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PEER-MEDIATED INTERVENTION: ATTENDING TO, COMMENTING ON, AND ACKNOWLEDGING THE BEHAVIOR OF PRESCHOOLERS WITH AUTISM

HOWARD GOLDSTEIN, LOUISE KACZMAREK, RUTH PENNINGTON, AND KARIN SHAFER

UNIVERSITY OF PITTSBURGH

This study investigated the effects of a peer-mediated intervention on the social interaction of five triads comprised of preschoolers with autism and their typical peers. Strategies thought to facilitate interaction were selected based on analyses of a descriptive data base. Peers were taught to attend to, comment on, and acknowledge the behavior of their classmates with disabilities. These are behaviors preschoolers typically exhibit frequently, but that do not obligate responses to the same extent as questions and requests do. The ABCB reversal designs revealed that improved rates of social interaction during play were clearly associated with the peer intervention for 4 of the 5 children with autism. This intervention offers an alternative peer-intervention package for increasing interaction between children with and without disabilities.

DESCRIPTORS: peer-mediated intervention, preschool children, integration, social skills training

As a result of PL 99-457, more young children with disabilities are being placed in preschools that include peers without disabilities. Descriptive research has shown that children with disabilities interact with other children more frequently in integrated settings than in segregated settings (Devoney, Guralnick, & Rubin, 1974; Guralnick & Groom, 1988; Paul, 1985; Peterson & Haralick, 1977). However, in the absence of adult intervention, typical preschoolers in integrated settings are more likely to select other typical preschoolers as playmates rather than those with disabilities (Beckman, 1983; Devoney et al., 1974; Peterson & Haralick, 1977).

Peer-mediated intervention has been one of the strategies used successfully to increase social interaction between children with and without disabilities in integrated settings. In these interventions, typical peers are taught social behaviors or strategies to direct to children with disabilities. The main focus of peer-mediated intervention strategies has been to increase the social behaviors of children with disabilities by teaching peers to (a) initiate interaction with children with disabilities at an increased rate, thus providing them with more opportunities to respond (e.g., Day, Powell, Dy-Lin, & Stowitschek, 1982; Odom, Hoyson, Jamieson, & Strain, 1985; Tremblay, Strain, Hendrickson, & Shores, 1981), or (b) respond to the social behaviors of children with disabilities, thus reinforcing their behaviors and making them more functional (e.g., Guralnick, 1976; McEvoy et al., 1988; Young & Kerr, 1979).

Descriptive research that has examined responses to behavior among typical children assists in laying an empirical foundation for optimizing the selection of peer-mediated intervention strategies. The descriptive work of Strain (1983) and Tremblay et al. (1981) has been used to identify strategies facilitative of social interaction between children with and without disabilities. This work, as well as other descriptive research with normal children (Mueller, 1972; Mueller, Bleier, Krakow, Hegedus, & Cournoyer, 1977), has shown that the most frequently appearing forms of social interaction are not necessarily the most effective in obtaining a response from a partner. For example, Tremblay et al. (1981) found that play organizers (i.e., statements that

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Requests for reprints should be directed to Howard Goldstein, Department of Communication, University of Pittsburgh, Pittsburgh, Pennsylvania 15260.

specify or maintain an activity or role for the partner) and questions had a higher probability of obtaining a response than more frequent communicative acts, such as statements, commands, and vocal attention-getters. Mueller (1972) demonstrated that the probability of communicative success (i.e., a verbal or nonverbal response to the speaker related to what the speaker had said) for preschool speakers with similarly aged, same-gender partners was predicted by the additive use of nine factors. These factors indexed properties of the speaker's utterances and the speaker's and listener's engagement at the time of the utterances. When considered together, the function of utterances and nonverbal communicative behaviors (e.g., proximity and listener attention) were highly predictive of successful interaction.

Although the research described above identified a variety of strategies for peer-mediated intervention, it would be useful to expand this empirical foundation in two ways. First, analyses that focus in greater detail on communicative function might be helpful in identifying additional facilitative strategies that would not only expand our current set of effective strategies for peer-mediated intervention but would also enhance the communicative repertoires of children with disabilities. Strategy selection for previous peer-mediated interventions that have focused on communicative interaction (Goldstein & Ferrell, 1987; Goldstein & Wickstrom, 1986) has been based primarily on the developmental literature and the adult–child language intervention strategies developed by special educators and speech-language pathologists. Examining child–child communicative interactions also would provide a basis for further refining these strategies. Second, more descriptive analyses including children with disabilities might lead to the identification of additional strategies that occur "naturally" when children without disabilities interact with classmates who are disabled. Teaching peers to apply strategies that are already a part of their social repertoires, but at higher rates, may be more efficient than training them to display novel behaviors.

The strategies selected for the present study were based on a descriptive analysis conducted to gather information on verbal and nonverbal communicative behaviors that typically facilitate interaction among preschool children with and without disabilities. Ferrell (1990) observed each of 10 typical children interact once with a partner with moderate disabilities, once with a partner with severe disabilities, and twice with a partner who was developing normally. The communicative act (i.e., pragmatic function) for each utterance, its accompanying behavior or setting event (e.g., eye contact and attention-getters), and the person to whom utterances were directed were specified. Sequential analyses were conducted to identify those behaviors that evoked responses more often than chance predictions. These analyses revealed that many more communicative acts and accompanying behaviors evoked responses from the typical partner than from the partner with severe disabilities. The results for the partner with moderate disabilities were especially useful for identifying potentially potent facilitative strategies, because he was not as consistently responsive as his typical partners but was not as unresponsive as the partner with severe disabilities.

