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Social communication effects of peer-mediated recess intervention for children with autism

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ABSTRACT

Children with ASD face enormous challenges in the area of social functioning. Research has shown that impairments in social functioning distinguish this population from both typically developing children and children with disabilities. This study incorporated several evidence-based social skills-teaching procedures (i.e., direct instruction, priming, prompting, peer-mediation, contingent reinforcement, and token economies) directly in the recess setting to increase appropriate social behaviors for four children with ASD (ages 6–8). Elements of peer networks and pivotal response training (two types of social skills intervention packages in the literature) were included. Results showed significant increases in social communication between focus children and their peers, as well as generalization of skills to non-intervention recesses.

1. Introduction

Impairments in socialization are a core characteristic of Autism Spectrum Disorder (ASD) (American Psychiatric Association, 2000). The effects of social impairments distinguish children with ASD from both typically developing children and children with other disabilities (Ingram, Dickerson, Mayes, Troxell, & Calhoun, 2007) and places them at risk of remaining excluded from key social opportunities, such as those found in integrated settings. Researchers have found that patterns of social isolation tend to continue without intervention. Ingersoll, Schreibman, and Stahmer (2001) reported that children who isolated themselves early in preschool continued this pattern of social avoidance, communicating less frequently over time than their same-aged peers.

Failure to communicate with peers at school may lead to a multitude of challenges for children with ASD. Light (1988) stated that four social purposes are accomplished through peer-to-peer communicative interactions: "(1) the expression of needs and wants, (2) information transfer, (3) social closeness, and (4) social etiquette". In other words, without social skills, one is left with very little control over one's environment in a social context. Since the majority of our experience takes place in social environments, the lack of adequate social behaviors can have long-term and far-reaching effects. Fortunately, there is sufficient evidence to suggest that social behavior (for individuals with and without autism) is firmly anchored to the social and physical environment (Ostrosky, Kaiser, & Odom, 1993; Zanolli, 1997). Therefore, a strong rationale exists for the development of environmental stimuli that can directly and desirably shape and control social behaviors.

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2. Peer-mediated social skills interventions

Peer-mediated interventions (PMIs) involve training peers to implement elements of behavioral interventions. PMI's have been used with a variety of skills from pre-academic (Egel, Richman, & Koegel, 1981) to community skills (Blew, Schwartz, & Luce, 1985) and social communication and play behaviors of young children with ASD and their neuro-typical peers (Goldstein, Kaczmarek, Pennington, & Shafer, 1992; Odom, Chandler, Ostrosky, McConnell, & Reaney, 1992; Thiemann & Goldstein, 2004; Zanolli, 1997). Peer-mediated social skills interventions involve training peers to model, initiate, prompt, and/or reinforce social behaviors and interactions with target children (Kamps et al., 2002; Odom & Strain, 1986; Pierce & Schreibman, 1995; Strain & Kohler, 1999; Thiemann & Goldstein, 2004). Adults' involvement is generally peripheral, and involves prompting through peers rather than directly interacting with the focus child unless it is determined to be necessary. PMIs have been shown not only to produce desirable and reliable changes in the social behavior of children with ASD, but when implemented properly, can result in positive collateral effects such as prolonged maintenance of skills, larger effect sizes than adult-mediated intervention, and generalization across peers, settings, and activities (Kohler, Strain, Hoyson, & Jamieson, 1997; Strain & Kohler, 1999). PMI is considered an evidence-based practice by the National Professional Development Center on Autism Spectrum Disorders (http://autismpdc.fpg.unc.edu/) and the National Standards Project (http://www.nationalautismcenter.org). Despite their status as an evidence-based practice, PMIs are not yet commonplace in school settings.

2.1. Peer network interventions

Researchers have also reported success when combining PMI with other evidence-based practices into multi-component intervention packages. Peer network is one type of packaged intervention. Social skills interventions using Peer Networks were first reported in the school-based literature in the early 1990s (Haring & Breen, 1992). A peer network includes a focus child with ASD and a small group of teacher-nominated typically developing peers in which adult instruction is combined with peer mediation and is provided in integrated settings. These interventions have been shown to result in positive outcomes across a variety of social behaviors such as increased frequency of communication behaviors, task engagement, and duration of interactions (Kamps et al., 1992; Morrison, Kamps, Garcia, & Parker, 2001; Parker & Kamps, 2011); responsiveness between children with ASD and their peers (Kamps, Potucek, Lopez, Kravits, & Kemmerer,1997); use of augmentative communication devices with peers (Garrison-Harrell, Kamps, & Kravits, 1997); and increases in sustained interactions (Gonzalez-Lopez & Kamps, 1997) and reciprocal interactions (Morrison et al., 2001).

2.1.1. Recess interventions

Several studies have demonstrated the benefits of recess setting intervention for children with ASD to include increased cooperation, communication, and play skills (Harper, Symon, & Frea, 2008; Lang et al., 2011). Baker and colleagues, for example, used perseverative interests of children to increase social interactions and affect at recess time (Baker, Koegel, & Koegel, 1998). Koegel, Kuriakose, Singh, and Koegel (2012) used pivotal response treatment strategies (child choice and task variation) during social play groups for participants with ASD, followed by facilitated social play with initiations training (i.e., choosing a peer or peers to play). Initiations training showed increased generalization of social engagement during recess time.

Kasari, Rotheram-Fuller, Locke, and Gulsrud (2012) conducted a large-scale randomized controlled trial conducted across 30 Los Angeles-area general education classrooms with children ages 6–11 in which they compared peer- versus teacher-mediated social skills interventions on cooperative game playing skills of children with ASD at recess. Experimental groups consisted of: (a) direct instruction (DI) only, (b) PMI only, and (c) a combination of the two. Results demonstrated that the groups that received the PMI (or combined treatment) displayed rapid and significant improvements in social network salience (number of peer nominations for belonging to a peer network), number of friendship nominations, teacher reports on rates of social skill use in the classroom, and decreased isolation during observations than children who received DI only. Given the growing focus on standards-based instruction in schools, children have increasingly limited social opportunities at school (Chiang, 2009; Harper et al., 2008; Lang et al., 2011). These studies suggest the recess setting as a highly social, largely unstructured part of children's school day, with multiple opportunities to learn and use appropriate social communication skills, thus a prime context for implementing PMI.

