

Peer Training to Facilitate Social Interaction for Elementary Students With Autism and Their Peers

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ABSTRACT: *There is increasing evidence that peer-mediated interventions for students with autism are effective in increasing participation in natural settings. Still unknown are the contributions peers make to the generalization of social behaviors. Results from two investigations of this issue are reported. In Study 1, social interaction with peers increased during interventions compared to controls; however, students in cooperative learning control groups showed higher levels of generalization than those in social groups. In Study 2, videotaped probes of 34 students indicated greater generalization of skills from groups with trained peers, and less from groups with untrained and stranger peers. Implications are discussed regarding the value of ongoing peer training and structured groups to establish relationships and generalization of skills over time.*

National trends indicate an increase in the number of children identified as having autism spectrum disorders (Autism Society of America, 1999). Diagnostic criteria for Autistic Disorder include qualitative impairment in social interaction and communication, a failure to develop peer relationships, and use of nonfunctional rituals and routines (DSM-IV, 1994). The challenges of this growing population have promoted an increased focus by educators and families on issues related to effective instruction and appropriate social and behavioral supports for students with autism within school and community settings. Research-validated, effective educational programming has been forthcoming with a consensus for (a) early and intensive one-to-one language intervention (e.g., Lovaas, 1987); (b) the use of small groups, peers, and individualized instruction in functional and academic skills (e.g., Gessler Werts, Caldwell, & Wolery, 1996; Kamps et al., 1995, 1997); and (c) inclusive education with accommodations and supports for students progressing in the academic curriculum (e.g., Koegel, Harrower, & Koegel, 1999).

A key to accommodating students with autism in public school settings is the provision of social and behavioral programming to develop meaningful participation with nondisabled peers (e.g., Koegel, Koegel, & Dunlap, 1996). The present investigations are part of a series of studies by the authors designed to investigate the benefits of peer mediation and social skills interventions for students with autism and other developmental disabilities. Prior reports provided empirical evidence supporting (a) peer tutoring and cooperative groups (Kamps, Barbetta, Leonard, & Delquadri, 1994); (b) social skills groups (Kamps et al., 1992); and (c) peer networks with academic and social components (Kamps et al., 1997).

A key to accommodating students with autism in public school settings is the provision of social and behavioral programming to develop meaningful participation with nondisabled peers.

These studies employed strategies targeting primarily the behavior of children with autism participating with peers. Yet to be examined, however, is the role of peers when trained in explicit interaction strategies with children with autism during and after specific treatment, and generalization of skills for target and peer participants to nontraining settings and with novel students.

The current studies investigated the role of peer training embedded within interventions to maximize participation for students with autism and the social benefits for all participants. Study 1 was an initial investigation of peer training within the contexts of social skills and cooperative learning groups in one school setting with a small number of students with autism. Study 2 replicated and refined these procedures with 34 students with autism and their peer groups across multiple school districts and multiple school years. Maintenance and skill generalization across participants (Stokes & Osnes, 1988) in both studies were measured via videotaped social behavior probes (Haring, Breen, Pitts-Conway, Lee, & Gaylord-Ross, 1987).

STUDY 1

This study examined the effects and generalization of three conditions: (a) social skills, (b) cooperative learning, and (c) control groups in which forms of peer training were embedded within the intervention. The overall design was a single subject reversal design (Barlow & Herson, 1984) including a no treatment baseline and social skills or cooperative learning groups intervention. Fall and spring social interaction behavior probes (videotaped sessions) were used to monitor maintenance and generalization effects to nontraining settings. The primary analysis of dependent variables (frequency, mean length, and duration of interactions) indicated that students changed with increased interaction levels during intervention conditions (see Dugan et al., 1995). In a secondary analysis, generalization effects were examined beyond the intervention settings. Three peer groups were available for this analysis of generalization: (a) those who participated in cooperative learning groups with students with autism,

(b) those who participated in social skills groups with students with autism, and (c) a group of peers who were familiar with the students with autism but had not received training. After establishing the initial effects of training, research questions addressing generalization were identified:

- Are differences observed between time engaged in social interaction for peers versus students with autism during *intervention versus generalization situation probes*?
- Are differences noted during generalization probes between time engaged in social interaction by *students without autism* across peer group conditions?
- Are differences noted during generalization probes between time engaged in social interaction for *students with autism* across peer group conditions?
- Are differences noted related to *contextual effects* (peer selection of activities) from pre- to postgeneralization probes?