Behaviors most likely to evoke social responses from partners were identified in two areas: the setting events preceding or accompanying communicative utterances and the communicative function of each utterance. Selection of a setting event for the current intervention program was straightforward, because one setting event—mutual attention to an object or activity—was consistently more effective than any other in being followed by a communicative act. However, four communicative functions were effective in obtaining responses from communication partners: comments, requests for information, requests for action, and simple acknowledgments. The results of the Ferrell study (1990) corroborated findings of other studies of young children's play interactions. These studies have indicated a tendency for children to make equal quantitative contributions to the play dialogue (Garvey & BenDebba, 1974; Kramer, Bukowski, & Garvey, 1989; Schober-Peterson & Johnson, 1989), balance each other for the most part in terms of initiator and responder roles (Schober-Peterson & Johnson, 1989), and maintain

conversational coherence by responding with utterances linked to a partner's preceding utterance (Brinton & Fujiki, 1984; Goncu & Kessel, 1984; Mueller, 1972). This literature highlights the importance of teaching peers to respond to the communicative behaviors of the target children as well as to initiate communication. Commenting was the initiation strategy selected, because of its consistently high frequency of occurrence, its higher than chance probability of obtaining a response (especially in dyads of typical children) and the absence of research that has used commenting as a peer-facilitative strategy (Goldstein & Kaczmarek, 1991).

This study examined the effects of a peer-mediated intervention in which the peers' strategies were based on a descriptive study that examined communicative interaction between both typical children and other typical children and typical children and their peers with disabilities. Specifically, the study was designed to address the following questions: Can peers without disabilities be taught to use the identified strategies (i.e., mutual attention, commenting, and acknowledging) to facilitate communicative interaction with autistic preschoolers? Do children with autism demonstrate corresponding increases in social interaction?

METHOD

Participants

The participants were 15 children enrolled in two integrated preschool classrooms. Five children with disabilities were identified as target children, and 10 typical peers were assigned to triads consisting of 1 target child and 2 peers.

The 5 target children were males ranging in age from 35 to 82 months. The children were assessed using the following instruments: the McCarthy Scales of Children's Abilities (McCarthy, 1972), the Learning Accomplishment Profile (LeMay, Griffin, & Sanford, 1977), the Sequenced Inventory of Communication Development (Hedrick, Prather, & Tobin, 1975), and the Childhood Autism Rating Scale (CARS) (Schopler, Reicher, DeVellis, & Daly, 1980). All 5 target children exhibited significant language, social, and cognitive deficits and all, except John, were diagnosed as autistic. Although John's score on the CARS was in the severe range for autism, his history included prenatal drug exposure; he also demonstrated pervasive developmental delay.

Greg, the oldest child, was able to speak in simple sentences. Bobby and Erik used single words, and Alan and John were nonverbal. The target children were observed several times over a 1-month period to determine their appropriateness as participants. All 5 demonstrated consistently low levels of assertive and responsive communicative behaviors during play in the classroom. Greg, although having the highest verbal ability of all the target children, rarely initiated social interaction. He was slow to respond and exhibited frequent stereotypic arm and leg movements. He generally did not engage in play or use materials without prompting. Bobby rarely played or used materials appropriately, and he typically circled around or left the play area. At the beginning of the study, Bobby used expressive jargon and some single words. Erik played appropriately by himself for short periods of time and would then leave the play area. He often used stereotypic verbal behaviors, repeating words, names, and phrases. Alan regularly used stereotypic motor and vocal behaviors and often mouthed toys and other materials. He cried during many of the initial sessions. John mouthed toys and materials but also demonstrated some play skills appropriate for a 15-month-old child (e.g., putting things in and out of a bucket, removing and replacing caps of markers). Results of formal assessments are summarized in Table 1.

All of the normal children enrolled in each classroom participated in the study. These children, 5 males and 5 females, ranged in age from 39 months to 64 months at the beginning of the study. The investigators observed the peers for several days in the classroom prior to the initiation of the study. These peers demonstrated communicative interactions with other peers during play; however, they rarely initiated interaction with a classmate with disabilities. All peers achieved a General Cognitive Index scale score at or above the normal range as measured by the McCarthy Scales and scores within

Table 1
Description of Target Children

	Greg	Bobby	Erik	Alan	John
Chronological age (months)	82	43	33	45	63
McCarthy: General Cognitive Index	<50	<50	55	<50	<50
CARS	33.5 Mild to moderate	34 Mild to moderate	35 Mild to moderate	40 Severe	39.5 Severe
SICD Receptive (months)	32	12	4	<4	4
SICD Expressive (months)	36	<4	<4	<4	4
LAP—D Language Comprehension	54–55[a]	—[b]	—[b]	24–36[a]	—[b]
LAP—D Language Naming	72–72[a]	—[b]	—[b]	15–24[a]	—[b]

Note. McCarthy = McCarthy Scales of Children's Abilities (McCarthy, 1972); CARS = Childhood Autism Rating Scale (Schopler et al., 1980); SICD = Sequenced Inventory of Communication Development (Hedrick et al., 1980); LAP—D = Learning Accomplishment Profile—Diagnostic Edition (LeMay et al., 1977).

[a] Basal and ceiling.

[b] No basal score.

6 months of their chronological age on the Language Naming and Language Comprehension subtests of the Learning Accomplishment Profile.

Setting

The study took place in a play area (2 m by 3 m) located in an unoccupied classroom. One of eight activities was set up for each play session. The activities included construction activities at a table (e.g., art/crafts projects, playing with pla-doh®), activities requiring primarily fine motor skills (e.g., airport, trucks), sociodramatic activities (e.g., baby dolls, beach/picnic), and activities involving gross motor skills (e.g., ball games, fishing). The activities were rotated and were used approximately the same number of times during each phase of the study.

Each target child was paired with 2 peers for play sessions that lasted approximately 5 min. For each triad, the 2 peers (1 male and 1 female) and target child were kept constant throughout the study, but when peers were absent a peer from another triad was substituted.

The children were monitored by a preschool staff member or by a member of the research staff. Prior to the beginning of each play session, the adult monitor put vests on the children, introduced the activity, and reviewed the play guidelines. The monitor stayed near the play area, but did not enter it unless providing physical prompts or other assistance. Unless behavior management was required, the monitor interacted verbally with the subjects only when providing prompts and praise statements appropriate for each phase.

The social interactions within the triads were observed and coded for the 5-min session by a trained observer. A second trained observer was present for reliability sessions. An audiotape cued the beginning of each 10-s recording interval. Audiotapes and videotapes were recorded for each session.