2.1.2. Purpose

The purpose of this study was to evaluate the effects of a peer network recess intervention package (PNRI) on the reciprocal social communication behavior of young children with autism and their typically developing peers in a recess setting. The study tested effects of a structured intervention package that included (1) class-wide social skills lessons and priming prior to recess time, (2) peer prompting and praise and adult feedback during recess time, and (3) use of a token economy. The primary research question addressed was: What are the effects of a peer-mediated intervention on the social communication behavior of children with ASD and their typically developing peers during recess? Secondary research questions included the following: What are the effects of the PNRI on participants' initiations and responses to peers? What are the effects of the PNRI on peers' initiations and responses to participants? What are the levels of adults and peer prompts during the intervention condition?

2.2. Methods

2.2.1. Participants

Four Caucasian males with autism, ages 5–8 years old, were chosen to participate in this study based on reports and observations of social behavior deficits in the recess setting. Participants had been diagnosed with an autism spectrum disorder by the age of 5 by clinicians independent of the researchers, and were currently or previously enrolled in a Peer Networks Project. Diagnoses were confirmed by school personnel and were supported by assessments administered by the researchers in the Peer Networks Project. Two of the participants (Andy and Connor) were considered in the severe range on the Childhood Autism Rating Scale (Schopler, Reichler, & Rochen Renner, 1988) with scores of 38 and 39 with Sheldon and Donny in the mild-to-moderate range (34 and 30 respectively). Further confirmation was obtained through parent report on the Social Responsiveness Scale (Constantino, 2005), with Andy and Donny receiving standard scores of 82 and 85 (severe) and Sheldon and Donny receiving a 71 (mild-moderate), respectively.

The Peer Networks Project is a group-design study examining the effects of reading and social skills groups in schools on the social and group-responding behavior of children with autism (Kamps et al., 2012). Andy and Connor, the kindergarten participants of this study, were current experimental group participants and attended three to five 30 min social groups per week in which they and a small group of classmates were taught social skills through DI, feedback, and reinforcement of skill use. The Peer Networks targeted specific social skills: "Ask and Share", "Commenting", "Turn Taking", and "Play Organizing". Sheldon and Donny, the 2nd grade participants, had participated and aged out of the assessment-only group, and were currently involved in a social skills group designed by their Special Education teacher at school. Because the intervention took place in a school setting, variables related to non-school related interventions were not tracked (e.g. medications, other interventions, etc.), relying on the use of the multiple baseline design to demonstrate the effects of the intervention.

Participant 1, Andy, was integrated into a regular education kindergarten classroom in a public school with the aid of two rotating paraprofessionals for 90% of the school day. Andy's receptive and expressive language was delayed (2–3 word phrases) and was very difficult to understand due to a physical abnormality of the tongue. Initiations were made primarily to adults and generally consisted of requests for access to preferred items or comments on perseverative topics.

Participant 2, Sheldon, spent most of his day in a second grade classroom with occasional classroom paraprofessional support. Sheldon had an extensive expressive and receptive language repertoire however his communication generally centered on perseverative interests such as specific video games and television shows. Sheldon frequently sought the attention of adults to tell them that his peers were ignoring him or did not want to talk about his preferred subjects.

Participant 3, Donny, spent most of his day in the same second grade classroom as Sheldon. Donny's receptive and expressive language was slightly delayed. While Donny demonstrated interest in his peers (approaching peers, initiating with peers), his use of language directed toward his peers was often labeled as "negative" in nature, such as arguing ("the sky is not blue, it is grey"), or accusatory ("I was supposed to be first – you always take my spot in line!"). In addition, Donny would often become elevated (loud voice) when his peers did not engage with his preferred play activity.

Participant 4, Connor, spent the first half of his day in a typical kindergarten classroom with no paraprofessional support, and the last half in a special education preschool classroom. Connor's expressive and receptive language was slightly delayed. During baseline observations, Connor was generally quiet, but would occasionally label his own actions ("I went down the pole") or respond to peers' initiations in the negative ("No thanks"). See Table 1 for additional participant characteristics.

2.3. Implementers

School personnel were recruited to implement the PNRI. During brief recruitment meetings, the intervention was outlined and a brief written description was distributed. Implementers were selected based on availability as well as familiarity with the participants and their peers. All were female. In one case (for Andy), the implementer was the participant's paraprofessional and social group implementer. It was her third year working with children with autism in the school setting, and her first year working with Andy. In Connor's case, the implementer was his speech therapist and Peer Networks Project social group implementer. It was her first year working in schools, and her first year working with Connor. Donny and Sheldon, because they were in the same class with the same recess time and classmates, had the same

Table 1
Participants' assessment scores.

Participant	Age	PPVT[a] total standard score	SRS[b] total T-score	CARS[c]
Andy	6 years, 4 months	85-average	82-severe	38-severe
Sheldon	8 years, 4 months	89-average	71-moderate	34-mild to moderate
Donny	7 years, 10 months	92-average	85-severe	30-mild to moderate
Connor	6 years, 10 months	75-moderately low	71-moderate	39-severe

Note. Data reflect most recent available scores.
[a] Peabody Picture Vocabulary Test IV: 70–84 moderately low; 85–114 average.
[b] Social Responsiveness Scale-Parent Scale: 59 or less normal, 60–75 moderate, >75 severe.
[c] Childhood Autism Rating Scale: 15–30 normal, 30–37 mild to moderate, 37+ severe.

implementer. She was the classroom paraprofessional, had three years of experience working in schools, and had worked with Donny and Sheldon since the beginning of the school year. In rare cases in which the implementer was unavailable, intervention sessions were run by research assistants.

