TRAINING MILDLY HANDICAPPED PEERS TO FACILITATE CHANGES IN THE SOCIAL INTERACTION SKILLS OF AUTISTIC CHILDREN

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We evaluated the effects of a peer-training strategy, consisting of direct prompting and modeling, on the occurrence and duration of interactions between autistic students and nonautistic peertrainers. Data were obtained in both training and generalization settings. The results of a multiplebaseline design across students demonstrated that: (a) the direct prompting procedure produced immediate and substantial increases in the occurrences and durations of positive social interactions between the peer-trainers and autistic students; (b) these increases were maintained across time at levels above baseline during subsequent free-play probes; (c) these findings were judged by teachers to be socially valid; (d) untrained peers increased their interactions with the autistic students in three of the four groups; (e) generalization of behavior change across settings occurred only after specific programming; and (f) interactions between untrained peers and peer-trainers decreased following training. Variables that may account for the results and the implications of these findings for peer-mediated interventions are discussed.

DESCRIPTORS: Social behavior, generalization, peers, autistic children

Deviant or delayed patterns of social interaction often characterize the behavior of autistic children (Denckla, 1983; Ritvo & Freeman, 1978; Rutter, 1978). Descriptions of their social withdrawal have included little or no eye contact, lack of appropriate play with peers, active avoidance of social contact, and failure to initiate or sustain interactions (Ritvo & Freeman, 1978; Rutter, 1978). These characteristics may decrease the likelihood that autistic children will benefit from exposure to ageappropriate models and other social learning opportunities because they are not likely to attend to relevant social cues (Stainback & Stainback, 1981).

Early efforts to facilitate social behavior in handicapped children primarily used adult-mediated interventions (Strain, Shores, & Kerr, 1976; Strain & Timm, 1974). These strategies were characterized by the presence of a teacher or experimenter who prompted, reinforced, or otherwise evoked appropriate social behavior from socially isolate children. Although these strategies were effective, they had two primary limitations. First, Walker, Greenwood, Hops, and Todd (1979) presented evidence suggesting that adult reinforcement produces a pattern of frequent but brief social interactions, bearing little resemblance to normal patterns of childhood interaction. Second, the constant presence of an adult to facilitate interactions among children in the natural environment may often be impractical.

More recently, the use of peers to facilitate social behavior in isolate children has been assessed. These efforts have demonstrated that normal and mildly

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handicapped peers can be trained to initiate and reinforce the occurrence of positive social behavior in handicapped children (e.g., Apolloni & Cooke, 1979; Lancioni, 1982; Strain, 1977; Strain et al., 1976; Strain & Timm, 1974; Young & Kerr, 1979).

Ragland, Kerr, and Strain (1978), for example, trained a nonhandicapped peer to initiate social interactions with three autistic children. The results demonstrated that a peer-training procedure could produce rapid increases in positive social behavior by autistic children. Strain, Kerr, and Ragland (1979) later extended this research by systematically comparing the effectiveness of peer initiation training with peer-prompting-plus-reinforcement training in facilitating the positive social behavior of four autistic children. Those results demonstrated that both interventions were equally effective in accelerating the children's positive social behavior. Neither procedure, however, was effective in promoting generalization of social interaction skills across settings.

Our study was designed to extend the literature on peer-mediated interventions in several important ways. First, we were interested in whether or not a direct prompting procedure (in which the peer-trainer practices directly with the target children) would increase generalized social interactions between autistic and nonautistic children. The studies just noted typically used a role-playing format in which the trainer participated in role-playing situations with the experimenter. Recent evidence suggests that this format may not be best for all subjects. In an investigation of the use of elderly mentally retarded adults as peer-trainers, Dy, Strain, Fullerton, and Stowitscheck (1981) found that a direct prompting procedure may, in some cases, be more effective than role playing.

A second variable we examined was the impact of a peer-training procedure on the peer trainers. Few investigator have systematically assessed this aspect of training, although several have assumed the effects are positive.

We also examined the duration of interactions. Previous peer-mediated studies have not examined this aspect of social interactions. Because Walker et al. (1979) noted that adult-mediated interventions produced brief social interactions, we thought it was important to assess whether peer-mediated interventions would result in brief or sustained interactions.

A fourth question addressed was the issue of cross-setting generalization. Strain (1980) noted that the lack of convincing cross-setting generalization may be due, in part, to the fact that generalization probes have occurred in environments that contained other nonresponsive children. This assumption was recently supported by Strain's (1983) research, which compared generalized social responding by autistic students in settings containing socially responsive or nonresponsive peers. The results demonstrated consistently higher levels of social interaction in the settings containing the responsive peers. We conducted generalization probes in settings containing responsive peers to assess this phenomenon.