Recording Equipment

Each peer and target child wore vests that had a lapel microphone and a pocket containing a wireless transmitter. The wireless system components included a Samson SR-22 receiver, ST-2 Body Pack transmitters, Shure High Pass filters, and Audio Technica 831 lapel microphones. A Yamaha MT100 audio mixer/recorder recorded the verbal output from the children's microphones. A Sony TCM-35 mini-cassette recorder played the prerecorded audible interval count. A videocamera (Panasonic Proline CamCorder AG170) with a wide-angle lens was set up near the audio equipment. Although all of the recording equipment was visible to the participants, its presence did not appear to interfere with the interaction.

Data Collection

All verbal and nonverbal communicative behaviors were recorded for the peers, the target child, and the adult monitor using a direct-observation coding system. In addition, nonverbal social behaviors that did not show specific communicative intent and two types of negative behaviors were also coded for the target children. Interactions were coded live by one of two observers. Coding was reviewed by the same observer with the audiotapes and videotapes following each session, and corrections were made as necessary before submitting the coding sheets for analysis.

An event recording system was used to code sequential behaviors occurring during the 5-min sessions. These sequences were recorded in 10-s intervals to assist with reliability calculations. Each event was coded along three dimensions: who displayed the behavior ("by whom"), the intended recipient of the behavior ("to whom"), and the type of behavior. The "by whom" and "to whom" dimensions were coded as Peer 1, Peer 2, target child, monitor, or ambiguous. Eleven behaviors were coded for peers and target children in two categories: (a) verbal communicative acts with eight behavior types based on an adaptation of Fey's (1986) taxonomy and (b) nonverbal communicative acts with three behavior types. Three behaviors were coded exclusively for the target children: (a) nonverbal social behavior, (b) vocal nonsocial behavior, and (c) nonverbal undesirable behavior. Three behaviors were coded for the adult monitor: (a) general prompts, (b) specific prompts, and (c) praise statements.

Peer and target child communicative acts. The eight verbal coded behaviors included:

1. Requests for information. These were direct and indirect questions and commands designed to solicit new information, and requests for permission or confirmation (e.g., "What are you doing?" or "Tell me that story").

2. Requests for action. These were direct and indirect requests seeking action or cessation of action (e.g., "Gimme that," or "Don't take the car").

3. Requests for clarification. These included direct or indirect questions seeking clarification of an utterance that was not understood by the partner (e.g., "What?" or "Huh?").

4. Requests for attention. These were utterances used to obtain attention (e.g., "Hey," or "Look").

5. General responses. These were simple acknowledgments of a prior utterance by the partner, or responses to requests for clarification or action (e.g., "Okay, here are the bandaids you want," or "Well, Joey needs a marker too").

6. Responses to requests for information. These included utterances providing new information in response to a request (e.g., "Yeah, I want that truck").

7. Imitative responses. These were repetitions of all or part of a previous utterance from another child or adult.

8. Unintelligible utterances. Verbalizations uninterpretable to the observer were coded in this category.

Three nonverbal behaviors for both peer and target children included:

1. Requests for action or attention. These were actions or gestures seeking action or cessation of action, or used to obtain attention from the conversational partner (e.g., a child reaching for a toy held by another child, a gesture to indicate refusal of an offered toy, or tapping a child on the arm to get his or her attention).

2. General responses. These included nonverbal responses acknowledging a prior utterance by the partner or responding to requests for action or clarification (e.g., a head nod, handing the partner a toy).

3. Imitative responses. These were nonverbal imitations of another child's actions.

Target child behaviors. Three additional behaviors coded only for target children were:

1. Nonverbal social behavior. These were positive nonverbal acts initiating interaction to gain attention or respond to the social interactive behaviors from others. The behavior was judged desirable when it was directed toward or obtained a response from another (e.g., vocalizations, gestures, eye contact, body contact).

2. Vocal nonsocial behavior. These were utterances and vocalizations that were not directed to a peer or adult and that did not receive a response. Because these behaviors were often repetitive, only one occurrence was tallied during any 10-s interval.

3. Nonverbal negative behavior. These were nonverbal or vocal behaviors appearing to indicate disinterest, refusal, avoidance, displeasure, or desire to escape in response to social behaviors of others (e.g., crying, whining, pulling away, lying on the floor, use of unconventional gesture). If the behavior was accompanied by a verbalization, such as "no," the communicative act code took precedence.

Adult monitoring behaviors. Three types of adult monitoring behavior were coded:

1. General prompts. These were general instructions related to the play and general behavior of the peers and target children. The monitor used verbal or nonverbal prompts to remind an individual or the group about rules for play, to remind them to stay within the play area, to assist in solving disputes, and to encourage children to join in an activity.

2. Specific prompts. These were utterances directed toward a peer for the purpose of prompting the peer to use a facilitative strategy in an interaction with a target child (e.g., "Matt, tap him on the shoulder," or "Laura, move so your friend can see you and the airport").

3. Praise statements. These were verbal statements intended to reinforce a peer or a target child for desired behavior (e.g., "Good work, Erik," or "I like the way you said your friend's name").

For the purposes of presentation and discussion of data, some of the behavior types were combined. Facilitative strategy use consisted of the following five communicative acts combined for both peers: verbal and nonverbal requests for attention, verbal and nonverbal general responses, and comments. Total communicative acts of the peers were made up of the facilitative strategies plus the remaining communicative acts combined for both peers. Total communicative acts of the targets consisted of the same categories as those in peer total communicative acts. Total social behavior of the target children was comprised of the total communicative acts plus nonverbal social behaviors. Verbal behavior of the target children was comprised of all the verbal communicative acts.

Interobserver Agreement

Interobserver agreement was determined on the final version of the coding sheets, after each observer independently reviewed the audio and video record of a session. Percentages of agreement were calculated for the 5-min sessions for three categories: by whom (the speaker of the utterance, or the initiator of an action), to whom (the recipient), and the type of behavior. For the "by whom" and "to whom" dimensions, an item was scored as an agreement if both observers coded the respective categories as either Peer 1, Peer 2, target child, monitor, or ambiguous. A disagreement was scored if the coders did not agree on the individual or if the behavior was missed. For type of behavior, agreement or disagreement was scored only if both coders agreed on the occurrence of the behavior. An agreement was scored if both observers identified the behavior with the same specific behavior code (one of the 17 described above); otherwise a disagreement was scored. Percentages were then calculated by dividing the number of agreements by the sum of agreements and disagreements and multiplying by 100.