Staff meetings also included information related to the goals and procedures of the intervention. Additionally, information was obtained regarding participants' interests and dislikes and a list of potential peers was developed. All questions and/or concerns regarding the intervention were addressed. Following the initial staff meetings, all students in each of the participant's classes were invited to participate, ensuring peers would be similar in age. Teachers reviewed those students who volunteered to participate during a follow-up staff meeting with researchers and nominated those they thought would serve as good peer models. Gender was not included as a factor in the selection. Four to five were selected based on information obtained during the staff meetings, and these peers would generally participate. Additional peers from this class and other classes would sometimes volunteer at recess and would be allowed to play with the group.

2.3.1. Settings

Observations and intervention took place at two elementary schools. One school was located in a small college town, and the second was located in a small rural town, both in the Midwest. The recess periods of each participant's class were selected as intervention settings. Playgrounds included standard equipment such as swings, jungle gyms, basketball courts, balance beams, slides, bridges, and blacktop/gravel fields.

2.4. Dependent measures and data collection

2.4.1. Social communication behaviors

The Peer Networks Recess intervention was conducted over a period of 7 months (October to May) resulting in 37 sessions for Andy, 23 sessions for Sheldon, 20 sessions for Donny and 17 sessions for Connor. The primary dependent variables for the study were total communications by the participants directed to their peers (initiations and responses) and total communications by the peers to the participants (initiations and responses). Descriptive modifiers of initiation/response types were also coded: comment, request, play organizer, turn-taking, niceties, helping or non-verbal behavior. These data were recorded by observers during recess sessions on PDAs using NOLDUS Observer XT (2009) software. Each coded behavior was time stamped by an internal timing application programmed into the software. Behaviors were coded as frequency counts and sequences of behaviors. For example, "Do you want to go to the swings?" followed by "Yes" would have been coded initiation/request and response/comment. It is important to note that a behavior was not to be coded until a three second pause followed its offset. In cases where a series of verbal statements occurred without a pause last part of the response was coded (for example, a behavior that began with a request and ended with a comment, such as "Do you want to go to the slide? It's my favorite," would have been coded as a comment only). The final behavior was selected for coding as it was deemed the most likely to elicit a response. Only child-to-child communicative acts that involved a participant were coded. Communicative acts were considered directed toward a peer (as an initiation or response) if the participant was looking at the peer, or at the object of the statement (e.g. at the slide when responding to a peer request to slide). Communication acts between peers or from child to adult were not coded. See Table 2 for definitions.

2.4.2. Teacher satisfaction survey

A 12-item teacher rating scale was used as a qualitative measure to determine the social validity of the intervention as well as a means to identify those intervention components that could potentially impact maintenance past the end of the study. Respondents rated their responses to the 12 items on a scale of 1–5; 1 being "strongly disagree", 2 being "disagree", 3 being "Somewhat", 4 being "Agree", and 5 being "Strongly Agree". Each item also included an "N/A" option. At the end of the survey, teachers and implementers had the opportunity to provide additional comments regarding the intervention and their participation.

2.4.3. Data collection

During recess sessions research assistants collected NOLDUS data on the behavior of the participant and peers. Observations were 10 min total, and collected two to four times per week depending upon scheduled recess sessions and availability of research assistants. Observation data were then uploaded into a NOLDUS database. Sessions were printed to show the raw, time-stamped NOLDUS data reflecting communicative behaviors. Research assistants divided this raw data into 30 s intervals and, for each interval, recorded whether an FI (Focus Child – the participant – initiation), FR (Focus Child Response), PI (Peer Initiation), or PR (Peer Response) occurred at any time during each interval. The percentage of intervals including initiations, responses and total communicative acts were then calculated using the following formula: number of 30 s intervals with a communicative behavior divided by the total number of intervals for the session. Most sessions contained 20 intervals (10 min).

Communication (e.g. comments, requests, etc.) modifiers were coded for 25% of sessions in each condition (baseline and intervention). To standardize the sample selection process, sample sessions were chosen by dividing the total number of sessions in a condition by three (for baseline) or five (for intervention). The result of that calculation was the number of sessions between sample sessions. For example, Donny had six baseline sessions, so every second baseline session was coded

Table 2
Operational definitions of NOLDUS social behaviors.

Dependent measure	Definition
Child designation	
F (focus child)	A communicative act emitted by the participant
P (peer)	A communicative act emitted by a peer
Response type	
I (initiation)	A communicative act that begins a new topic of conversation or is not contextually related to ongoing communication between or action(s) of group members.
R (response)	A communicative act that refers to or is on topic with recent (within 10 sec) initiations or responses of other group members.
Social behavior definitions	
COM (Comment)	A communicative act that refers to ongoing events, items, or actions, but is not a compliment. Examples: "There's the slide," "This is fun," "You slid down the pole".
RQ (Request)	A communicative act whose function is to elicit information, action, or reciprocal communication from group member(s) (i.e., greetings). Examples: "Hi, Charlie", "Follow me", "Pass the baton", "Where's Andy?".
PLO (Play organizer)	A communicative act that functions to set up a game or activity or labels a general rule of the activity. Examples: "The jungle gym is base", "The first one to the slide gets to be Captain", "We're going to play Power Rangers", "You guys are on the red team", "We're pirates".
TT (Turn taking)	A communicative act that contains the word "turn" or refers to turns by number or ordinal. Examples: "It's your/my turn", "Whose turn is it?", "I'll go next", "You're first", "Andy is third".
NIC (Nicety)	A comment that is complimentary. Niceties also include terms synonymous with "good manners" such as "Thank you" and "You're welcome". Examples: "Good idea", "Thanks", "Nice jump", "Well done".
HLP (Help)	A communicative act that elicits help from a communication partner or offers help. Examples: "Help me", "Need a hand?", "Can we help?".
NonV (Non-verbal)	A non-verbal communicative act. Examples: waving, looking at a peer when requested to do so, shoulder-tapping, winking, gesturing toward an object or person.

for participant modifiers (six divided by three equals two). Sample sessions were coded for percent of interval including each modifier (comment, request, nonverbal, turn taking, nicety, and play organizer).

