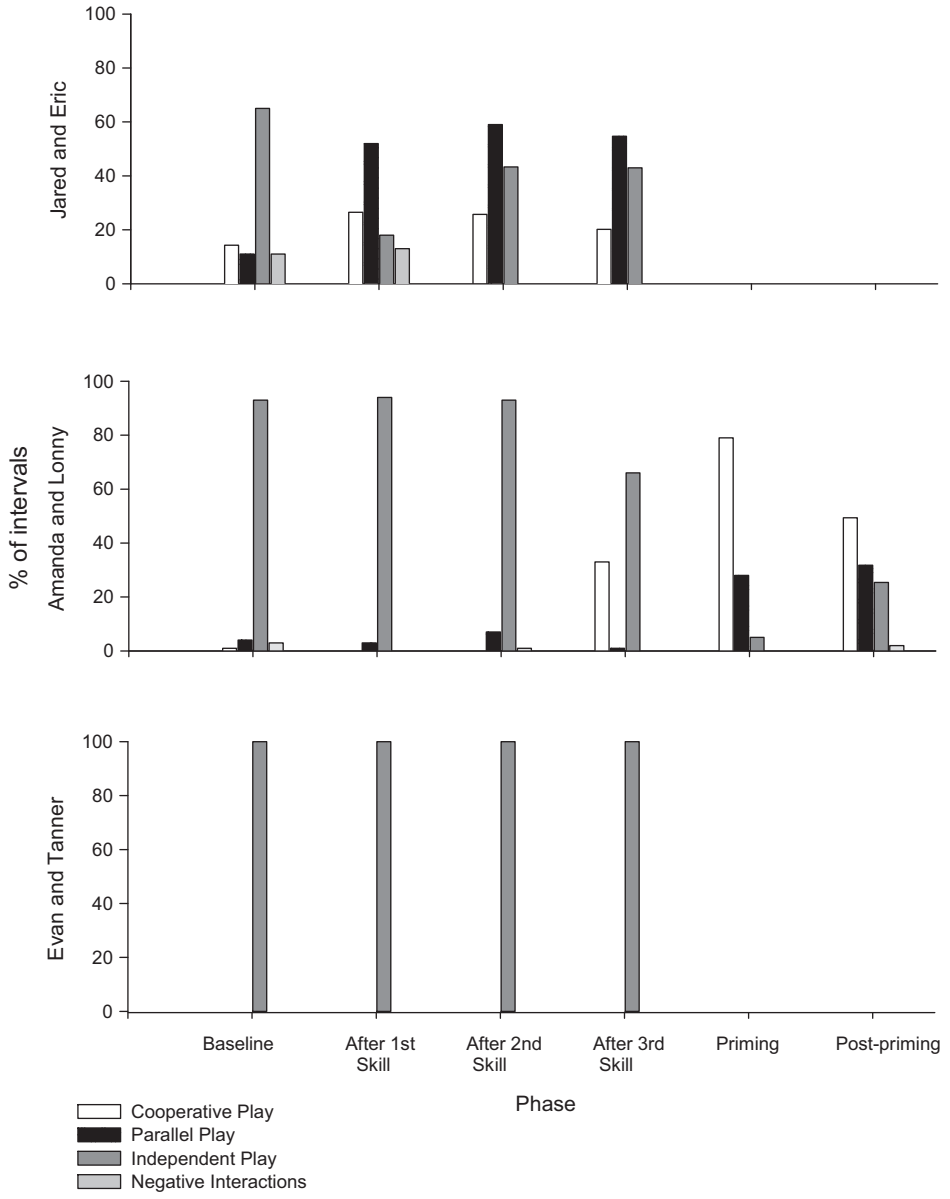

Fig. 7. Average percent of intervals that Jared and Eric (top panel), Amanda and Lonny (middle panel), and Evan and Tanner (bottom panel) engaged in cooperative play, parallel play, independent play, and negative interactions during each phase of the study (i.e., during baseline, following teaching of first skill, following teaching of second skill, and following teaching of third skill).