Prior to baseline data collection, the observers were trained to a criterion of 80% interobserver agreement. Two trained observers coded the social interactions of each triad for 33% of the 231 sessions. Mean interobserver agreement over all phases for the "by whom" category was 80.7% (range, 68% to 93%); for "to whom," 82.6% (range, 64% to 100%); and for type of behavior, 90.2% (range, 76% to 100%).

Peer Training

Following baseline data collection, training was implemented with the typical peers through six direct instruction lessons. These lessons focused on the three facilitation strategies identified in a previous study (Ferrell, 1990). These strategies were (a) mutual attention to the play activity, (b) commenting about ongoing activities, and (c) general acknowledgment of the partner's communicative

behaviors. These facilitation strategies were taught to the children as the following steps: (a) establishing mutual attention by moving in front of the target child and looking at the child, the toys being played with, or what the child is doing; (b) saying the target child's name; (c) saying the target child's name again if the child gives no response and then if necessary, tapping the target child on the shoulder and saying his or her name again; (d) talking about ongoing activities and watching and listening to see if the target child takes a turn; and (e) talking again.

Peers were trained in groups of 4 (from Classroom 1) and 6 (Classroom 2). Training sessions included an overview of each new step in the chain and a review of previously learned steps. Introduction of a new step was followed by opportunities for individual and group descriptions of the requirements of each step, adult modeling of the step in isolation and within the complete sequence of steps, adult–child demonstrations with practice, and child–child practice. Posters were used to illustrate the strategies during training and demonstrations. Peers displayed strategy use with an adult playing the role of the target child, meeting a criterion of 80% accuracy on 2 of 3 consecutive days. Peers then met the same criterion during interactions with the target child in their free-play triad. Peers required between 11 and 16 sessions to attain this 80% mastery criterion. Rewards were provided at the end of the training sessions to peers who listened attentively and followed directions satisfactorily.

Experimental Design and Conditions

An ABCB reversal design replicated across five triads was applied to assess changes in peer and target interactions. Throughout the study, the adult monitors were responsible for delivering general prompts if an entire 10-s interval transpired without social behavior on the part of the target child. Also, they praised the group for positive play interactions.

After strategy training, general prompts could be followed by prompts to peers to use specific interaction strategies. Also, the monitors provided praise to peers for successful strategy use during the remaining phases. Following each play session, verbal and token reinforcement was provided. The peers received stickers or small toys for displaying the behavioral chain with 80% accuracy with their designated partner at least twice during the session. The target children received similar rewards noncontingently.

Baseline. During baseline, the monitor gave general instructions and ideas for the play activity and provided general prompts (e.g., "Remember to talk and play with all your friends"). No specific prompts about how to initiate or maintain interaction with other group members were provided in this condition. When stable interaction rates were demonstrated, peer training was instituted for all groups.

Intervention. In the first intervention condition, peers were given 10 s to initiate spontaneously to the target children. Posters used during peer training were placed in the play settings as reminders to use the communicative strategies. If neither peer initiated, peers were then given a general prompt to have a conversation with the target child while playing. If the peer did not complete the entire chain of behaviors (e.g., because of interruptions or movement of the target child away from the play area), the monitor prompted the peer to complete the behavior chain by using specific prompts (e.g., "Watch and listen to your friend"), or prompted the peer to start the sequence again. The only change from baseline to intervention for the adult monitors was the inclusion of prompts and praise specific to strategy use. As the interaction rates for each group stabilized, the reversal condition was instituted.

Reversal. During reversal, the peers were prompted to use the same chain of trained behaviors, but they were instructed to "have a conversation" with one another. Monitors prompted in a manner similar to the intervention condition (i.e., wait for 10 s without peer interaction, then give a general prompt followed by more specific prompts for strategy use if necessary). After rates of interaction between the peers and the target child became stable, return to intervention was instituted.

The rationale for use of a reversal design, rather than a withdrawal (i.e., return to baseline) design was to demonstrate within a short period that

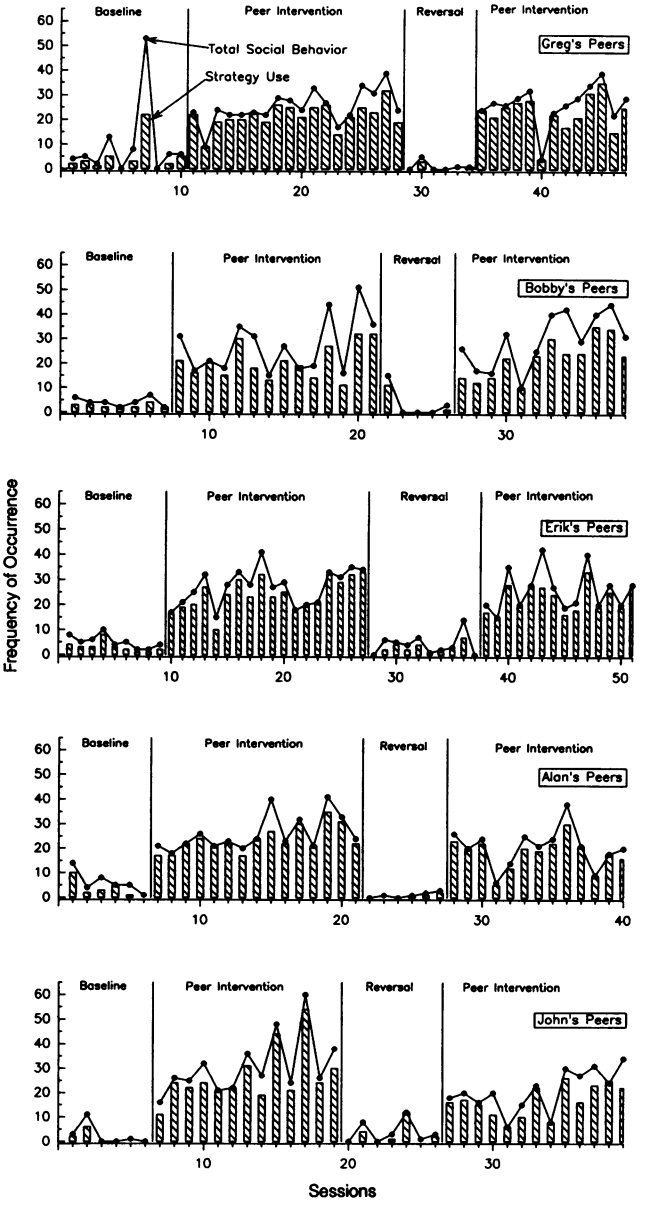

Figure 1. The frequency of peers' social behavior directed to the target children during 5-min observations of play. The bars indicate the number of those social behaviors involving the use of facilitative strategies.