Probe data were collected in non-training settings during the intervention phase for three of the four participants to determine generalization and maintenance. These probes were collected when intervention sessions were scheduled but did not occur. Given the dependability of the implementers, the number of non-intervention probes for participants was low (one, two, two, and zero respectively). Connor's implementer was always available whenever observation was possible, and because of time constraints no non-intervention probes were collected with his group.

2.4.4. Observer training

Prior to baseline data collection, all observers were trained to a minimum of 80% inter-observer agreement across three sessions, practicing with videos of Peer Networks Project social group treatment sessions and baseline videos of children playing during free time. All observations were conducted in real time to minimize the intrusiveness of the intervention (no video-cameras during recess for consented peers). Thus, observers (coders) were not naive to the intervention. Reliability checks were completed for 28% of observations to maintain the integrity of the data.

2.4.5. Inter-observer agreement

Inter-observer agreement was calculated using reliability data collected independently and simultaneously by a second observer at recess, using interval-by-interval IOA calculation (Cooper, Heron, & Heward, 2007). Reliability data sessions were printed and analyzed using the same procedures outlined above. This was then compared to the primary session for interval by interval agreement. An agreement was coded if both the primary and reliability observers agreed for a particular interval on the occurrence or non-occurrence of a communicative behavior. A disagreement was coded if the primary and reliability data within the given interval did not match. The total number of agreements were then divided by the total number of intervals in the session and multiplied by 100. The mean agreements for total communications for focus participants across all baseline sessions (31% of sessions) were 94% with a range of 80–100%. Mean agreements across all focus participants' intervention sessions (28% of sessions) was 83%, with a range of 65–100%. Mean agreements for initiations in baseline averaged 93% (range 85–100%); in intervention, 81% (range 35–95%); and for responses 95% (range 75–100%) in baseline and 76% (range 57–95%) in intervention. Mean agreements for peers' social initiations and total communications averaged 94% (range 70–100%) in baseline and 89% (range 71–100%) in intervention. Mean agreements for peer initiations were 94% and 78% in baseline and intervention; and for responses, 94% and 77%, respectively. Inter-observer agreement for communicative modifiers was for a total of 38% of sampled sessions. Baseline and intervention agreements for comments were 88% and 99%, and 100% all other modifiers across conditions.

2.4.6. Fidelity measures

Fidelity measures, consisting of a 15-item checklist, were taken during 14 observations (25% of sessions) using a recess fidelity checklist. Items were scored as yes or no and related to PNRI procedures (i.e. priming of four key social skills,

observing during play sessions, prompting peers to initiate to the participants, use of the 1 min checks time sample procedure to monitor performance, giving feedback and charting points). Fidelity data were calculated by dividing the count of "yes" scores in a given session by the total number of items on the fidelity checklist. The mean fidelity score during intervention sessions was 89% and a range of 73–100%.

2.5. Experimental design

A multiple baseline across participants design was used to assess change in the social behavior of participants across conditions (Baer, Wolf, & Risley, 1968; Kennedy, 2005). The design was selected for its internal validity and ability to demonstrate experimental control. Specifically, the effectiveness of the intervention is demonstrated by contrasting low and stable baseline rates to subsequent increases following the introduction of the PNRI. Once the intervention had begun for a participant, treatment was not introduced for the next participant until data on the social behaviors of the current participant showed an increase over baseline rates for at least five sessions. Distinct changes in level, variability, and trend across participants were visually inspected to ensure that positive changes in behaviors (total communication acts) occurred following the introduction of the intervention.

2.5.1. Baseline procedures

During baseline, children played freely for 15 or 20 min according to school and classroom rules. The number of baseline sessions for the four participants were 13, 7, 6, and 13, respectively. During baseline recesses across schools, communication between adults and children was sparse and was generally limited to verbal reprimands for rule-breaking, redirection, or announcing the end of recess.

2.5.2. Implementer training

Before the introducing the PNRI, the class-wide social skills lesson was scheduled. In vivo implementer training on intervention procedures began during initial intervention recesses. During training sessions, the researcher modeled and coached the implementer on: gathering participants and peer volunteers, pre-recess priming, monitoring the group with the one-minute checklists, prompting through peers, providing whistle stop feedback, and awarding points during the post-recess huddle. Modeling and coaching continued for three or four sessions until the implementers reported that they felt comfortable implementing the procedure independently. Following training sessions, fidelity data informed subsequent coaching and training.

2.5.3. Intervention procedures

The PNRI was a treatment package consisting of several components: class wide lessons, pre-recess huddles, implementer and peer prompting and feedback, whistle stops, post-recess huddles, and class parties. These components included the following behavioral techniques: direct instruction of social skills, priming, peer prompting, token systems, group contingencies, and reinforcement.

2.5.4. Class-wide lesson

The class wide lesson consisted of a rationale for the recess groups, a description of recess social skills, a series of role-playing demonstrations, and an explanation of the contingencies of the intervention (class parties that were contingent upon a targeted number of points earned by the groups at recess). The specific social skills described during the lesson were defined as (a) *playing together and having fun*, (b) *complimenting and encouraging our friends*, (c) *talking about what we're doing and giving ideas*, and (d) *using names and getting attention* (see Table 3 for examples and non-examples). These skills were based on principles of Koegels' Pivotal Response Training (Pierce & Schreibman, 1995). Following the introduction of the social skills in the class-wide lesson, the participant and two peer volunteers were guided through two or three role-playing scenarios in front of the class. After the role-playing, the contingencies of the intervention were introduced to the class.

Table 3
Examples and non-examples of targeted recess skills.