Finally, we were interested in whether changes in social behavior would be evident to others in the students' environment. Therefore, teachers rated the effectiveness of the treatment on both the autistic students' and peer-trainers' social behavior.

METHOD

Participants

Three boys and one girl, ranging in age from 5.5 to 6.7 years (M = 5.9), participated. Each student had been diagnosed as autistic by an independent agency according to the diagnostic criteria established by the National Society for Autistic Children (Ritvo & Freeman, 1978). These students were selected because their teachers reported and informal prebaseline observations showed that they evidenced severe social deficits. Although these students did not typically engage in social play behavior during recess or other unstructured time, they did not avoid social contact. For example, spontaneous social interactions among the students were observed infrequently, and social reinforcement was effectively used in their classrooms.

These students also displayed deficient language and communication skills (e.g., immediate and delayed echolalia, pronoun reversal, limited length of utterances), inappropriate play, and self-stimulatory behaviors (e.g., object spinning, hand flapping, repetitive finger manipulations). The most recent results of standardized intelligence tests (Stanford-Binet, Merrill Palmer Scale of Mental Tests) yielded mental age scores of 2 years, 6 months; 2 years, 3 months; and 3 years, for Students 2–4, respectively. No intelligence test scores were available for Student 1; however, he scored at 2 years, 2 months on the Vineland Social Maturity Scale.

Classroom curricula consisted of a variety of academic tasks, which included Distar Language, Reading, and Math. These tasks were presented daily to groups of 2–4 autistic students. Specific tasks included letter and sound identification (reading); appropriate pronoun and preposition use and complete sentence structure (language); and number recognition and rote and rational counting (math). Additionally, these children were learning self-care skills including toothbrushing, zipping, buttoning, shoe tying, and face washing.

Peers

Sixteen nonautistic peers, ranging in age from 5.7 to 8.7 years (M = 7.1) were grouped into four triads in the free play setting, and two dyads in the generalization environment with Autistic Students 1 and 2. Each group was formed to match the sex and approximate age of each of the autistic students. Variation in students' ages within each group was the result of also selecting peers with good attendance records, minimal support staff scheduling conflicts, and parental permission. These children, all students at the same school, were referred by their teachers, who reported that the peers possessed more appropriate social repetoires than their other classmates. These students had opportunities to interact with the autistic students during recess, adaptive physical education, and lunch, although interactions were rarely observed during these times. All the peers exhibited delayed language development with associated handicaps including learning disabilities, mild mental retardation, and conduct problems. The average IQ score for the peer trainers was 86 (range, 75 to 101).

Setting

All free-play and peer-training sessions were conducted in a 4 m \times 3.5 m area with a variety of toys placed throughout the otherwise barren room. Many of the toys were chosen because they facilitated cooperative play (Quilitch, Christophersen, & Risley, 1977; Strain, Kerr, & Ragland, 1981); others were selected because they were highly preferred by the autistic students.

A video recording deck and camera were located in the closet of the room and remained visible during all sessions. Their use was explained to students prior to the first baseline free-play probe.

Generalization probes were conducted in a 4 m \times 7 m partitioned area of the school gymnasium. A variety of novel toys were placed throughout and were selected in a manner similar to that described earlier. Video recording equipment was located on the adjacent stage behind curtains and was not conspicuous to students.

Toy Preference Assessments

Toy preferences were assessed individually for each of the autistic students prior to any baseline free-play probes. During these assessments, the experimenter individually brought the autistic students to the free-play room and instructed them to play with any of the toys present. The order in which each student then selected the toys was recorded. After 30 consecutive seconds of playing with the toy, the student was instructed to select a new toy, and the original choice was removed from the available pool of toys. Each toy preference assessment lasted approximately 10 min, or until the student had selected five toys. Experimenterstudent interactions occurred only if the student was using a toy in a dangerous or destructive manner. When this occurred (two sessions for Student 2), the experimenter prompted the student to play with the toy appropriately.

Autistic Students 1-4 required 8, 5, 10, and 6 assessments before stable performances among the

top three choices were observed. These toys were then added to the selection of toys in the free-play setting and the most preferred toy was used during the experimenter modeling phase of each peertraining session.