PARTICIPANTS AND SETTINGS

Participants included 5 students with autism and 51 general education peers. Ann, a 10-year-old female with autism, was identified by her teachers as functioning in the moderate level. Ann used short sentences to communicate needs to adults, but had problems with echolalia and pronoun reversals. Initiations to peers in integrated settings (e.g., recess) were limited. Her teachers gave her a score of 41 on the Autism Behavior Checklist (ABC; Krug, Arick, & Almond, 1980). Matt, a 10-year-old male, was described as high functioning. He used sentences to communicate but was observed to be quiet in peer groups with few initiations. Roberto, a 9-year-old male, was described by teachers as lower functioning, with limited, two- to three-word communication skills, echolalia, and pronoun reversals. He showed few initiations to peers and appeared withdrawn and quiet in social settings and with novel adults. His score was 48 on the ABC. Carla, 9 years old, was described as lower functioning with challenging behaviors (e.g., repeated noises, difficulties with changes in routines, non-compliance). Carla could use two- to three-word phrases to communicate needs and choices, but

was frequently echolalic when verbalizing. Her score was 71 on the ABC rating scale. Tony, a 9-year-old male, was described as having lower functioning abilities. Language consisted of slowly spoken, single-word utterances, with frequent echolalia and difficulty with receptive language. He appeared shy and withdrawn in social situations with few initiations. Ann and Matt participated in cooperative learning; Roberto and Carla participated in social skills; and Tony participated in mainstream art. Ann, Roberto, and Tony were included in the social behavior generalization probe component of the study.

All students attended an elementary school located in a low to middle socioeconomic status (SES) urban neighborhood (80% free or reduced lunches), and 70% of the students were from minority groups. Seven males and 8 females in fourth grade (9 to 10 years old) participated in cooperative learning groups with Ann and Matt. Seventeen third grade peers (11 males and 5 females), aged 8 to 9 years old, participated in social skills groups with Roberto and Carla. Ten males and 9 females in fourth grade participated as the control group. These 9- to 10-year-olds were familiar with students with autism, with 6 students having participated in prior social groups with Roberto. During the school year in which the study was conducted, this control group did not participate in training or scheduled social groups; however, Tony was mainstreamed in their weekly art classes.

EXPERIMENTAL PROCEDURES

Peer training was embedded in the intervention and consisted of skills necessary for successful participation in the specified setting. For *cooperative learning groups*, peers were trained to tutor partners in vocabulary and facts from their social studies curriculum and to complete a team activity. Procedures were adapted from those outlined in a tutoring manual (i.e., Greenwood, Delquadri, & Carta, 1997). In addition, students were taught responsibilities for group roles (Johnson & Johnson, 1986) and social skills for working in groups based on a published curriculum (Vernon, Schumaker, & Deshler, 1993). Ann and Matt participated in training and cooperative learning groups three to four times per week in the fourth-grade classroom. Experimental condi-

tions included (a) 2 weeks of baseline, (b) 4 weeks of cooperative groups, (c) 2 weeks of baseline, and (d) 4 weeks of cooperative groups (see Dugan et al., 1995, for details).

Peer training for the *social skills groups* focused on initiating and responding to peers, cooperating, and engaging in positive interactions during play activities as outlined by the curriculum (Walker, Hops, & Greenwood, 1988). The 10-min teaching format consisted of introduction and modeling of a skill by the experimenter, individual and choral responding, student-to-student practice of the skill, and review. Students then participated in 10 to 15 min of play/free time during which they received points for appropriate use of social skills. Roberto, Carla, and 17 peers participated in training and social skills groups three to four times per week in the third-grade classroom. Experimental conditions included (a) 2 weeks of baseline, (b) 4 weeks of social skills groups, (c) 2 weeks of baseline, and (d) 4 weeks of social skills groups. Pre- and postsocial behavior probes to note generalization for both groups were conducted in the fall and spring. See Figure 1 for descriptions of procedures.

MEASUREMENT

Dependent measures included (a) the frequency of interactions, mean length of interactions, and total duration of social interaction time during 5-min probes; and (b) the frequency of initiations to the target students by the peers. During intervention sessions and during the generalization probes, the Social Interaction Code (SIC; Niemeyer & McEvoy, 1989) was used to collect the data. This is a computerized system that records initiations, responses, and total duration time for each interaction during the observation. Initiations were defined as motor or vocal behavior (assisting, sharing materials, conversing), clearly directed to a peer/target to evoke a response. Responses were defined as a reply within 3 sec, thus reflecting reciprocity (initiation-response sequences). This code has been previously reported (e.g., Dugan et al., 1995; Kamps et al., 1992), and updated (Tapp, Wehby, & Ellis, 1992).

Social Behavior Generalization Probe Procedures. A total of 306 social behavior generalization probes were collected in the fall ($n = 153$) and

spring ($n = 153$) to measure maintenance and generalization of skills. This procedure was modeled after the social behavior probes in Haring et al. (1987). In that study, probes were collected to note generalization of social behaviors for students with disabilities and peers who had participated in special friends or tutoring experiences, as well as with nonparticipants. Procedures in the current study were similar in that the probes were in a nontraining setting and standardized across probes and participants. One target student with autism and three nondisabled peers participated in each probe. All peers participated in three probes each, one with each student, Ann, Roberto, and Tony. Sessions were conducted in the special education classroom. Students were told they had 15 min of free time and they could use any of the materials, academic (sorting objects, pictures, flash cards) or social (balls, books, music cassettes, magazines). Observers sat to the side to collect interaction data and to note the activity (tutorial, social, or noninteractive).