Skill	Examples	Non-examples
Playing together and having fun	Reciprocal verbal and motor behavior centered around a group-selected activity such as Jungle Explorer, playing tag, or taking turns going down the fireman pole.	Argumentative communication or solitary play
Complimenting and encouraging our friends	"Good idea", "nice move", and "you did it"; "come on", "you can do it", or "let's catch up with the group"	"I don't want to play with you", and negative comments such as "you're not fast enough.
Talking about what you are doing and giving ideas	"Let's play Donny's game again" or "we're playing Jungle Explorer, so if you want to play a Pirate let's say that you wrecked your ship and got lost in the jungle"	"I want to play Pirates, not Jungle Explorer" or "We never get to play my game".
Using names and getting attention	Lightly tap your friend on the shoulder or call the name of a friend	Crowding, grabbing and pulling friends into a group activity, and ignoring unengaged group members

During each PNRI session, participants and peer volunteers would earn points for using the social skills. The points would be transferred to a visual token economy chart called the Party Chart, which would provide a visual display of progress toward a class party. Regardless of individual class members' levels of participation, all classmates present that day would participate in the party.

2.5.5. Pre-recess huddle

Following the class-wide lesson, the intervention was introduced on the playground. The first component introduced was the pre-recess huddle in which the implementer gathered a group of the peer-volunteers by asking who would like to participate in the group. Sometimes, the implementer would approach individuals and encourage them to volunteer, but generally a group of participating peers would approach the implementer. These volunteers included classmates of the participant as well as members of other classes. Once the group was gathered, the implementer primed peer volunteers and the participant by briefly reviewing the four social skills, providing examples and/or models, and reminding the group of the contingencies of the intervention. This priming generally lasted approximately 2 min, depending on the fluency of the group members with the intervention social skills. The group was then told to go play.

2.5.6. Recess play session and monitoring

Because of the naturally-occurring variety of activities and unpredictable changes in trends seen during typical recesses, it was decided that specific, structured activities would not be enforced during intervention. During both 5-min play sessions, the implementer would look up at the end of each 1 min interval to see that the participant's behavior met the definition of "engaged". If not, the implementer would use a peer-mediated prompting procedure of prompting the peers to initiate the child with autism until the participant was engaged. Once the participant was engaged, the implementer would allow the group to play without interference until the participant's engagement lapsed. Implementers were usually able to dedicate more attention than was required by the 1 min checks.

2.5.7. Whistle stops

Whistle stops occurred two times during each recess play session during intervention conditions: once at the end of the first 5-min play period, and again at the end of the second 5-min play period. Implementers carried the whistle stop checklist charts on their clipboard. During whistle stops, the implementer gathered the participating children together and reviewed each item on the checklist, asking if everybody was using the skills discussed during the lesson. If the answer was "yes", a check was received on the whistle stop checklist for the corresponding skill and descriptive feedback and praise was delivered. If the answer was "no", the implementer would remind the children how checks were earned and model or role-play the specific skill. Whistle stops generally lasted about two or three minutes each.

2.5.8. Post-recess huddles

Post-recess huddles occurred at the end of a recess session. During post-recess huddles, the implementer or a peer-volunteer transferred points from the whistle stop checklist to a Party Chart. A Party Chart was a visual token economy that showed a group's progress toward the class party. For each participating class, the first class party was contingent upon seven successful intervention recesses. Thereafter, the reinforcement schedule was thinned to eight successful intervention recesses for the second party and 19 successful intervention recesses for the third and fourth parties.

2.5.9. Class party

Over the course of the project, Andy's class earned four parties, Sheldon and Donny's class earned three, and Connor's class earned one. The number of parties was limited for Connor because the intervention was introduced close to the end of the year. Class parties were 10- to 15-min long and consisted of preferred activities, party favors and snacks, and descriptive praise for those who had participated.

2.6. Results

Results of the PNRI showed notable increases in social communication behavior across all four participants and their peers. Results are presented for total communication acts (initiations plus responses for the participants and their peers). Additional results for secondary research questions are then described.

2.7. Total social communications

Fig. 1 shows the percentage of 30-s intervals in which the social communication acts of participants and peers were observed during recess for each of the participants. Focus Child data are represented by filled-in circles, peer data by triangles, and non-intervention probe data are represented by open data points. Data for Andy and his peers are presented in the first tier. Data are primarily low and stable during baseline followed by a rapid increase following the introduction of the intervention. Andy's social communication baseline mean was 9% of intervals, with an increase to a mean of 77% during intervention. The second tier shows data for Sheldon and Donny and their peers. Data for both participants indicate low levels of social communication during baseline, with the exception of an outlying data point (session five) with Donny.