Free-Play Probe Procedures

Free-play probes with three peers and an autistic student were conducted 2-3 days a week for each play group. During these probes, the experimenter brought the students to the playroom and instructed them to play together. No further interactions occurred between the experimenter and the students during the 10-min recording period. Afterwards, the experimenter told the students that play time was over and returned them to their classrooms. These probes were conducted for different numbers of sessions for each play group prior to the implementation of peer training. During this baseline phase, the levels of positive social behaviors among the peers and between the peers and the autistic student were assessed. Based on this information, the peer from each play group who had exhibited the highest level of positive interactions toward the autistic student was selected to receive training.

Peer-Training Procedures

Peer-training sessions began for each play group when the level of positive social interactions between the autistic student and the peer-trainer was stable during baseline probes (within 20% across four sessions) or indicated a decreasing trend. During the training phase, only the selected peer-trainer and the assigned autistic student were brought to the playroom. Free-play sessions with the remaining peers were not conducted until peer training was terminated. Each session was approximately 20 min in length (depending on the number of interactions modeled) and consisted of three conditions, which were always presented in the following order.

Modeling. The experimenter modeled a variety of target interactions for the peer-trainer while playing with the autistic student and the most preferred toy. These interactions consisted of the ex-

perimenter initiating and prompting responses as he attempted to interact with the autistic student. With Student 2, for example, the experimenter held out the can of Tinker Toys and said, "Come play with me" or "Let's play Tinker Toys." If the autistic student failed to respond, the experimenter modeled a sharing response by placing two Tinker Toy parts in the student's hands and giving an instruction (e.g., "Put them together."). The experimenter, following each demonstration, turned to the peer-trainer, described the modeled response, and emphasized the importance of playing with the student. Approximately 3-5 modeled interactions were provided during each training session. The number of modeled responses varied from session to session, depending on how long the peertrainer attended to the experimenter.

Practice with feedback. After the experimenter had modeled several target interactions with the autistic student, the peer-trainer was invited to play with the autistic student. For the next 5 min, the experimenter observed and provided intermittent verbal prompts such as "Put the ball in her hands" or "Show her what to do," followed by social praise. Prompts were provided following 10-s intervals during which no positive social behaviors were observed by the experimenter.

Training probes. After 5 min of peer-trainer practice with experimenter feedback, a 5-min video recorded training probe was conducted to determine the effectiveness of experimenter modeling and practice with feedback. During this time, the experimenter provided no feedback to the peertrainer or the student. The experimenter told the students at the end of this probe that play time was over, thanked the peer-trainer for participating, and returned the students to their classrooms.

These training sessions continued until the data showed that the peer-trainer's level of positive social behavior to the autistic student was comparable to or exceeded that directed to the other peers during baseline probes. Once the peer-trainer's positive social behavior the autistic student was stable, free-play probes with the remaining two peers were resumed on the following day. These probes were conducted in the same manner as pre-

Motor-gestural:	All movements that cause a child's head, arms, or feet to come into direct contact with the body of another child; or that involve waving or extending arms directly toward another child; or that involve placing of hands directly on a material, toy, or other movable apparatus that is being touched or manipulated by another child.			
	A. <u>Positive</u> : touch with hands, hug, holding hands; wave or kiss; all cooperative responses in- volved with sharing a toy or material.			
	B. <u>Negative</u> : hit; pinch; kick; butt with head; nonplaying push or pull; grabbing object from another child; destroying construction of another child.			
Vocal-verbal:	All vocalizations emitted while a child is directly facing any other child within a radius of 0.9 m or all vocalizations that by virtue of content (e.g., proper name, "hey you") and accompanying motor-gestural movements (e.g., waving or pointing) clearly indicate that the child is directing the utterance to another child within or beyond a 0.9 m radius.			
	A. <u>Positive:</u> all vocalizations directed to another child excluding screams, shouts, cries, whines, or other utterances that are accompanied by gestures indicating rejecting, oppositional, or aggressive behavior.			
	B. <u>Negative</u> : screams, shouts, whines, or other utterances that are accompanied by gestures that indicate rejecting, oppositional, or aggressive behavior.			
Initiation:	Any response that begins an interaction between two children observed not to interact for the previous 10 s, or involves a new activity not shared by the two children for the previous 10-s period.			
Response:	Any behavior that follows in close contiguity (3 s) the initiation or response of another child and shows a direct relationship to the other child's previous response.			

Table 1

Behavioral Measures

viously described. Training was continued with Peer-Trainer 3 because free-play probes following training indicated minimal transfer. This additional training was conducted until Peer-Trainer 3's level of interactions with the autistic student began to approximate that obtained with the other peertrainers. Free-play probes were then resumed in the same manner described previously.