Reliability. Reliability for generalization probes data was collected for 21% of pre- and 27% of postsessions. The average percentage agreement for frequency of interactions was 90% ($R = 50\%-100\%$), and 95% ($R = 33\%-100\%$), respectively for pre and post; 87% ($R = 45\%-100\%$) and 92% ($R = 38\%-100\%$) for mean length; and 90% ($R = 76\%-100\%$) and 96% ($R = 62\%-100\%$) for duration. Low agreements, a limitation, occurred during sessions with minimal interactions and lesser duration; however, means show acceptable overall agreement.

RESULTS AND DISCUSSION

As depicted in Table 1, both cooperative learning and social skills groups, each with embedded peer training in critical skills, increased the amount of time engaged in social interaction for the students with autism and their peers over baseline conditions. During cooperative learning groups (upper panel), the students' time engaged in interaction increased from less than 30 to 191 or more seconds during 5-min probes, similar to peer levels. These changes were also reflected in increases for the frequency and mean length of interaction. During social skills training (see lower panel,

FIGURE 1

Overview of Experimental Procedures

<i>Social Skills Groups</i> (Walker, et al., 1988)	
Structure: 10-min scripted lessons with modeling, role-plays, and feedback 10- to 15- min free play with stickers and praise for skill use 5-min team bonus for stickers/points during free play	
Starting	Initiating interactions: find someone to play, use names, ask to play
Responding	Looking at, turning to, and answering friends when spoken to
Keeping It Going	Keeping play going, talking and asking questions, changing what you are doing
Saying Something	
Nice–Praising	Saying what you like, saying what is good, saying what you see
Cooperating– Getting Along	Helping people, sharing materials, taking turns, problem-solving
<i>Cooperative Learning Groups</i> (Dugan et al., 1995)	
Structure: 10-min teacher introduction of new material 10-min peer tutoring in vocabulary words 8-min peer tutoring in social studies facts 5-min team activity 5-min team bonus for SCORE points	
Peer tutoring using <i>States and Regions</i> (Bacon, 1991)	Students in groups of four, tutoring in dyads within groups (5 min each person) for vocabulary words/comprehension facts with definitions and sample facts on flash cards
Team activity	Students worked together (four) to complete worksheet, answer board questions, etc.
Student roles	Materials manager, recorder (write answers), checker (complete checklist on group’s cooperation), and organizer (leader)
SCORE skills (Vernon et al., 1993)	Cooperation skills taught during first week of groups and reviewed each session with desk charts for points for skill use. Skills included sharing ideas, correcting others’ work, offering praise, reacting calmly, encouraging and helping others.

Table 1), the students with autism increased their time engaged in interaction with peers from a range of 7–56 to 152–262, also similar to peers in this group who improved over baseline. Changes in frequency of interactions also occurred.

Generalization effects (social behavior probes) showed that the cooperative learning group peers increased their interactions to more than three times the level of baseline (see Figure 2). Peers in the social skills program doubled their

time in interaction from pre to post. The control group peers increased their interaction time by about 50% in comparison. They were somewhat higher than either intervention group on the preintervention probes. Repeated measures analysis of variance tests indicated significance for the group x time interaction for frequency and duration of time engaged in interaction. Planned contrasts indicated a significance between the peer groups (Wilks’ lambda, $F = 4.958, p = .000$). Dif-

TABLE 1

Social Interaction Behaviors During Cooperative Learning and Social Skills Groups Intervention Sessions: 5-min Samples—Study 1

Social Interaction	<i>Cooperative Learning Group Means</i>											
	Ann				Matt ^a				Peers			
	B	I	B	I	B	I	B	I	B	I	B	I
Frequency	0.3	2.1	0	1.6	1	3	2	3	1	4	1	3
Duration	1	191	0	273	28	219	17	210	16	197	42	185
M Length	1	93	0	216	10	84	13	76	6	81	21	110

Social Interaction	<i>Social Skills Groups</i>											
	Roberto				Carla ^a				Peers			
	B	I	B	I	B	I	B	I	B	I	B	I
Frequency	1	2	0.3	2	0.2	4	2	3	3	4	3	3
Duration	7	173	32	262	12	152	56	197	140	216	137	217
M Length	6	79	16	162	5	56	21	74	94	85	66	142

Note: Frequency = total number of interactions; duration is in number of seconds with 300 possible in 5-minute probes; M length = duration divided by frequency; B = Baseline; I = Intervention.

^a Students who participated in intervention, but not in generalization probes.

ferences also were noted favoring the cooperative learning over the social skill group and control peers at posttest for frequency ($p < .05$), duration ($p < .05$), and initiations of social interaction ($p < .05$).