demonstrated the social behaviors that the target children were taught to promote. The high level of prompts provided by the target children following intervention, however, suggest that the siblings with autism did not consistently and independently engage in the targeted social behaviors. While we do not know whether the target children were actually teaching their siblings with autism to engage in appropriate social behaviors, following teaching the target children provided more frequent opportunities for their siblings with autism to practice appropriate social behaviors. It has been suggested that one long-term influence of sibling interactions is that "one sibling learn certain characteristics, expectancies, or skills from another sibling that in turn influences future learning or behavior" (Abramovitch, Pepler, & Corter, 1982). Thus, one possible advantage of using siblings to promote social behaviors in children with autism is that the similarity between sibling interactions and interactions with other peers may better foster generalization of skills to interactions with peers (better than, for example, adult-mediated interventions).

Although the target children generalized target skills to their brothers with autism during generalization probes, the children showed idiosyncratic effects of training during free-play probes. We do not know why some sibling dyads demonstrated more effects of training during free-play probes than other sibling dyads. We suspect, however, that the

existing social skills of the siblings with autism are an important factor. Certainly, it was the case that Eric (Jared's sibling with autism) displayed a greater amount of appropriate social behavior during observations prior to the start of the study than did the other two siblings with autism, which may have contributed to Eric and Jared showing the greatest increase in amount of play interactions during post-training free-play probes. Existing social skills of a sibling with autism may make it easier for a target child to prompt appropriate social behavior from their sibling. Additionally, more frequent appropriate social behavior from the sibling may well serve to positively reinforce the target child's attempts to play. Sibling dyads 2 and 3 may not have shown increases in interactions because they never came into contact with those reinforcers. Once priming was implemented for Amanda, and she began to receive reinforcement in the form of her brother's appropriate social behaviors, she continued to engage in social behaviors once priming was removed.

There are several limitations of the present study. One is that the intervention had clear effects only on the unprimed play interactions of one of the sibling dyads during free-play probes. A second limitation was that we were not able to evaluate the extent to which play interactions were maintained over a longer period of time and generalized to other situations. Future research may address these issues, as well as extensions of this research such as: (a) Will children with autism who have learned to play appropriately with their sibling also display these improved play skills when playing with other children? (b) Will the new play behaviors displayed by children with autism be positively reinforcing to other children so that the other children will want to continue to play with the child with autism? (c) Will the play interactions between children with autism and other children result in learning new play interactions that have not been directly taught by a teacher or other adult? (d) Will the increase in play interactions between children with autism and their siblings lead to a better quality relationship between the children?

There are also limitations in our ability to draw conclusions from the data. One limitation is the increasing trend during baseline role-play and generalization probes for skills two and three for Evan. This increasing trend decreases our ability to assert that the intervention was responsible for behavior changes; however, the increasing trend was not observed until skill one was taught and is most likely due to common skill steps among the skills. Additionally, Evan did not reach mastery on skills two and three until after intervention was implemented for those skills and Tanner did not begin to engage in the target behaviors of sharing and following instructions until after intervention was implemented. Second, the infrequent opportunities for the children with autism to engage in appropriate social behaviors during baseline makes it difficult to know whether or not they could already demonstrate target behaviors. While we do not know if the intervention led to the target children teaching new social behaviors to their siblings with autism, the intervention did appear to lead to them at least providing more opportunities for their siblings with autism to engage in appropriate social behaviors, and taught them to prompt the behaviors when their siblings with autism failed to respond appropriately.

Although there are still many questions to be answered, involving typically developing children in intervention for their siblings with autism may have advantages for the typically developing children, the siblings with autism, and the sibling relationship. Results from this study suggest that typically developing children are able to learn how to use behavioral instructional skills such as the ones taught in this study to promote social behavior in their siblings with autism. In addition, learning these skills may increase the number of opportunities that the siblings with autism have to practice appropriate social skills, increase their use of those social skills, and increase positive interactions during the time that the children play together.

References

Abramovitch, R., Pepler, D., & Corter, C. (1982). Patterns of sibling interaction among preschool-age children. In M. Lamb & B. Sutton-Smith (Eds.), *Sibling relationships: Their nature and significance across the lifespan*. Hillsdale, NJ: Erlbaum.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., Text Revision). Washington, DC: American Psychiatric Association.