Generalization Probes

Generalization probes were conducted prior to peer training and subsequent to the completion of free-play probes following training. These probes were similar to the free-play probes previously described with the exception of the location (school gym), the toys, and the composition of the play group (autistic student, peer-trainer, and two new, untrained peers). Generalization probe data were collected only for Autistic Students 1 and 2. Students 3 and 4 participated only during summer school and were not available for the collection of these additional data.

Generalization training. Generalization train-

ing was implemented because initial generalization probes following training indicated minimal transfer. These training sessions only differed from the previously described training sessions in that toys from the generalization setting were used and more specific emphasis was placed on reinforcing reciprocal interactions. These sessions were conducted in the free-play setting and were continued until the peer-trainer exhibited levels of positive social behavior toward the autistic student that were comparable to those observed during the free-play probes following training. Generalization probes were resumed following the completion of this additional training.

Behavioral Measures

Social behaviors of the autistic students and their respective peers were recorded for each free-play, training, and generalization session. Both interval and duration measures were used to assess interactions among peers, and between peers and the autistic students, during the free-play and training probes. Only interval measures were used to assess interactions during the generalization probes. The interval measure was adapted from Strain et al. (1976) and Strain (1977). The system used in our study included two broad categories of social behavior, verbal and motor, which were defined further as positive or negative, according to their topographic and functional characteristics; and, temporal characteristics of each social behavior were specified as "initiated" or "responded" events. Operational definitions for each of these categories are given in Table 1.

Duration measures were taken to assess all interactions between the autistic students and their peer-trainers during free-play probes and training sessions. Each duration interval began with the first initiated response directed to, or exhibited by, the peer trainer or autistic student. The duration interval continued to be measured until no social responses were observed to occur for 3 consecutive seconds.

Reliability

Prior to scoring experimental free-play sessions, all observers were required to attain a minimum interobserver reliability score of 80% for three consecutive 10-min pilot probes. During the investigation, these observers used a 10-s continuous observation system to record all social responses. Reliability scores were computed by summing the number of agreements per category (occurrence or nonoccurrence), dividing that number by the summed number of agreements plus disagreements and multiplying by 100. Agreements were scored only if both records reflected the same topography (motor or vocal), temporal sequence (initiated or responded), and functional effect (positive or negative), occurring in the same interval, with the same initiator and recipient.

Reliability coefficients for the duration measures were calculated in the following manner. Each duration measure was compared by dividing the longer duration by the shorter and multiplying by 100. These scores were then summed and averaged across each session (cf. Bailey & Bostow, 1979).

Reliability checks were conducted on 72% of the baseline free-play probes, 75% of the training probes, 70% of the free-play probes following training, and 70% of the generalization probes. These checks yielded average reliability scores of 90% for occurrence, 94.8% for nonoccurrence, 97.3% for occurrence plus nonoccurrence, and 71.4% for duration.

Experimental Design

A multiple-baseline design across students (Baer, Wolf, & Risley, 1968) was used to assess the effects of peer-training on the social behavior of autistic students as well as trained and untrained peers.

Social Validation

Classroom staff rated two randomly presented baseline and posttraining free-play probes for each play group (16 sessions total). Three classroom teachers and one teacher's aide, all of whom were familiar with the students participating in the investigation, but unfamiliar with the purpose, observed one session at a time. A 5-point Likert-type scale ranging from 1 (very little) to 5 (very much) was used to score: (a) the extent to which the autistic students played with the other students, (b) the extent to which the other students played or interacted positively with the autistic students, and (c) the amount of time each peer played with the autistic student. These data were collected to provide a measure of the extent of change in social behaviors as observed by significant others in the school environment (cf. Wolf, 1978).

RESULTS

Peer-Trainers' Behavior

Figure 1 shows the results of the multiple-baseline analysis. Although data were collected on both the topographical (motor or vocal) and functional (positive or negative) characteristics of social behavior, these distinctions are not presented. Topographical distinctions were collapsed into one category of positive social behavior because the separated data for vocal and motor behavior were approximately equivalent. Negative social behaviors are not presented due to their low occurrence. During baseline, all three peers exhibited variable or infrequent interactions with the autistic students. Peer-Trainers 1, 2, and 3, for example, interacted with the autistic students an average of less than 5% of the intervals (range, 0% to 16.7%) during baseline probes. Peer-Trainer 4's interactions with the autistic student were initially high but rapidly dropped to 0% after 13 sessions (range, 0% to 96.7%). The level of interaction between trained and untrained peers was variable, averaging 22.6%, 28.5%, 14.5%, and 30% for Peer-Trainers 1–4, respectively.