All three target students improved their time engaged in social interaction from the fall to spring (see Figure 2, pre/post means by peer groups). Ann's means increased from 86.2 to 199.5; Roberto's from 64.5 to 148.4; and Tony's from 76.4 to 126.9. Ann's time engaged in interaction during generalization probes was similar to her interaction levels during intervention, but slightly lowered levels were noted for Roberto (see Table 1). These data reflect stronger changes (i.e., more generalization) for target students in the intervention programs than for Tony who did not receive intervention in that school year. Further generalization based on peer groups was evident (see Figure 3), that is, Ann demonstrated more generalization during the probe with her intervention peers (cooperative groups), and Roberto during the probe with his social skills peers.

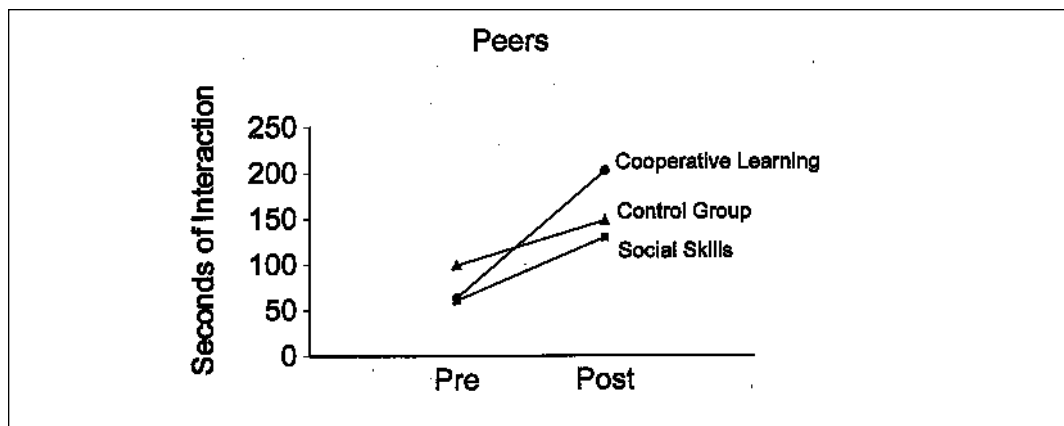
Contextual generalization effects were also noted when looking at student choices during

probe sessions. During the preessions, 29% were tutorial in nature with students selecting academic materials, 27% were social, and no materials were selected for 43%. During the postsessions, tutorial and social contexts both increased to 39%, and sessions with no materials decreased to 21%. The data also indicated that durations matched to contextual variables increased for both groups from pre- to postsessions (121 to 220 for sessions reflecting tutorial choices, 140 to 178 for social choices, less than 5 seconds of interactions when no materials were chosen). These data support the validity of peer training within tutorial and social contexts.

SUMMARY OF STUDY 1 FINDINGS

Key findings were: (a) intervention components, including peer training, increased social interaction between students with autism and their peers across academic and social contexts, and (b) peer mediation programs facilitated generalization of interaction skills to nontraining settings as evidenced in the social behavior probes in the spring. The fact that the control group peers also increased interaction skills may have occurred be-

FIGURE 2
Duration in Seconds of Interaction Time for Peers by Intervention Groups—Study 1



cause the classes for students with autism had been in the school for 4 years, and thus increases were a function of familiarity. Several hypotheses also exist as to why the cooperative learning group participants evidenced more generalization: (a) social skills training may not be as robust, (b) cooperative learning groups in this study included social skills instruction, and thus were a multi-component intervention (academic and social in nature), and (c) the tutoring nature of the cooperative groups may have provided more momentum because of its repeated, consistent interactions, whereas social skills groups were “free time,” allowing members to exhibit more variance in interactions. Two limitations to the study may have also contributed: The cooperative learning peers were a year older (fourth-graders vs. third-graders), and 6 peers had participated in a prior social skills intervention, perhaps indicating an additive effect of more training with students with autism.

STUDY 2

Based on Study 1 results, Study 2 examined the maintenance and generalization effects of peer-inclusive social groups for 34 students with autism. Results from Study 1 suggested that both academic (cooperative learning) and social groups with peers showed better generalization effects than did familiar peers with no intervention. It was further hypothesized that students with autism who participated in both types of peer groups rather than