changes in target child behavior were related to peer behavior. During the reversal phase, some interactions between peers and targets occurred, but the peers were prompted and verbally praised only for interactions with the other peer. Target children were praised for positive play interactions as in other phases.

Return to intervention. The peers were asked to use the trained behaviors with the target child as they had in the initial intervention condition. All procedures were identical to the first intervention.

RESULTS

Peer Behavior

The frequency of peers' social behavior directed to the target children during 5-min observations of play is presented in Figure 1. During baseline, the

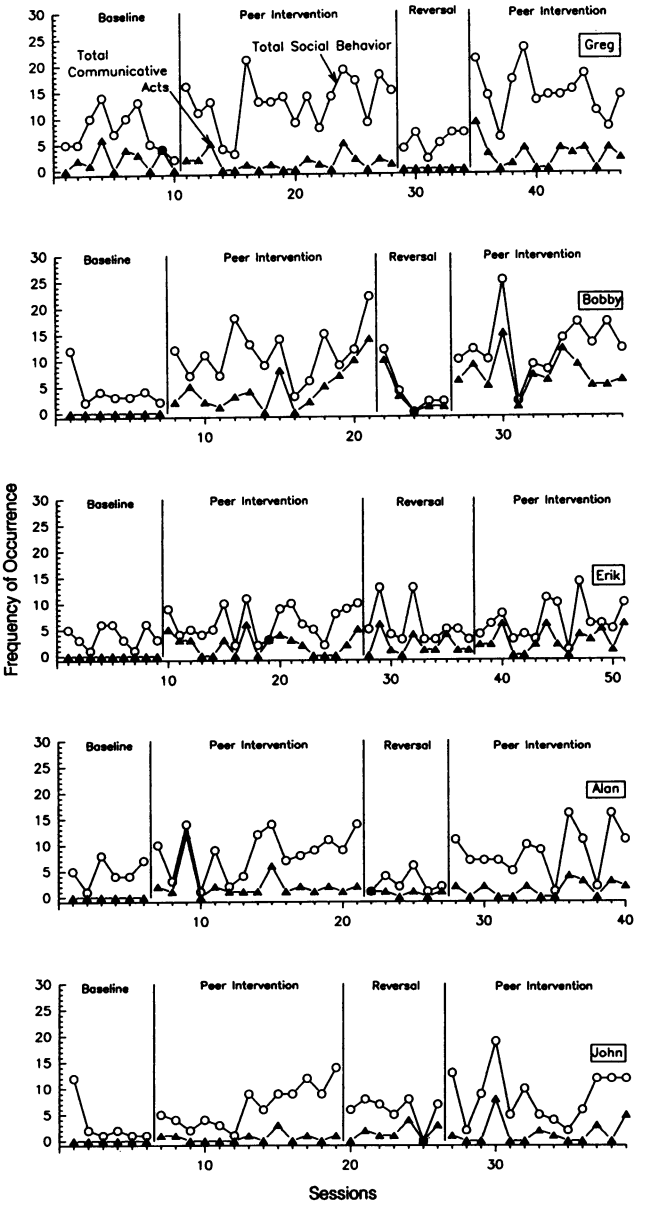

Figure 2. The frequency of social behavior demonstrated by target children. The circles indicate the total number of social behaviors, and the triangles indicate the total number of communicative acts.

frequency of interaction between peers and the target children was quite low. In the 5-min play sessions, typically no more than an average of five social behaviors were directed to a target child. The one striking exception was one session with Greg, in which peers persisted in trying to obtain a desirable toy that Greg had. It was notable that the peers all demonstrated some use of facilitative strategies. During the peer-intervention conditions, consistently high rates of strategy use were evidenced (averaging 20.5 to 26.5 per session). The amount of interaction with target children that supplemented strategy use (Figure 1) was variable within and among the triads. During the reversal condition, when the peers were told to use the facilitative strategies with one another, very low rates of social behavior were directed to the target children. The enhanced rates of social interaction with target chil-

dren were recovered immediately once peer intervention was reinstated.

Target Child Behavior

The frequency of social behavior demonstrated by target children is presented in Figure 2. Except for Greg, social behavior during baseline was comprised solely of nonverbal social behavior. Greg averaged 7.5 total social behaviors during his play sessions with peers, with an average of 2.0 categorized as communicative acts. The other target children rarely exceeded an average of five social behaviors per session during the baseline condition (Figure 2). Once the peer intervention condition was instituted, increased frequency of total social behavior was demonstrated by each of the target children (averaging 6.5 to 13.0 social behaviors per session). This effect was somewhat more evident for Greg, Bobby, and John than for Erik and Alan. Communicative acts increased from baseline levels for all children except Greg, whose communicative acts remained about the same.

During the reversal condition, when peers were encouraged to interact with one another, each of the target children demonstrated a drop in total social behavior. Only in the case of Erik did we find some variability, with higher frequencies of social behaviors demonstrated during this condition. A clear decline was demonstrated by John, even though his frequency of social behavior did not return to as low a rate as in the initial baseline condition. Communicative acts during this phase, however, dropped dramatically for Bobby and to zero (which was below baseline) for Greg; the other 3 children's communicative acts showed little change. This indicated that an increase in nonverbal social behavior (the difference between total social behavior and communicative acts) was primarily responsible for the intervention effects.