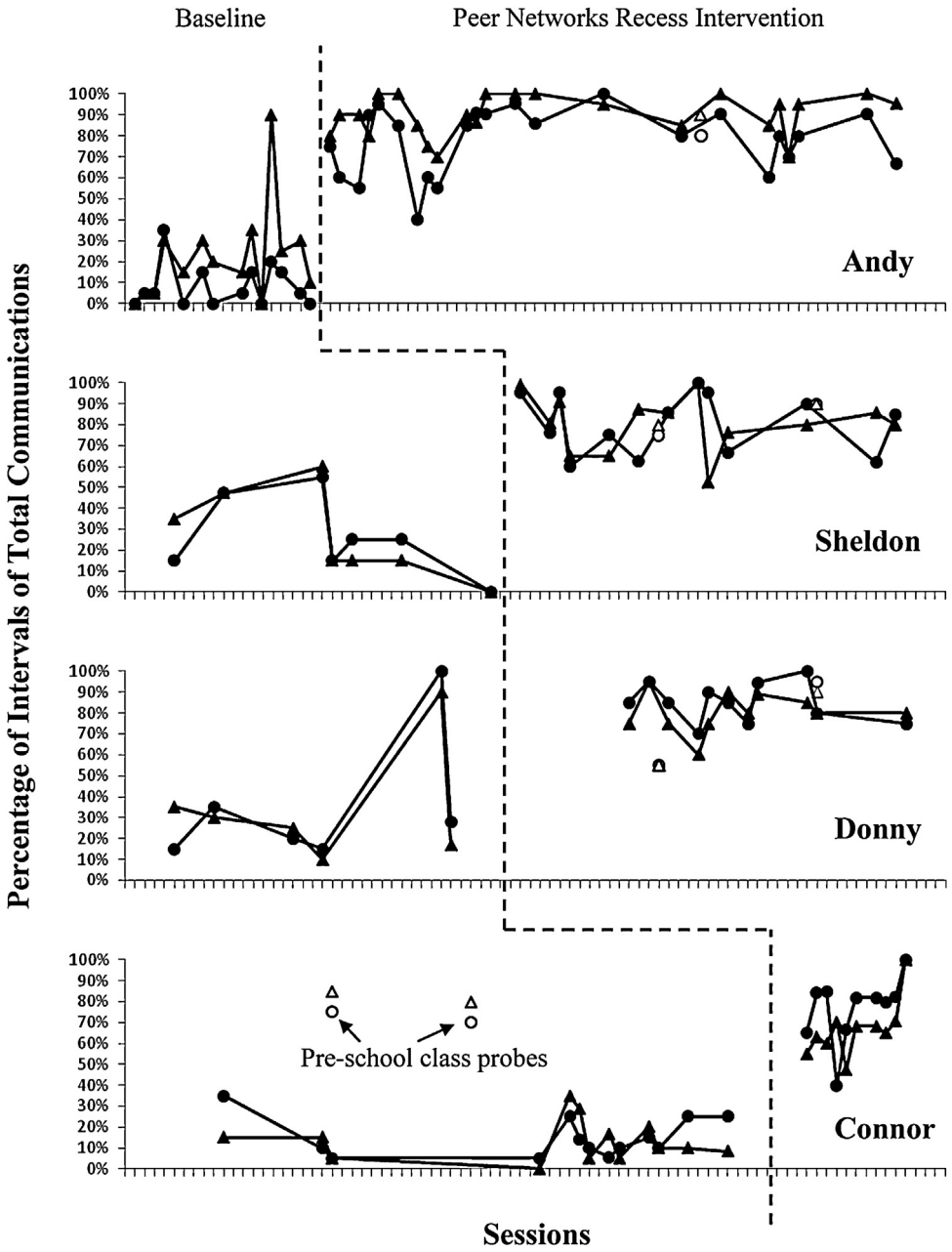

Fig. 1. Percentage of intervals including focus child and peer social communication behavior. Circles, focus child behavior. Triangles, peer behavior. Open markers, non-intervention probes.

Following introduction of the intervention, communication rapidly rose and mostly maintained at above-baseline levels: Sheldon's baseline 26% with an increase to 81%, and Donny, 35–85%, respectively. The bottom tier represents data from Connor and his peers with a baseline mean of 15%, increasing to 77%.

Fig. 1 also presents peer data. All peers showed large increases from baseline to intervention. Andy's peers' data showed a baseline mean of 27% and an increase to 80% during PNRI, with similar trends for Sheldon's peers (27–81%), Donny's peers (34–80%), and Connor's peers (13–67%).

2.8. Initiations

Fig. 2 shows individual session data for initiations of participants and peers across conditions. Andy's initiations were low during baseline (3% of intervals), with an increase during intervention to 34% of intervals. Similar trends were noted for