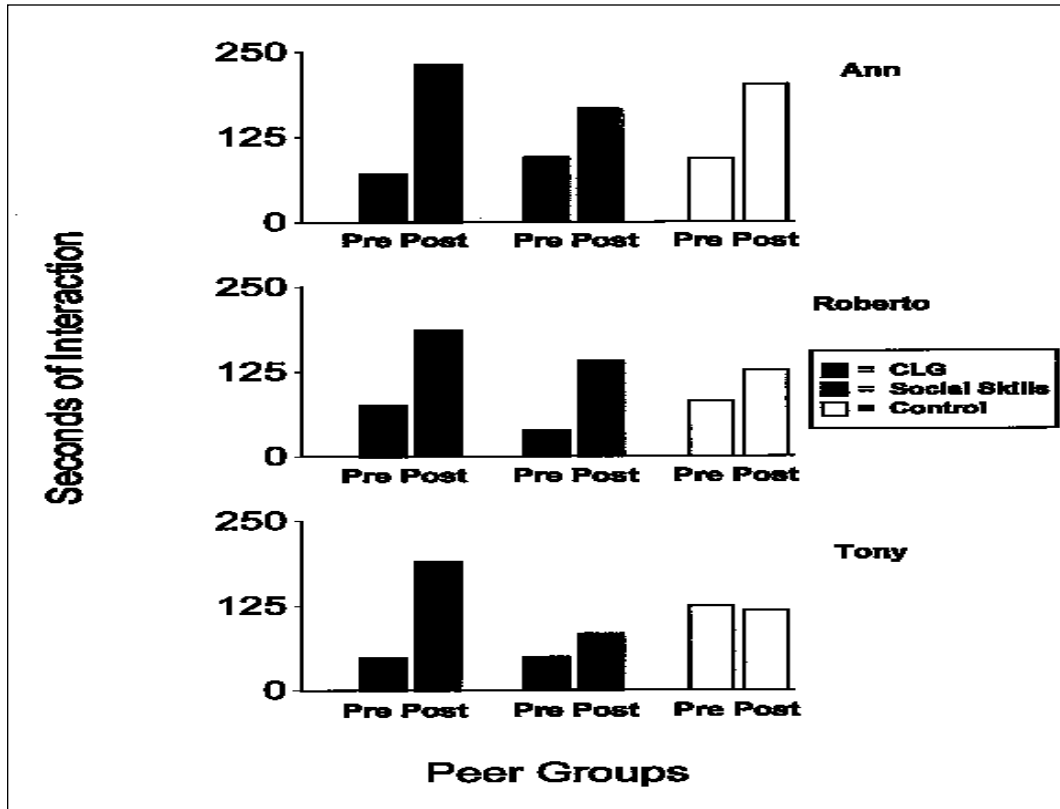
a single intervention would show increased benefits. Thus, an important goal in this study was to examine the effects of multiple peer groups for each participant, sustained over time. Peer groups included social skills groups, tutoring/cooperative learning groups, and lunch and recess buddy programs. As in Study 1, videotaped social behavior probes to note generalization, were conducted in the fall and spring, and again 2 years later. Videotaped probes included peers from three groups: (a) students trained in interaction skills (i.e., intervention similar to those in Study 1); (b) peers familiar with the target students but untrained (similar to the control group in Study 1); and (c) students who were strangers to the participants with autism. Research questions identified were:

- Is there maintenance over time (school years) and generalization of social interaction time from natural settings to generalization probes?
- Are there differences across peer group conditions?
- How do videotape probe data compare to data collected in intervention settings?

Intervention components, including peer training, increased social interaction between students with autism and their peers across academic and social contexts.

FIGURE 3

Seconds of Interaction Time for Students with Autism by Peer Group—Study 1



- Are there differences in interaction time between students with autism and peers following intervention?

PARTICIPANTS AND SETTINGS

Thirty-four students with autism participated in the study, 24 males and 10 females (see Table 2). Students ranged in age from 7 to 14 years old across the 3-year period, and all attended public school programs in six school districts in the Midwest. Twenty-six (76%) of the students had at least minimal verbal skills (2- to 3- word requests) and 8 were nonverbal (i.e., mute, single-word approximations, gestural/augmentative communication). Mean Childhood Autism Rating Scale scores were 32 ($R = 17-46$) in Year 1 and 36 in Year 3. ABC scores averaged 50, indicating a range of autistic behaviors ($R = 8$ to 113 in Year 3). Over half of the students were served in general education settings 70% of the time, with paraprofessional support, during the initial and

final years. Peer programs averaged 2.1 in Year 1 (total of 62) and 2.3 in Year 3 (total of 79).

Peer Groups. Approximately 130 peers participated in videotaped probes in the initial year and 120 during the final probe year. About 60% were female and 40% were male. Peers were the same age or within a 1-year difference of the students with autism. *Trained peers* were defined as (a) having participated in at least one peer mediation program with the target student, (b) having received training in prompting and reinforcing social interaction via the program, and (c) currently in the target student’s participating general education classroom when possible. *Familiar peers* were also in the same general education class, but had not participated in a peer mediation program, were typically not assigned as a class buddy, and did not have a negative history with the student with autism according to the teacher. *Stranger peers* were not enrolled in the target student’s general education class, nor were they ob-

served to be in groups with the student during common times (e.g., recess) or considered to be a neighborhood friend.