Implementing the peer-training procedure resulted in immediate and substantial increases in the peer-trainers' interactions with the autistic students. Interactions increased to an average of 70%, 83%, 44.5%, and 89% for Peer-Trainers 1–4, respectively. When free-play probes were resumed following training, Trainers 1, 2, and 4 continued to interact with the autistic students at levels above baseline, averaging 49.8%, 60.4%, and 90%, respectively. Interactions between Peer-Trainers 1, 2, and 4 and the untrained peers decreased following training, averaging 14.8%, 9.1%, and 0%, respectively.

A booster training session was conducted with Peer-Trainer 3 after the first two free-play probes following training showed little maintenance. The booster session was effective in reinstating high interaction levels. During subsequent free-play probes, however, interactions remained low and continued to decline across sessions. As a result, additional training sessions were conducted with Peer-Trainer 3 until her interaction level during training averaged 50% of the intervals. Subsequent free-play probes showed that the additional training was ineffective in promoting interactions.

A further analysis of the free-play probe sessions suggested that one of the untrained peers was interrupting and terminating interactions between Peer-Trainer 3 and the autistic student. To evaluate this observation, the untrained peer was systematically removed and returned (during the freeplay probes) in an ABAB reversal. The results showed that when the untrained peer was absent from the free-play probes, interactions between Peer-Trainer 3 and the autistic student were substantially higher (average = 71.7%) than when the untrained peer was present (average = 6.2%).

Autistic Students' Behavior

The effects of the peer-training procedure on the social responsiveness of the autistic students are shown in Figure 2. Baseline data for the first three autistic students are consistent; interactions with peers occurred infrequently (range, 0% to 16.7%). Autistic Student 4 initially exhibited high levels of social interaction with the peer-trainer and the untrained peers (range, 0% to 96.7%); however, the levels rapidly decreased to 0% by the end of baseline. During training, all four autistic students exhibited marked, but variable, improvements in social interaction, increasing to an average of 69.9%, 32.8%, 29%, and 39% for Autistic Students 1-4. For three of these students (1, 2, and 4), these improvements were maintained during subsequent probe trials at levels substantially higher than baseline (45.9%, 38.7%, and 89.9%, respectively). In addition, Autistic Students 1 and 3 showed slight increases in their interactions with the untrained peers, averaging 13.9% and 16% of the intervals. Autistic Student 3's data are similar to that reported for Peer-Trainer 3. Specifically, the data showed that interactions with the peertrainer during free-play probes were higher when the untrained peer was removed (M = 41.1%)than when he was present (M = 14.6%).

More detailed analyses of the interactions are presented in Tables 2, 3, and 4. Table 2 presents the percentage of interactions between autistic students, peer-trainers, and untrained peers that were coded as initiations or responses.

These data show that, following training, the peer trainers increased their initiations and responses toward the autistic students, with responses increasing more substantially. In contrast, three of four peer-trainers decreased their level of initiations and responses directed toward the untrained peers.

The data for the autistic students demonstrate that three of the four slightly increased their initiations to the peer-trainer. All four substantially



Figure 1. Percentage of intervals of positive social behavior by peer-trainers directed toward autistic students and untrained peers.



Figure 2. Percentage of intervals of positive social behavior by autistic students directed toward peer trainers and untrained peers.

Table 2	
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Average Percentage of Interval in Which Initiations and Responses Occurred