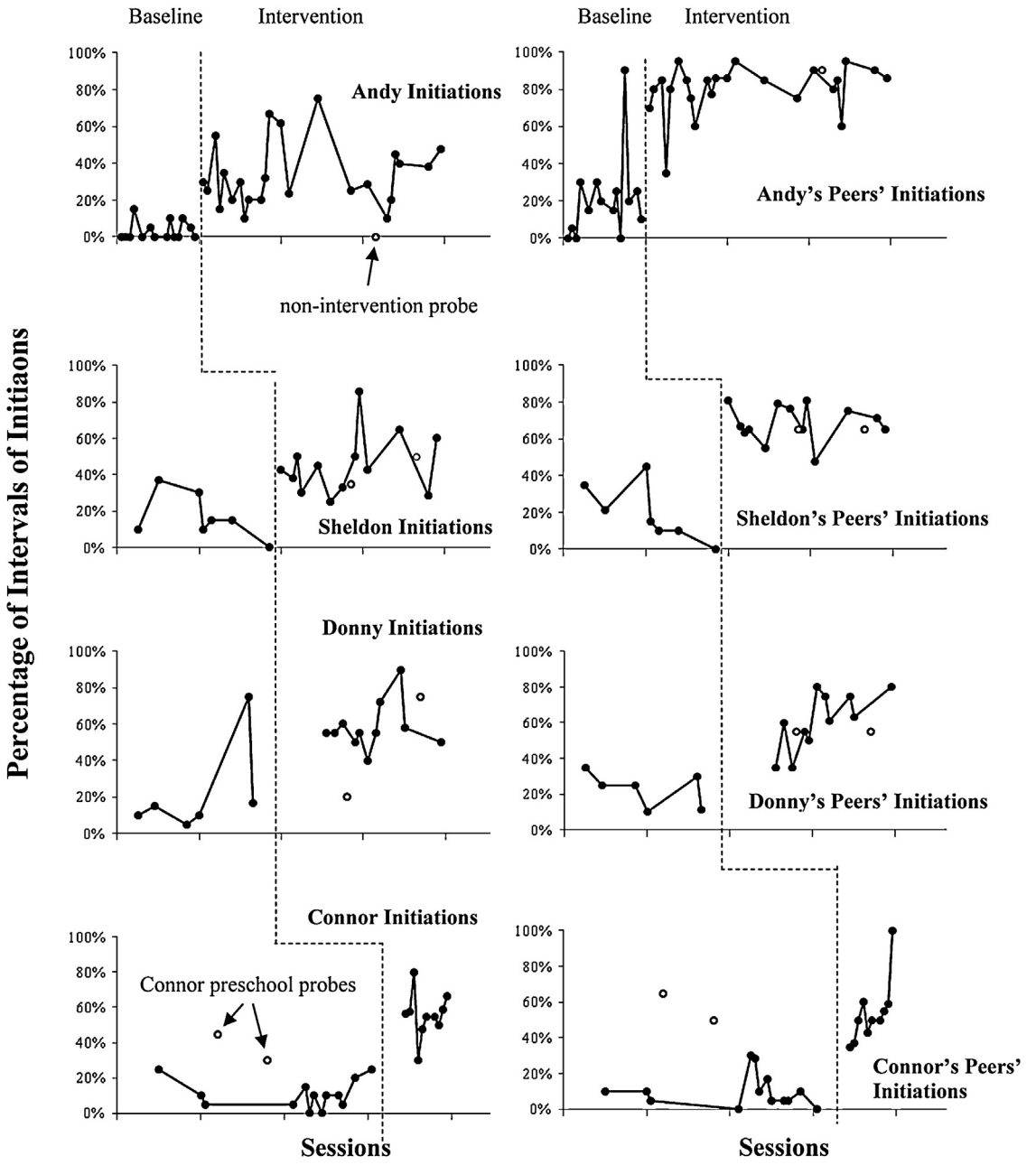

Fig. 2. Percentage of intervals including focus child and peer social initiations. Circles, focus child behavior. Triangles, peer behavior. Open markers, non-intervention probes for top 3 tiers and preschool probes for 4th tier.

Sheldon, baseline initiations 17% increasing to 69%; Donny, 23–61%; and Connor, 11–56% respectively across conditions. Peer initiations showed similar trends with averages 20% of intervals or less in baseline and increases to 60% or higher across participants during PNRI.

2.9. Responses

Table 4 shows the effects of the PNRI on levels of participants' and peers' responses to each other's communication behavior during recess. When inspecting these data, it is important to keep in mind that response rates are not necessarily tied directly to initiations, as a response may follow an initiation or another response (as in a multiple-turn conversation). During baseline, Andy responded to peers during only 5% of intervals on average, increasing to 63% of intervals during

Table 4
Effects of PNRI on responses.

	Baseline responses means (ranges)	Intervention responses mean (ranges)
Andy	5% (0–25%)	63% (20–90%)
Andy's peers	2% (0–10%)	42% (15–81%)
Sheldon	12% (0–30%)	62% (43–95%)
Sheldon's Peers	12% (0–40%)	45% (20–86%)
Donny	24% (5–75%)	57% (30–70%)
Donny's Peers	18% (0–80%)	48% (10–75%)
Connor	5% (0–15%)	47% (25–78%)
Connor's Peers	4% (0–20%)	35% (5–55%)

intervention. Response data for the other participants show similar changes in means and ranges across conditions. Peers' responses for all participants improved from baseline to intervention conditions as well.

2.10. Non-intervention probes

Data from non-intervention probes (indicated by open data points) are also presented in Figs. 1 and 2. Non-intervention probes during the intervention phases were conducted with Andy, Donny, and Sheldon. Fig. 1 shows increases from baseline levels in total social communications across participants and peers following the introduction of the intervention during non-intervention recesses. Note that data remained high for all participants during these probes with Andy and his peers maintaining at 90% and 80%, respectively, Sheldon his peers at 75% and 90% of intervals respectively, and Donny and his peers at 55% and 95%, respectively. Because Connor attended kindergarten in the morning and preschool in the afternoon every day, non-intervention probe data for him were collected during his preschool class. Peers observed during these probes had not participated in the PNRI. Connor's data during these probes were 75% and 70% respectively, and peer data were 85% and 80% respectively. No non-intervention sessions were observed with Connor's kindergarten class during the intervention phase.

The open data points in Fig. 2 indicate levels of initiations for participants. During this probe, Andy was not observed to initiate to his peers. Peer initiations to Andy, however, are significantly higher at 90% than the baseline mean of 20%. Non-intervention data show that Sheldon and Donny initiated at levels higher than most baseline sessions, and their peers initiated more than 50% of intervals, also exceeding baseline levels. The open data points in Connor's baseline phase indicate that, even without intervention, Connor and his preschool peers initiated to each other at much higher levels during baseline than did Connor and his kindergarten peers. Connor's initiations during these probes were observed during 45% and 30% of intervals respectively, and peer initiations were at 65% and 50% (see Fig. 2).

2.11. Prompt levels across conditions

The PNRI increased levels of adult-to-participant and peer-to-participant prompts during recess. During Andy's 14 baseline sessions, he was prompted twice by an adult on the playground with no more than one prompt observed during any single baseline recess. During intervention adult prompts to communicate with peers increased to 63 times during the total intervention period (mean 4.8; range of 0–10 per session) across a total of 13 sessions. Of the four participants, Andy was the only one to have been prompted by an adult during baseline. During intervention, Sheldon was prompted by an adult 20 times during the total intervention across 13 sessions, with a range of 0–7. Donny received adult prompting 34 times (total intervention) during his 11 intervention sessions, with a range of 0–6 per session. Connor was prompted 93 times (total intervention) across 10 intervention sessions, with a range of 1–19.

In addition to prompts from adults, participants were also prompted by their peers to use appropriate social communication behavior. Peer prompts may have been spontaneous, or prompted by the implementer or researcher. Andy received a single peer-prompt during his 14 baseline observations, and 98 (mean, 4.3) across the entire intervention. Connor received three during only one baseline observation (out of 13 baseline sessions), and 8 total across all intervention recesses. Neither Sheldon nor Donny (the second grade participants) received peer prompts during baseline during intervention, Sheldon received only 2 prompts from peers and Donny received none.

2.12. Specific social communication skills comments

Large increases in commenting were seen for all participants during intervention. Andy's mean commenting data showed the most significant increase, from 2% of intervals during baseline to 50% of intervals during intervention. Although the increase in Sheldon's commenting data is the least significant of the participants (47% in baseline; 61% during intervention), he commented more frequently in both conditions than any other participant. Sheldon's commenting mean percent of intervals increased from 20% to 54%. Donny's commenting increased from 47% to 61% and Connor's from 15% to 40%.