PEER MEDIATION PROGRAM CHARACTERISTICS

Students received a variety of peer mediation programs during the 2 school years in which generalization data were collected. Peer mediation programs consisted of the following: (a) *social skills/games/play groups* that included three to five peers and the target child with age appropriate toys and activities (cars, puzzles, Trouble®, Connect 4®, card games); (b) *lunch buddy groups* during which three to five peers and the target student took turns commenting on pictures/topics, and asking/answering questions of each other; (c) *recess buddy programs* during which peers and the target students selected an activity, practiced interactions in advance of recess and then played together during at least 10 min of recess; and (d) *tutoring activities* during which a peer would tutor the student in language, reading, or math (higher functioning students served in reciprocal tutoring arrangements within small tutoring groups or classwide applications). Using social skills curricula (Hops, Greenwood, and Walker, 1997; Odom & McConnell, 1997) and tutoring manuals (Greenwood et al., 1997), peers and target students received direct instruction in the use of skills within the context of the activity. Skill areas focused on interaction behaviors including looking, using names, play organizers, asking/answering questions (academic or social), commenting, sharing materials, taking turns, demonstrating (imitating) play behaviors, and helping. Prior reports describe interventions in more detail and experimental analysis of effects on student outcomes (e.g., Kamps et al., 1992; Kamps et al., 1994; Kamps et al., 1997).

Implementation Levels and Effects. Thirty of the students during the initial year were enrolled in peer mediation programs including 22 games/play groups, 18 peer networks (i.e., lunch or recess programs, special activities), and 8 peer-tutoring groups ($N = 48$ programs). Seventeen of the students (50%) were involved in multiple groups with 9 (28%) participating in both academic and social peer programs. During the subsequent probe year, 34 students were monitored,

and all were enrolled in peer mediation programs including 20 games/play groups, 18 peer networks, and 25 peer-tutoring groups ($N = 63$ programs). Twenty-two (68%) were in multiple programs; 56% were in both academic and social groups. A summary of effects for 20 programs (Kamps et al., 1998) noted that the time engaged in interaction during social skills play groups sessions averaged 140 to 190 during 300 s probes (5-min), with reciprocal interaction occurring 34–63% of session intervals. Time engaged in interaction during academic/tutoring intervention sessions average 190 to 200+ s during 5-min probes.

GENERALIZATION MEASUREMENT

Four behaviors (dependent measures) were assessed from the videotape probes to monitor students' social performance. The time engaged in *social interaction* (duration) was recorded using an update of the Social Interaction Code from Study 1, the MOOSES (Multiple Option Observation System for Experimental Studies; Tapp et al., 1992). Prior reports describe the use of the MOOSES code in various forms (e.g., Kamps et al., 1997). Duration of interactions was recorded for 10 min from the videotaped probes (total time = 600 s), with the same start time noted as for the interval coding. In order to note additional student behaviors in Study 2, a 10-s whole interval coding system was used to code reciprocal interaction, appropriate toy use, and on topic/off topic verbalizations. *Reciprocal interactions* were defined as the target student taking a turn, giving or receiving materials, initiating an interaction, or responding to a peer (verbal, physical responses). *Toy play* included manipulating materials and pieces appropriately, and holding materials while waiting for a turn. *On topic verbalizations* included comments, questions, and phrases used appropriately to initiate or respond to peers or to describe activity (e.g., "I have 4." "It's your turn." "Okay."). Interval code observations from videotapes were recorded for 10-min probes, and summarized by percentage of intervals for occurrence.

Reliability. Reliability for MOOSES files was collected for 5% of the files and for approximately 30% of the interval data probes. Average percentage agreement across social behaviors was 92% for the duration of interactions, 90% for

TABLE 2
Student Characteristics—Study 2

<i>Students Initial year</i>	<i>Mean Age Initial year</i>	<i>Mean CARS Initial year</i>	<i>Mean ABC Initial year</i>	<i>Peer Programs</i>	<i>Integration Time %</i>
21 males 9 females	110 months 75-148	32 17-46	50 5-127	2.1 total = 62	60% 0-100%
<i>Students Final year</i>	<i>Mean Age Final year</i>	<i>Mean CARS Final year</i>	<i>Mean ABC Final year</i>	<i>Peer Programs</i>	<i>Integration Time %</i>
24 males 10 females	138 months 94-172	36 19-52	51 8-113	2.3 total = 79	55% 10-100%

Note: CARS = Childhood Autism Rating Scale; ABC = Autism Behavior Checklist

reciprocal interaction, 83% for on topic language, and 93% for toy play. Reliability for peer data was collected for 10% of the interval and MOOSSES files, with mean percentage agreements at 90% for the duration of interaction, 83% for reciprocal interaction, 79% for on topic language, and 96% for toy play.