Cash, W. M., & Evans, I. M. (1975). Training pre-school children to modify their retarded siblings' behavior. *Journal of Behavior Therapy and Experimental Psychiatry, 6*(1), 13–26.

Celiberti, D. A., & Harris, S. L. (1993). Behavioral intervention for siblings of children with autism: A focus on skills to enhance play. *Behavior Therapy, 24*(4), 573–599.

El-Ghoroury, N. H., & Romanczyk, R. G. (1999). Play interactions of family members towards children with autism. *Journal of Autism and Developmental Disorders, 29*(3), 249–258.

Gurlanick, M. J. (1976). The value of integrating handicapped and nonhandicapped preschool children. *American Journal of Orthopsychiatry, 46*(2), 236–245.

Harchik, A. E., Sherman, J. A., Sheldon, J. B., & Strouse, M. C. (1992). Ongoing consultation as a method of improving performance of staff members in a group home. *Journal of Applied Behavior Analysis, 25*(3), 599–610.

Hastings, R. P. (2003). Behavioral adjustment of siblings of children with autism. *Journal of Autism and Developmental Disorders, 33*(1), 99–104.

Hastings, R. P. (2007). Longitudinal relationships between sibling behavioral adjustment and behavior problems of children with developmental disabilities. *Journal of Autism and Developmental Disorders, 37*(8), 1485–1492.

Hazel, J. S., Schumaker, J. B., Sherman, J. A., & Sheldon-Wildgen, J. S. (1983). Social skills training with court-adjudicated youths. In C. LeCroy (Ed.), *Social skills training for children and youth* (pp. 117–137). New York: Haworth Press.

Himle, M. B., Miltenberger, R. G., Flessner, C., & Gatheridge, B. (2004). Teaching safety skills to children to prevent gun play. *Journal of Applied Behavior Analysis, 37*, 1–9.

Horner, R. D., & Baer, D. M. (1978). Multiple-probe technique: A variation on the multiple baseline. *Journal of Applied Behavior Analysis, 11*(1), 189–196.

Howlin, P. (1988). Living with impairment: The effects on children of having an autistic sibling. *Child: Care, Health, and Development, 14*(6), 395–408.

James, S. D., & Egel, A. L. (1986). A direct prompting strategy for increasing reciprocal interactions between handicapped and nonhandicapped siblings. *Journal of Applied Behavior Analysis, 19*(2), 173–186.

Johnson, B. M., Miltenberger, R. G., Knudson, P., Egemo-Helm, K., Kelso, P., Jostad, C., et al. (2006). A preliminary evaluation of two behavioral skills training procedures for teaching abduction-prevention skills to schoolchildren. *Journal of Applied Behavior Analysis, 39*(1), 25–34.

Kaminsky, L., & Dewey, D. (2002). Psychosocial adjustment in siblings of children with autism. *Journal of Child Psychology and Psychiatry, 43*(2), 225–232.