	Toward au	itistic students	Toward	peer trainers	Toward untrained peers	
	Baseline	Post-training	Baseline	Post-training	Baseline	Post-training
PT 1						
Initiations	0.0	11.0	XXX	XXX	4.0	2.0
Responses	1.0	39.5	XXX	XXX	16.0	7.0
PT 2						
Initiations	1.0	15.0	XXX	XXX	7.0	2.0
Responses	2.0	45.0	XXX	XXX	2.0	6.0
PT 3						
Initiations	2.0	4.0	XXX	XXX	1.0	3.0
Responses	2.0	10.0	XXX	XXX	14.0	10.0
PT 4						
Initiations	7.0	13.0	XXX	XXX	7.0	0.0
Responses	32.5	79.0	XXX	XXX	28.3	0.0
AS 1						
Initiations	XXX	XXX	1.0	40	2.0	0.0
Responses	XXX	XXX	10.0	35.5	0.0	13.0
AS 2						
Initiations	XXX	XXX	0.0	1.0	1.0	0.0
Responses	XXX	XXX	0.0	38.0	0.0	0.0
AS 3						
Initiations	XXX	XXX	1.0	1.0	1.0	2.0
Responses	XXX	XXX	7.0	21.0	9.0	17.0
AS 4						
Initiations	XXX	XXX	1.0	12.0	0.0	0.0
Responses	XXX	XXX	29.5	77.0	10.5	0.0
UTP 1						
Initiations	0.0	1.0	5.0	2.0	XXX	xxx
Responses	0.0	0.0	19.0	8.0	XXX	XXX
UTP 2						
Initiations	0.0	12.5	3.0	3.0	XXX	XXX
Responses	3.0	33.5	14.0	6.5	XXX	XXX
UTP 3						
Initiations	7.5	9.0	4.0	4.0	XXX	xxx
Responses	24.0	23.0	6.0	16.5	XXX	XXX
UTP 4						
Initiations	0.0	5.0	3.5	0.0	XXX	XXX
Responses	0.0	12.0	14.0	0.0	XXX	XXX

increased their responsiveness to the peer-trainers. Initiations toward the untrained peers decreased for three of four autistic students, and their responses toward the untrained peers were variable. peers. All the untrained peers increased their initiations to the autistic students during posttreatment sessions, and three of four increased their responsiveness. These increases occurred despite the fact that the untrained peers had received no spe-

Table 2 also presents data for the untrained

Table 3

Range and Mean Percentage of Social Initiations Emitted by Peers that Autistic Students Responded to Positively for Each Experimental Condition

	Baseline		Posttraining	
	Range	Mean %	Range	Mean %
AS 1				
Peer-trainer	0-50	25	25-80	57
Untrained peers	0-33	6	0-66	26
AS 2				
Peer-trainer	0	0	10-100	63
Untrained peers	0-100	50	0	0
AS 3				
Peer-trainer	0-75	25	20-100	50
Untrained peers	0-100	33	0-100	55
AS 4				
Peer-trainer	0-75	50	0-100	83
Untrained peers	0-100	25	0	0

Table 4

Range and Mean Percentage of Social Initiations Emitted
by Autistic Students that Peers Responded to Positively
for Each Experimental Condition

	Baseline		Posttraining	
	Range	Mean %	Range	Mean %
AS 1				
Peer-trainer	0-75	40	20-100	85
Untrained peer	0-50	25	0-100	55
AS 2				
Peer-trainer	0	0	0-100	70
Untrained peer	0	0	0	0
AS 3				
Peer-trainer	0-100	50	0-100	80
Untrained peer	0-75	25	0-100	75
AS 4				
Peer-trainer	0-75	60	0-100	90
Untrained peer	0-100	20	0	0

cific training. In contrast, both initiations and responses to the peer-trainers either decreased or remained at baseline levels.

Table 3 presents the range and mean percentage of social initiations emitted by the peer-trainers that were responded to positively by the autistic students.

These data show that, overall, the autistic students responded positively to 63% of the peertrainers' initiations following training. In contrast, the autistic students responded only to 25% of the peer-trainers' initiations during baseline.

Table 3 also shows that the autistic students' responses to initiations by the untrained peers varied across students. Autistic Students 1 and 3 increased their responsiveness from baseline to post-treatment (6%–26% and 33%–55%, respectively), whereas Autistic Students 2 and 4 decreased their responsiveness to the untrained peers (50%-0% and 25%-0%, respectively).

The data in Table 4 show the range and mean percentage of social initiations emitted by the autistic students that were responded to positively by the peer-trainers and untrained peers.

All the peer-trainers increased their responsiveness to initiations by the autistic students following training. Overall, the peer-trainers responded to 81% of the initiations by autistic students. The data also show that untrained peers in triads 1 and 3 increased their baseline levels of responsiveness (25%) to 55% and 75%, respectively. The untrained peers in triad 2 decreased their responsiveness following training; untrained peers in triad 4 never responded to the autistic students during either baseline or posttreatment sessions.

Duration Effects

Figure 3 presents the mean duration of interactions between the autistic students and peertrainers during both baseline and posttraining freeplay probes. In addition, the mean duration of interactions between peer-trainers and other peers during baseline free-play probes are presented for comparative purposes.