Social Behavior Generalization Procedures. Social behavior generalization probes consisted of approximately 15-min sessions in which a student with autism and four peers were seated at a table with toys and games. Only play materials were used in Study 2 in order to determine generalization of social skills and interaction. Academic or tutorial type materials were eliminated to reduce the possibility of inflated interaction levels due to tutoring structures. Kindergarten through second-grade level materials included memory games, Floam®, Trouble® or Don't Break the Ice®; cars, blocks, and puppets. Materials for third through seventh grades included Uno®, cards, Gak®, Connect 4®, Pogs®, Jenga®, and magazines. Instructions to groups were: "Here are some toys and games you can play with for about 10 minutes. Please stay at the table when you play." No prompts or reinforcement were provided. Similar to Study 1, and as reported in other investigations with generalization probes, these assessments were designed to measure the following conditions: (a) maintenance and generalization of social communication skills with the trained peers and teaching adult to *nontraining settings* (e.g., Haring et al.,

1987); and (b) generalization of skills for peers or students with disabilities to *novel persons* (e.g., Pierce & Schreibman, 1997; Taylor & Harris, 1995).

The schedule for videotape probes consisted of fall and spring sessions in the initial year with familiar and stranger peers observed with 30 students with autism for both probes, and trained students observed only for the spring probes ($N = 134$ probes). Videotape probes were again conducted in the spring 2 years later ($N = 65$) with trained and familiar peers and 34 students with autism. The total number of probes by peer group was 61 with trained, 88 with familiar, and 50 with stranger peers. Probes were also collected for 30 peers in the initial year (fall and spring, $N = 60$ probes), to provide a normative comparison for the social behaviors.

Data Analysis. Visual inspection of the means across behaviors and time were conducted for a subset of the students who were available across repeated probes/years with each peer group. Twenty students were available for both probes with the trained peers; 24 were available for all three probes with the familiar peers. Twenty-three were available for both probes with stranger peers. An analysis of variance was conducted with the entire sample ($N = 34$ students with autism, 199 videotape probes) by condition (familiar, trained, stranger peer groups).

RESULTS AND DISCUSSION

Generalization data are presented in Table 3 for the students with autism over time and across groups (probes with trained, familiar, and stranger peer groups). Three social behaviors showed increases over time for students with *trained peers*: The duration of interaction (time engaged) and reciprocal interaction showed notable differences, with smaller changes for on topic language. In the three probes with *familiar peers*, the duration of interactions and reciprocal interaction again showed noteworthy increases over time, but no changes were noted for language. All behaviors occurred with less frequency with *stranger peers*, with decreases in the duration of time engaged in social interaction, and slight increases in reciprocal interaction. Differences over time confirmed the hypothesis that students who received intervention over multiple years (i.e., increased opportunities to participate in peer mediation programs) would also show more generalization. Appropriate use and play with toys (see Table 3) remained stable and appropriate regardless of the peer groups (means ranged from 58% to 78%).

Analysis of variance of data aggregated across all probes (column 4, Table 3) showed significantly different effects by peer group condition for the durations of *social interaction time* (Wilks' lambda, $F = 7.718$, $p = .001$). Pairwise comparisons showed higher duration times for the students with autism and trained peers (393 s), than with the familiar peers (301 s; $p < .05$) and with stranger peers (246 s; $p < .05$). The duration of interactions was also equal to peer levels (373 to 419 s). Probe data with trained peers were similar or slightly lower than durations during intervention sessions (range of 60% to 80% social engagement during 5-min samples, a comparable range for 10-min probes of 360 to 480 s; e.g., Kamps et al., 1992, 1998), again clearly indicating generalization of interaction skills for students with and without autism. Significantly more *reciprocal interaction* (Wilks' lambda, $F = 9.888$, $p < .000$) also occurred with students with autism and the trained peers (64% of intervals) than with the familiar peers (39% of intervals; $p < .05$) or with the stranger peers (29%; $p < .05$). These levels were equal to peers who averaged interactions in 55%-60% of intervals. *On topic language* was only

Differences over time confirmed the hypothesis that students who received intervention over multiple years (i.e., increased opportunities to participate in peer mediation programs) would also show more generalization.

slightly higher for target students with the trained peers (26%) than with familiar and stranger peers (21%, 19%) and less than verbalizations by peers, which averaged 51%-52% of intervals. These data, however, included nonverbal students with only minimal ability to make word approximations. When analyzing data for the verbal students ($n = 24$), on topic language occurred during 36% of the intervals with trained peers during the final probe. *Toy play* was high (66% to 74%) for target students with all peer groups and slightly less than peers (85%).