Knott, F., Lewis, C., & Williams, T. (1995). Sibling interaction of children with learning disabilities: A comparison of autism and Down's syndrome. *Journal of Child Psychology and Psychiatry, 36*(6), 965–976.
Knott, F., Lewis, C., & Williams, T. (2007). Sibling interaction of children with autism: Development over 12 months. *Journal of Autism and Developmental Disorders, 37*(10), 1987–1995.
Lafasakis, M., & Sturmey, P. (2007). Training parent implementation of discrete-trial teaching: Effects on generalization of parent teaching and child correct responding. *Journal of Applied Behavior Analysis, 40*, 685–689.
Lancioni, G. E. (1982). Normal children as tutors to teach social responses to withdrawn mentally retarded schoolmates: Training, maintenance, and generalization. *Journal of Applied Behavior Analysis, 15*(1), 17–40.
Leaf, J. B., Dotson, W. H., Oppenheim, M. L., Sheldon, J. B., & Sherman, J. A. (2010). The effectiveness of a group teaching interaction procedure for teaching social skills to young children with a pervasive developmental disorder. *Research in Autism Spectrum Disorders, 2*, 186–198.
Leaf, J. B., Taubman, M., Bloomfield, S., Palos-Rafuse, L., Leaf, R., McEachin, J., et al. (2009). Increasing social skills and pro-social behavior for three children diagnosed with autism through the use of a teaching package. *Research in Autism Spectrum Disorders, 3*, 275–289.
Lobato, D., & Tlaker, A. (1985). Sibling intervention with a retarded child. *Education & Treatment of Children, 8*(3), 221–228.
Miltenberger, R. G., Roberts, J. S., Ellingson, S., Galensky, T., Rapp, J. T., Long, E. S., et al. (1999). Training and generalization of sexual abuse prevention skills for women with mental retardation. *Journal of Applied Behavior Analysis, 32*(3), 385–388.
Minkin, N., Braukman, C. J., Minkin, B. L., Timbers, G. D., Timbers, B. J., Fixsen, D. L., et al. (1976). The social validation and training of conversational skills. *Journal of Applied Behavior Analysis, 9*, 127–139.
Odom, S. L., Hoyson, M., Jamieson, B., & Strain, P. (1985). Increasing handicapped preschoolers' peer social interactions: Cross-setting and component analysis. *Journal of Applied Behavior Analysis, 18*, 3–16.
Odom, S. L., & Strain, P. S. (1986). A comparison of peer-initiation and teacher-antecedent interventions for promoting reciprocal social interaction of autistic preschoolers. *Journal of Applied Behavior Analysis, 19*(1), 59–71.
Odom, S. L., & Watts, E. (1991). Reducing teacher prompts in peer-mediated interventions for young children with autism. *The Journal of Special Education, 25*(1), 26–43.
Orsmond, G. I., & Seltzer, M. M. (2007). Siblings of individuals with autism or down syndrome: Effects on adult lives. *Journal of Intellectual Disability Research, 25*(1), 26–43.
Phillips, E. L., Phillips, E. A., Fixsen, D. L., & Wolf, M. M. (1971). Achievement place: Modification of the behaviors of pre-delinquent boys within a token economy. *Journal of Applied Behavior Analysis, 4*, 45–59.
Rodrigue, J. R., Geffken, G. R., & Morgan, S. B. (1993). Perceived competence and behavioral adjustment of siblings of children with autism. *Journal of Autism and Developmental Disorders, 23*(4), 665–674.
Sarokoff, R. A., & Sturmey, P. (2004). The effects of behavioral skills training on staff implementation of discrete-trial teaching. *Journal of Applied Behavior Analysis, 37*(4), 535–538.
Schreibman, L., O'Neill, R. E., & Koegel, R. L. (1983). Behavioral training for siblings of autistic children. *Journal of Applied Behavior Analysis, 16*, 129–138.
Strain, P. S., & Fox, J. (1981). Peer social initiations and the modification of social withdrawal: A review and future perspective. *Journal of Pediatric Psychology, 6*, 417–433.
Strain, P. S., Kerr, M. M., & Ragland, E. U. (1979). Effects of peer-mediated social initiations and prompting/reinforcement procedures on the social behavior of autistic children. *Journal of Autism and Developmental Disorders, 9*(1), 41–54.
Strain, P. S., Shores, R. E., & Timm, M. A. (1977). Effects of peer social initiations on the behavior of withdrawn preschool children. *Journal of Applied Behavior Analysis, 10*(2), 289–298.
Swenson-Pierce, A., Kohl, F. L., & Egel, A. L. (1987). Siblings as home trainers: A strategy for teaching domestic skills to children. *Journal of the Association for Persons with Severe Handicaps, 12*(1), 53–60.
Tsao, L., & Odom, S. L. (2006). Sibling-mediated and social interaction intervention for young children with autism. *Topics in Early Childhood Special Education, 26*(2), 106–122.
Verte, S., Roeyers, H., & Buysse, A. (2003). Behavioral problems, social competence and self-concept in siblings of children with autism. *Child: Care, Health and Development, 29*(3), 193–205.
Wahler, R. G. (1967). Child–child interactions in free field settings: Some experimental analyses. *Journal of Experimental Child Psychology, 5*(2), 278–293.
Weiss, M. J., & Harris, L. (2001). Teaching social skills to people with autism. *Behavior Modification, 25*, 785–802.