These data indicate that, during baseline probes, Autistic Students, 1, 2, and 3 exhibited brief interactions with their peer-trainers, averaging 4.2, 0.9, and 5.3 s, respectively. Autistic Student 4 displayed longer durations, averaging 2 min, 53 s; however, these durations were variable, ranging from 3 s to 4 min, 45 s. For all four autistic students, peer-training produced dramatic in-



FREE PLAY PROBES

Figure 3. Duration of interactions between autistic students and peer-trainers and between peer-trainers and untrained peers. Data for Autistic Students 1-3 represent seconds; data for Autistic Student 4 are presented as minutes.

creases in the duration of their interactions with the peer-trainers, averaging 7.6 s, 12 s, 26.9 s, and 8 min, 57 s, for Autistic Students 1–4, respectively. In comparison, the mean duration of interactions between the peer-trainers and the other peers during baseline probes averaged 8.9 s (range, 2 to 48 s), 31.7 s (range, 1.4 s to 3 min, 11 s),

18.7 s (range, 1.9 to 50.9 s) and 29.7 s (range, 1.9 to 47 s) for Peer-Trainers 1-4, respectively.

Generalization

The data on generalization of responding across settings are presented in Figure 4. Baseline data showed that interactions were low, averaging 17.5%



Figure 4. Percentage of intervals of positive social behavior in the generalization setting.

and 0.5% for Peer-Trainers and Autistic Students 1 and 2, respectively. Following training, interactions initially increased over baseline, but they dropped rapidly back to baseline levels. A separate analysis of initiations and responses showed that Autistic Student 1 initiated (2%) or responded (4%) to interactions during the intervals. The peer-trainer in that group initiated (4%) or responded (11%) to the autistic student. Autistic Student 2 did not initiate or respond to interactions with the peertrainer; the peer-trainer initiated (1%) and responded (4%) to the autistic student.

Generalization probes following generalization training showed that interactions increased and maintained above baseline. Specifically, interactions increased to an average of 34.5% and 47.5% of the intervals, respectively. A breakdown of the interactions showed that Autistic Students 1 and 2 increased their initiations to 5% and 9%, respectively, and that responding increased to 14%. The peer-trainers increased their initiations to the autistic students to 12% and 14%, respectively; responding increased to 51% and 54%, respectively.

Social Validation

The data from the social validity assessment showed that the teachers' ratings of the increases in interactions paralleled the student data. The teachers' ratings during baseline averaged 1.2 on the 5-point scale. Ratings of the free-play probes following training showed that the teachers viewed the autistic students and the trained peers as engaging in substantially more interactions than in baseline (M = 3.4). Furthermore, the teachers' ratings also showed that interactions between untrained peers and the autistic students were viewed as higher following training in those groups in which spillover effects were noted.

DISCUSSION

The direct prompting procedure produced an immediate and substantial increase in positive social interactions between the peer-trainers and autistic students during training. Additionally, the increases were maintained at levels above baseline during subsequent free-play probes. Such findings support the effectiveness of peer-mediated interventions (Strain, 1980; Strain & Fox, 1981; Strain et al., 1981).

The data presented in this study demonstrate that, overall, the autistic students and peer-trainers became more mutually socially responsive as a function of training. The peer-trainers and autistic students rarely interacted during baseline. In addition, teachers reported that, prior to training, the autistic and nonautistic students in the school rarely interacted during other integrated activities. During the free-play probes following training, both the peer-trainers and autistic students became more responsive to initiations and also increased (to a lesser extent) their initiations toward each other. Teachers also reported that the interactions between the peer-trainers and autistic students seemed to increase slightly at other times when the students were together (e.g., school arrival).

Few studies have reported percentage of initiations by autistic students. Strain's (1983) analysis showed that the autistic students were initiating interactions during an average of 35% of the in-

tervals. This is higher than we found and could be due to several factors. First, the substantial increases in duration of interactions following training may have lessened the opportunity for the autistic students to initiate interactions. The levels of initiations may also have been affected by our definition of an initiation-"any response that begins an interaction between two students observed not to interact for the previous 10 s" (see Table 1). Previous researchers (e.g., Strain, 1983; Strain & Timm, 1974) defined an initiation as occurring when social behaviors were separated by 3 s. Thus, studies using the shorter time interval would be more likely to show greater initiation levels. The optimal criterion, derived from normative data, may deserve closer scrutiny in future research, because the temporal aspect of the definition can influence whether initiations are recorded. It may be more accurate to define an initiation as occurring when students change topics or begin a new play activity.

The overall effectiveness of the intervention program may have been due to several variables. One variable may have been the use of students' preferred toys during training and the presence of these toys during subsequent free-play probes. These toys may have increased the probability that initiations by the peer-trainer would be reciprocated and thus maintained. Given the low levels of social behavior that are characteristic of autistic children, it may be necessary to "prime" appropriate play and social behavior during initial phases of peer interaction.