GENERAL DISCUSSION

In general, findings for students with autism tracked over a 3-year period with participation in multiple peer mediation interventions indicated improved social interaction skills with nondisabled elementary school students. The level of interaction also matched those of peers sampled. Similar to other reports (e.g., Ostrosky & Kaiser, 1995), significantly more social behaviors occurred with peers who were trained via participation in social/play groups, peer networks during lunch and recess, and tutoring programs, than for control group peers. Peer training formats that have included the use of modeling, prompting, and reinforcement strategies within the context of activities, and those that included multiple peers over time, have shown notable changes in interaction skills for students with autism (e.g., Kamps et al., 1997; Pierce & Schreibman, 1997; Sasso, Hughes, Swanson, & Novak, 1987). These outcomes suggest generalization of social skills by both students with autism and peers—a trend where social situations become more naturally reinforcing for students with autism, with an improvement in general responsiveness on the part

TABLE 3

Means for Social Interaction Behaviors for Students with Autism and Trained, Familiar, and Stranger Peers in Study 2

<i>Duration of Social Interaction Time—Seconds in 10-min Probes</i>				
	Time 1	Time 2	Time 3	All Data
With Trained Peers	---	355	440	393
With Familiar Peers	271	267	378	301
With Stranger Peers	261	232	---	246
Typical Peers	373	419	---	---
<i>Reciprocal Interaction—% of Intervals</i>				
	Time 1	Time 2	Time 3	All Data
With Trained Peers	---	48	69	64
With Familiar Peers	28	37	53	39
With Stranger Peers	25	33	---	29
Typical Peers	55	60	---	---
<i>On Topic Language—% of Intervals</i>				
	Time 1	Time 2	Time 3	All Data
With Trained Peers	---	25	35	26
With Familiar Peers	23	19	23	21
With Stranger Peers	23	20	---	19
Typical Peers	51	52	---	---

Note: Times 1-3 data = means with trained peers and 20 students with autism; means with familiar peers and 24 students with autism; means with stranger peers and 23 students with autism. All data column includes means for 34 students with autism with data across 3 years ($N = 199$ probes).

of peers to students with disabilities. Interview data from over 100 peers also noted a strong favorable impression by peers of their participation (Kamps et al., 1998). Over 90% indicated an interest in continued programs with their classmates with autism.

A second positive outcome was that consistent contact with peers, or familiarity via inclusive classes in the absence of peer training also generalizes to social behaviors, though less interaction occurs than with structured peer mediation. Social interaction also occurred among the students with autism and stranger peers, although again

less frequently than with trained or familiar peers. These findings suggest generalization of skills by

These outcomes suggest generalization of social skills by both students with autism and peers—a trend where social situations become more naturally reinforcing for students with autism, with an improvement in general responsiveness on the part of peers to students with disabilities.

Consistent contact with peers, or familiarity via inclusive classes in the absence of peer training, also generalizes to social behaviors.

students with autism, trained peers modeling interaction in natural settings for novel peers, or an interest by many elementary-aged children to engage with students with disabilities in social situations when the expectation to do so is stated and reinforced by teachers and peers (Sasso et al., 1987).

A limitation to the study is that social probes were not also conducted in other settings such as recess and lunch. In many cases, however, the social settings served as the intervention time with peers, in other cases time constraints prohibited additional data collection. A second limitation is that generalized language use for verbal students with autism with trained peers was lower than for typical peers (36% compared to 51%). Several factors could have accounted for this difference, including the size of the groups (3 to 4 peers and 1 student with autism), and the limited language skills for many participants. Additional research is needed in this area. Recommendations include (a) training for students with autism in the use of language in social settings, perhaps in dyads with one peer initially, and (b) training peers to prompt and reinforce language, and to use specific strategies such as time delay and incidental teaching.

IMPLICATIONS FOR PRACTICE

Findings from these and related studies (e.g., Kamps et al., 1997; Pierce & Schreibman, 1997) suggest the viability of peer mediation programs to support elementary school programs for students with autism. Recommendations for practitioners that appear to be most beneficial for improved social outcomes include the use of pro-

It is especially important to encourage and reinforce peers for interactions with peers with disabilities.

grams that include academic and social mediation, peer groups across multiple settings, and recruitment of novel peers to generalize effects. Second, peer mediation needs to incorporate the use of effective instructional strategies such as modeling and reinforcement (Gonzalez-Lopez & Kamps, 1997), visual cuing and scripts (Krantz & McClannahan, 1998), and self-management techniques (Koegel, Harrower, & Koegel, 1999) to enhance student acquisition of social skills. It is especially important to encourage and reinforce peers for interactions with peers with disabilities. A third recommendation for the success of social interventions is incorporation of generalization tactics including (a) functional mediators (i.e., peers); (b) natural settings for intervention (recess, play groups); (c) natural communities of reinforcement for peers and target students (play, preferred toys, games); (d) diverse and loose training allowing for variability as occurs in applied settings; and (e) stimuli common to multiple settings (classmates, activities; Stokes & Osnes, 1988). Final recommendations include continued research incorporating (a) additional attention and monitoring of communication expansions within peer contexts (Pierce & Schreibman, 1997) and (b) intervention for longer time spans and with consistent implementation across school and family contexts to improve generalization and durability of effects (Strain & Schwartz, 2001).

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