The reinstatement of the peer-intervention condition resulted in recoveries of the higher frequencies of total social behavior in all of the target children. Erik again showed more variable performance during his social interactions with peers in this final condition. Communicative acts for both Bobby and Greg increased in frequency, although Greg's level never exceeded that observed in baseline.

Verbal communicative acts were also examined. During baseline, only Greg displayed communicative acts that were verbal (averaging 1.2 per session). In the initial intervention, Greg's verbal communicative acts decreased to an average of 0.8 per session and then decreased to zero during reversal. These verbal behaviors, however, increased to an average of 2.2 in the second intervention phase. Both Bobby and Erik began to display verbal communicative acts following baseline. Erik's verbal behavior remained at the same level during the initial intervention phase and reversal (a mean of about 0.3 per session), but increased in the second intervention (0.9). Bobby's level of verbal behavior remained approximately the same in the three phases following baseline, averaging 3.1, 3.0, and 3.5, respectively.

Distinctions made among behaviors in our data collection system permitted a description of the nature of the social behavior that developed in the target children during this intervention. In Table 2, the total number of occurrences for each behavior type combined for both intervention conditions (regardless of the recipient of these behaviors) is presented. In addition to 399 nonverbal social behaviors, Greg expressed 70 communicative acts in 31 sessions, 79% of which were verbal utterances. Bobby expressed 240 communicative acts in 26 sessions, representing a diverse variety of specific categories. Bobby demonstrated considerable improvement in communicative behavior; 85% of his communicative acts were verbal utterances. Erik expressed 77 communicative acts in 32 sessions, 25% of which were verbal utterances. In addition to over 180 nonverbal social behaviors each, Alan and John demonstrated 55 and 32 nonverbal communicative acts during the peer intervention conditions, respectively.

Further analysis of our sequential data explored relationships between adjacent social behaviors of target children and peers. The likelihood of a peer social behavior following a target child social behavior is presented in Table 2 for each of the social behavior types (i.e., criterion behavior). The num-

Table 2
Frequency of Target Children's Behavior and Probability of Responses from Peers

	Greg	Greg's peers	Bobby	Bobby's peers	Erik	Erik's peers	Alan	Alan's peers	John	John's peers
Request for information	3	.67	46	.63	0		0		0	
Request for action	0		3	.67	2	1.00	0		0	
Request for clarification	0		1	1.00	0		0		0	
Request for attention	1	0	31	.42	0		0		0	
Comments	12	.50	66	.53	7	−.29*	0		0	
Other assertives	6	.67	4	.75	3	0	0		0	
Nonverbal request for action	6	.67	12	.67	47	.81*	39	.59	13	.92
Response to request for information	10	.90	6	.67	1	.00	0		0	
General response	21	−.43*	22	.46	2	.50	1	0	0	
Imitative response	2	.50	24	.54	2	.50	0		0	
Nonverbal general response	9	1.00*	25	.52	13	.85	16	.63	19	.79
Nonverbal social behavior	399	.77**	253	.55	127	.61	210	.56	181	.61
Nonverbal negative behavior	3	.67	24	.50	35	−.51*	46	−.28**	34	.62
Unintelligible	10	.60	21	.62	2	.50	0		0	
Total behavior	482		538		241		312		247	
Expected probabilities		.67		.57		.67		.56		.67

* $p < .05$, ** $p < .01$.

ber of times a target child criterion behavior was followed by any peer social behavior was divided by the total number of target child criterion behaviors (i.e., all the possible opportunities) to obtain a conditional probability. It should be noted that codes were inserted within the stream of events whenever 3 s or more transpired without social interaction. Thus, the conditional probabilities accurately reflect relationships relatively adjacent in time, but do not take into account to whom social behavior appeared to be directed, because apparent directionality does not preclude others from sustaining or redirecting the interaction. The expected probability (unconditional) represents the proportion of peer social behaviors present in the data set (i.e., the number of peer social behaviors was divided by the total number of events coded). The differences between the conditional and expected probabilities were tested statistically using the binomial test. Positive and negative z values indicated whether peer social behaviors followed target criterion behavior more often or less often than would be predicted by chance. A computer program for lag sequential analysis of contingency in behavioral interaction data was used for these calculations (Sackett, Holm, Crowley, & Henkins, 1979).

The conditional probabilities presented in Table 2 indicated that peers were generally quite responsive to the social behavior of target children. However, peers' responses to target child behaviors exceeded chance for only a small number of categories and for only 2 children. The proportion of responses to Greg's nonverbal social behavior and nonverbal general responses significantly exceeded chance. Peers also responded to Erik's nonverbal requests for action more often than chance. On the other hand, peers responded less often than chance to general responses by Greg, nonverbal negative behavior and

Table 3
Frequency of Peers' Communicative Acts and the Probability of Target Children's Responses

	Greg's peers	Greg	Bobby's peers	Bobby	Erik's peers	Erik
Request for information	140	.14	82	.26	81	.07
Request for action	188	.13	145	.34**	176	.09
Request for clarification	12	.17	15	.47*	8	.13
Request for attention	397	.13	340	−.17*	512	.08
Comments	944	.26**	517	.33**	607	.15**
Other assertives	144	.15	61	.25	92	−.02*
Nonverbal request for action	35	.20	33	.52**	34	.32**
Nonverbal request for attention	1	0	8	.50	9	.11
Nonverbal other assertive	5	.20	8	.13	7	.14
Response to request for information	20	.15	19	.16	11	0
General response	200	−.08**	107	.17	106	<.02**
Imitative response	8	.25	18	.33	1	0
Nonverbal general response	11	.09	5	.60*	27	.07
Unintelligible	0		3	.33	0	
Total behavior	2,105		1,361		1,671	
Expected probabilities		.16		.23		.10

* $p < .05$, ** $p < .01$.

comments by Erik, and nonverbal negative behavior of Alan.