A second variable potentially responsible for increasing positive social behavior may have been the direct prompting training for peer-trainers. Fading the training sessions until the peer-trainer and the autistic student were interacting without feedback may have facilitated maintenance of responding during the subsequent free-play probes, because the only change was the presence of the untrained peers.

We also found that training resulted in lengthier interactions between peer-trainers and autistic students. Few researchers have measured changes in duration even though that has been identified by some as an important dependent variable (Strain et al., 1981). The increases in the duration of social interactions in our study may also be explained by the use of preferred toys during training and their presence in subsequent free-play probe sessions. Because the toys provided an occasion for continued activity, one would predict that the students' responsiveness would be maintained for longer periods of time, thus increasing the likelihood of longer reciprocal interactions.

The results also demonstrated that the untrained peers increased their interactions with the autistic students in three of four groups. This "spillover" effect replicates that of other social interaction investigations (e.g., Strain et al., 1976). The lack of spillover effects in one case may have been due to the behavioral characteristics of the autistic student in that group. Specifically, that student exhibited substantially more self-stimulatory behavior and less language than the autistic students in the other groups.

Another finding was that the level of the peertrainers' positive social behavior toward the untrained peers decreased following training. The decreases were often accompanied by comments from the untrained peers such as "If you play with him, you can't play with us" and "Don't play with him, he's weird." These data represent one of the first attempts to measure changes in peer-trainer behavior resulting from participation in a peer-training program. Several authors have suggested that such training should have positive effects on the peer-trainer (e.g., Stainback & Stainback, 1981), although systematic analyses were not conducted. The variables responsible for decreases in interactions between trained and untrained peers in this investigation are not entirely clear, although the training package certainly encouraged the peer trainer to interact with the autistic student. Informal observations of the peer-trainers at recess and mealtime, and discussions with their teachers, suggested that this effect was not maintained over time or across settings. Because the behaviors that were reinforced in this study are not substantially different from those in previous studies, it is possible that the effects are not limited to the direct prompting strategy we used. Clearly, more research is needed to determine the effects of peer-mediated interventions on the short- and long-term social status of the peer-trainers.

The data on generalization of responding across settings showed that, following training, interactions were initially above baseline levels but rapidly decreased. It was only after specific programming that interactions increased and maintained above baseline levels. These data suggest that the problem may have been one of maintenance rather than transfer (Koegel & Rincover, 1977). A closer analysis of the data suggests that the initial increases in interactions almost exclusively reflected peertrainer initiations. Because these were infrequently reciprocated by the autistic student, it is not surprising that the overall level of interactions would rapidly extinguish. The generalization training may have been effective because it provided reinforcement for reciprocal interactions and used the toys present in the generalization setting.

These data are somewhat inconsistent with recent investigations showing that generalization of social interactions occurs when probes are conducted in settings containing socially responsive peers (Strain, 1983). We used "socially competent" peers in the generalization setting, but interactions were not maintained without additional training. One variable that may account for these differences is that peers in this study, although socially responsive, were handicapped. Strain (1983) used nonhandicapped peers who were described as both bright and socially responsive. It may, therefore, be important to quantify those characteristics of peers described as "socially competent." A related variable may have been the characteristics of the autistic students. The peers in this study may have been socially competent, but the autistic students exhibited behaviors (e.g., selfstimulation, self-talk, mild aggression) that may have lessened the probability that the peers would interact with them outside of the treatment setting. Thus, target students' language, play, and social skills, as well as levels of inappropriate behavior, as they occur in the natural environment should be described in detail so that relevant subject characteristics can be identified.

It is possible that the target behaviors selected for training may influence the extent to which social interactions generalize and maintain. Further research is needed to identify those behaviors. Strain's training package included several behaviors (play organizers, shares, and assistance) that we did not include. This may explain the differences in results.

A final variable that may have accounted for the differences is group size. Strain (1983) conducted generalization probes in a setting containing 24 nonhandicapped peers, whereas in our investigation, the generalization setting contained only three peers. It is possible that a larger group of peers increases the probability that responses will be provided to initiations by the autistic students.

Substantial progress has been made in understanding how peer-mediated interventions can be used to promote the social behavior of autistic and other severely developmentally delayed students. However, additional research is necessary to identify variables that will facilitate generalized and durable social interaction skills and will not adversely affect the social status of peer-trainers.

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