Table 3 summarizes the frequency of peers' communicative acts. Also, the conditional probabilities for these peer behaviors being followed by a target child's social behavior are presented. As reflected by the expected probabilities, the target children's social behaviors represented a relatively small percentage of the coded events, ranging from 10% for Erik to 23% for Bobby. Nevertheless, certain peer behaviors were responded to either more or less often than chance for each of the target children. For example, peers displayed 944 comments in Greg's presence, and he responded 26% of the time, significantly more often than chance. On the other hand, Greg responded to peers' general responses less often than predicted by chance. Bobby was especially responsive to comments, requests for clarification and action, nonverbal general responses, and nonverbal requests for action, but responded to peers' requests for attention less often than chance. Erik was especially responsive to comments and nonverbal requests for action, but responded to peers' other assertives and general responses less often than chance. John was responsive to comments, nonverbal requests for action, and general responses, but did not comply with requests for attention. Alan was especially responsive to comments, verbal and nonverbal requests for action, and nonverbal requests for attention, but was unresponsive to other assertives. It is noteworthy that all 5 children were responsive to comments, one of the three facilitation strategies, at a statistically significant level.

Adult Prompting

The description of monitor behavior in Table 4 includes the mean rates of adult intervention for each triad during each experimental condition. Monitors consistently demonstrated less intervention during the initial baseline condition; this decrement was due to a lack of specific prompts and few praise statements. A high rate of general prompts was provided throughout the study; typically, 10 to 15 general prompts per session were provided, with no consistent change across conditions, replicated among the triads. Specific prompts to peers were demonstrated less often than general prompts (4.2 to 5.9 prompts per 5-min session) during the intervention conditions. During the intervention conditions, the total number of monitor behaviors

Table 3
(*Extended*)

Alan's peers	Alan	John's peers	John
39	.10	85	.09
98	.24**	124	.14
2	0	3	0
370	.14	373	−.05**
531	.20**	647	.15**
87	−.07*	96	.16
28	.27*	62	.35**
6	.50**	2	0
7	0	7	.29
5	0	13	.08
72	.13	163	.05*
5	.2	15	.13
15	0	9	0
0		0	
1,265		1,599	
	.14		.11

ranged from 17.3 to 22.2 occurrences in 5 min. A slight reduction in teacher involvement was demonstrated during the reversal condition.

DISCUSSION

A peer-intervention package that focused on attending to, commenting on, and acknowledging the behavior of children with disabilities was effective in promoting improved social interaction among typical preschoolers and their classmates with autism. Peers directed low rates of social behavior to target children during baseline and reversal conditions. When prompted to use facilitative strategies with classmates with autism subsequent to training, they demonstrated dramatic improvements in the frequency of their interaction. Improvements in the frequency of social interaction also occurred for the children with autism. Clear experimental control over total social behavior was demonstrated by 4 of the 5 children with autism; the lack of a clear reversal for Erik on this dependent variable indicated that other variables may have influenced his behavior, at least in part. Because only 1 child showed clear experimental control for communicative acts, the increase in nonverbal social behavior appears to be primarily responsible for the intervention effects.

This study applied the results of a descriptive study of communicative interaction among preschoolers to select the facilitative strategies used by peers to interact with children with autism. Behaviors with higher-than-chance probabilities of obtaining responses (Ferrell, 1990) were selected. Commenting, which had not been used previously in peer-mediated interventions, was among the behaviors selected. It is notable that the package (i.e., establishing mutual attention, commenting, and acknowledging the behaviors of the target children) enhanced interaction on the part of preschoolers with autism. These behaviors did not appear to obligate responses to the same extent as questions, requests, and suggestions for playing and sharing (i.e., strategies often employed in peer-mediated social skills interventions). The fact that improvements were seen among children who were nonverbal and who demonstrated significant cognitive delays is especially surprising.

A distinction was made among social behaviors without readily perceptible communicative intent (i.e., nonverbal social behavior), conventional nonverbal communicative acts, and verbal communicative acts. Regardless of the function or intent of nonverbal social behaviors, the inclusion of this category allowed us to capture less sophisticated social behavior than our other communicative categories would have otherwise allowed. Because Bobby's improvements were reflected in a large number of verbal communicative acts, the changes in his behavior were readily perceptible to his teachers and parents. Behavior changes were less perceptible for the children who continued to interact nonverbally. Nonetheless, the improvement in their quality as well as quantity of interaction may be a good prognostic indicator. One would expect that concurrent intervention to facilitate the development of verbal or alternative modes of communication would augment the effects of this approach.

Sequential analyses were conducted to determine whether peers were especially responsive or unresponsive to certain communicative acts demonstrated by the target children. Although peers responded

Table 4
Means (and Standard Deviations in Parentheses) for Monitor Behavior per Session

	Baseline	Intervention	Reversal	Intervention
Greg				
Prompts	0.0	4.7 (2.1)	1.8 (1.9)	4.2 (2.0)
General prompts	10.9 (3.6)	10.3 (3.8)	7.0 (5.4)	12.6 (4.9)
Praise	0.9 (1.0)	2.4 (1.3)	5.0 (3.4)	2.5 (1.9)
Total monitor behavior	11.8 (3.6)	17.4 (3.4)	13.8 (3.8)	19.4 (3.7)
Bobby				
Prompts	0.0	5.0 (2.6)	2.6 (2.7)	5.8 (2.3)
General prompts	11.3 (2.4)	10.8 (4.6)	14.4 (4.2)	14.8 (7.6)
Praise	0.9 (0.7)	2.1 (1.7)	0.4 (0.7)	1.7 (1.6)
Total monitor behavior	12.1 (2.9)	17.9 (5.3)	17.4 (5.4)	22.2 (8.3)
Erik				
Prompts	0.0	5.4 (3.1)	3.8 (3.2)	5.4 (1.9)
General prompts	12.3 (3.0)	10.4 (4.6)	8.8 (2.4)	13.7 (4.7)
Praise	0.6 (0.5)	1.4 (0.8)	2.6 (2.0)	1.6 (1.5)
Total monitor behavior	12.9 (3.0)	17.3 (3.4)	15.1 (3.1)	20.6 (4.2)
Alan				
Prompts	0.0	4.6 (2.4)	4.3 (1.2)	4.6 (1.7)
General prompts	12.5 (3.0)	13.1 (4.4)	12.7 (3.4)	13.6 (4.0)
Praise	0.5 (0.8)	2.9 (1.3)	1.3 (1.0)	2.7 (1.7)
Total monitor behavior	13.0 (2.8)	20.5 (4.1)	18.3 (3.8)	20.9 (3.5)
John				
Prompts	0.0	5.9 (2.2)	1.0 (1.2)	4.8 (2.7)
General prompts	14.2 (3.4)	10.8 (4.0)	9.3 (3.7)	15.4 (5.6)
Praise	0.7 (1.2)	2.6 (1.6)	5.0 (1.7)	2.0 (1.6)
Total monitor behavior	14.8 (3.1)	19.3 (3.8)	15.3 (4.6)	22.2 (4.1)

to few specific target child behaviors at above-chance levels, relatively high probabilities of responses were demonstrated generally. A decrease in responsiveness to communicative acts reached significance for Greg's general responses, Alan's and Erik's nonverbal negative behaviors, and Erik's comments. The relatively low frequency of occurrence of individual communicative acts by target children may have diminished our ability to detect strategies that were especially effective in gaining responses from peers.

The target children were given opportunities to respond to a large number and variety of communicative acts by the peers. All of the target children demonstrated a statistically significant level of responsiveness to comments, one of the three facilitation strategies. Other significant sequential effects may be indicative of important differences among the target children. For example, the significant unresponsiveness of Bobby and John to requests for attention was consistent with their individual social behavior patterns. Alan was particularly responsive to nonverbal requests for attention, indicating that body contact may heighten his awareness of his social environment. Bobby responded more often than chance to requests for clarification, indicating more awareness of a peer's verbal behavior than might otherwise have been apparent, given their relatively low rates of occurrence. Such findings could spark further refinements and individualization of peer-intervention packages. For example, Bobby's peers might be encouraged to request clarification of more of Bobby's communicative attempts. The peers of Bobby, John,

and Alan might be encouraged to initiate interactions nonverbally without requesting attention explicitly.

The high rate of adult involvement during the study raises questions regarding the peer- versus monitor-mediated nature of the intervention. The rate of general prompts to peers and targets was at least in part a reaction to the implicit demands of keeping target children with rather challenging behavior problems (e.g., mouthing objects, leaving the play area, throwing toys, social approaches to the observers or monitors) involved in the activities. The monitors might be viewed as managers of the play environment whose tasks included mediation of the frequent undesirable behaviors of the target children. Adult function in this regard was no different than it would be during free play in many preschool environments, except that with these children the need for monitor mediation occurred more frequently. Specific prompts for peers to use strategies were not particularly frequent, rarely exceeding an average of one prompt per minute. The rate of general prompts was quite frequent, but was relatively consistent throughout the study. Nevertheless, it would be desirable to fade the level of adult involvement systematically in future refinements of this intervention.

Peers were successfully taught a chain of behaviors to use when interacting with children with disabilities. It should be noted that in training the chain, children were not taught explicitly to differentiate comments from requests. Instead, examples and demonstrations during training were limited exclusively to commenting. However, requests and other forms of communication were accepted as appropriate for both "talking steps" of the behavioral chain during intervention. The success of this training strategy in increasing comments is shown by the fact that comments were the most frequent communicative acts displayed by peers. In addition, our data also indicated that requests and other assertives (exclusive of requests for attention, which were a part of the intervention) did occur during intervention, but at relatively lower rates than comments. The resulting overall interaction pattern of the children in this study did not achieve an equitable balance of social acts, but did resemble the descriptive study (Ferrell, 1990) in which requests and other assertives were observed embedded within a substantially higher rate of comments. These findings contrast with the comments of Tremblay et al. (1981), who noted that the quality of the interaction was altered and that peers' initiation repertoires were restricted when they compared results of previous peer-initiation studies to the social interactions demonstrated by normal preschool children in their descriptive study.

The results of our study suggest that teaching peers to comment may preserve a better balance in the initiation repertoires of peers. Further examination of the baseline data in terms of communicative acts sheds some light on how this was achieved. Although baseline communication between peers and target children was infrequent, the communicative acts that did occur were requests and other similar assertives. Thus, our intervention achieved more normative communication patterns between children with and without disabilities by teaching peers to increase the frequency of their lower probability behavior (i.e., commenting) and permitting them to continue to display the other forms of communication that occurred fairly often in baseline (e.g., verbal and nonverbal requests). Clearly, additional research is warranted to ascertain further the specific effects of commenting on the quality of the interaction in peer-mediated interventions.

Requests for attention were the only request form of communication that peers were taught as part of the behavioral chain. Interestingly, these were among the most frequent communicative acts in baseline and were second in frequency to comments during the intervention. However, the lag sequential analysis revealed that they were not particularly effective in garnering responses from the target children and, for Bobby and John, were responded to less often than predicted by chance. Although the peers were taught to persist in directing or obtaining the attention of a target child, they were also instructed to continue the chain whether or not the

target child responded to the request. However, it should be noted that frequently the attention (i.e., a nonverbal social behavior) of the target child was obtained or directed following the ensuing communicative act. It is unclear whether this was a function of the communicative act or whether peers should have allowed more time for the target child to respond. Future interventions might be designed to explore more carefully the nature of requests for attention in peer-mediated interventions.

The chain of behaviors taught not only required peers to initiate to the target children (i.e., move in front of the target child, request attention, and talk about ongoing activities) but also required that they gauge their interaction according to the behaviors displayed by the target children (i.e., request attention a second and third time if attention was not obtained; watch and listen to see if the target children took a turn before talking again). The anecdotal comments of the monitors and our sequential analyses indicated that it was easier to teach and to maintain those behaviors that were not dependent upon the behaviors of the target children. This observation suggested that in future studies, our peer-training procedures be refined to enhance the sensitivity of peers to more subtle changes in the behaviors of the target children.

This study illustrates the application of a descriptive data base to the development of peer-mediated interventions. It represents an initial step towards expanding the development of our empirical basis for selecting peer facilitative strategies. Results support the use of comments in conjunction with requests for attention and acknowledgments as strategies for increasing social communicative interaction between children with and without disabilities. This intervention offers an additional peer-intervention strategy package that may be used with or as an alternative to more common peer-intervention strategies (e.g., sharing toys and using play organizer statements). We hope that additional research efforts along these same lines will lead to other strategies that will increase interaction between children with disabilities and their normal peers.

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