Percent of intervals for requests also increased during intervention. Andy's mean requesting data increased from 5% of intervals during baseline to 22% of during intervention. Sheldon's requesting data increased from 7% in baseline to 12% in intervention. Donny's requests increased from 5% to 21%, and Connor's from 7% to 23%. Though increases were again seen across conditions for all participants, it appears that much more time was spent commenting during intervention recesses than requesting.

2.13. Teacher satisfaction surveys

Two classroom teachers (Andy's Kindergarten teacher, and Sheldon and Donny's 2nd grade teacher) and all three implementers provided favorable ratings of the intervention. Average ratings for the implementers were 3.6, 4.2, and 4.2, respectively for the participants; and 3.9 (Andy) and 4.2 (Sheldon, Donny) for the teachers. The most frequent rating being 4 (53%), then 5 (28%), then 3 (18%). All responses fell within the range of 3–5, meaning that there were no disagreements with any of the survey items. Three items averaged 3.6 the lowest average rating per item) and reflected that the time of the recess groups was not always acceptable or easy to schedule, and that more peer time was needed than acceptable sometimes. Items that received the highest average rating of 4.4 were items reflecting that the research staff provided necessary assistance, that positive changes were noted in the network peers and other classmates, and that they would support peer network interventions in the future.

2.14. Discussion

Results of the current study demonstrated that the use of PNRI procedures (social skills teaching, priming, prompting and reinforcement) was very successful in increasing participants' social behaviors and peer interactions. These findings are consistent with prior research showing increased social behaviors with implementation of peer mediation in recess settings (Harper et al., 2008; Kasari, Locke, Gulsrud, & Rotheram-Fuller, 2011) and that interventions simultaneously targeting peer and participant behavior can produce significant and desirable behavior changes (Harper et al., 2008; Ingersoll, 2009; Kamps et al., 1997; Owen-Deschryver, Carr, Cale, & Blakeley-Smith, 2008; Pierce & Schreibman, 1997a). The PNRI was a low intensity, naturalistic intervention based on PRT skills that had been successful in other social skill interventions (Harper et al., 2008; Koegel, Koegel, Harrower, & Carter, 1999; Pierce & Schriebman, 1997b; Schriebman, Stahmer, & Pierce, 1996). The PNRI behaviors were easy for the children to remember with simple reminders at two 5-min recess intervals, and universal enough to work within a variety of activities, thus having the potential to contribute to a larger and generalized class of appropriate social communication skills. Increases in participant initiations demonstrated the participants' responsiveness to the contingencies of the PNRI as well and concur with prior research showing improved initiations with peer mediation (Oke & Shreibman, 1990; Reichow & Sabornie, 2009; Zanolli, Dagget, & Adams, 1996).

An additional finding is that PNRI was effective at increasing specific communications behaviors including commenting and requesting during recess. This concurs with prior studies showing improvements in appropriate peer-directed language (Parker & Kamps, 2011), turn-taking (Harper et al., 2008), and responses (Owen-Deschryver et al., 2008). While commenting was by far the most common form of communication across all participants, there was variability in the display of other skills. In Andy's case, data indicated that he spent more time during both conditions engaging in non-verbal communication behavior than other participants. Considering he had significant articulation impairments, high levels of nonverbal communication showed responsiveness to the intervention and adaptability on his part. In contrast, second grade recess activities were more imaginary and sophisticated in nature than kindergarten activities, and so play organizing was a pivotal skill for these participants. Sheldon, for example, was often observed complaining to teachers and staff that his classmates did not want to talk about his interests or play what he wanted to play. With the play organizing skills learned during intervention, Sheldon was able to inject those interests into the games of others' choosing with positive responses from his peers.

2.15. Generalization effects of PNRI

The PNRI was designed to promote generalization through the use of a more loosely-structured intervention (Stokes & Baer, 1977). Other elements facilitating generalization were included, such as intervening in natural settings and training multiple peers (Pierce & Schreibman, 1997b). Results of probes during non-intervention recess observations showed that, following a series of intervention sessions, peer and participant behaviors remained above baseline levels in the absence of the intervention.

2.16. Social validity

Results of staff surveys provided evidence for social validity of PNRI. Most survey items received a score of 4 (Agree). Participating schools have continued the project in one form or another following the end of the study. A version of the PNRI was implemented with Andy and other students with ASD in a special education summer day camp, and Connor's special education teacher (who was not involved during the study) has used elements of the PNRI in her Lunch Buddies and Recess Buddies programs with Connor. Survey items that received less favorable ratings (3) were items related to time requirements

for teachers and peers. This is consistent with other researchers' statements that time constraints in classroom schedules are an obstacle for those attempting to intervene on social behaviors (Harper et al., 2008; Lang et al., 2011). Another survey item that received a lower rating was the response requirements for the peers with some implementers indicating that some peers grew tired of the intervention over time. Peers should be viewed as an instructional asset on the playground or in any social context (Lang et al., 2011); findings suggest the inclusion of a greater variety of peers to diminish over-reliance on a small number of peers to direct all intervention.

2.17. Limitations

There are a number of limitations to this study, primarily the small number of participants which limits the ability to generalize findings to larger groups of children with ASD. Another limitation is the fact that two of the participants, Donny and Sheldon, were in the same classroom. Both participants met the inclusion criteria, and were accessible to PNRI staff. It was necessary however to begin intervention based on Sheldon's stable baseline trend, and not wait for more data/stability for Donny's baseline due to time constraints and the desire to introduce the intervention for Connor before the end of the school year. A further limitation of the study was the minimal number of generalization probes and the lack of non-intervention probes during Connor's intervention phase. Because Connor's intervention was begun so close to the end of the school year, it was decided to forego non-intervention generalization data in exchange for more primary intervention data.

The variability in the data is a limitation in this study and others using social interaction measures (Harper et al., 2008). This could have reflected the many types of activities occurring across sessions and could account for the few low reliability points that occurred during sessions with low occurrences of behaviors. Further these data only reflect only one aspect of appropriate engagement, social communication. Future studies may include other indicators of social engagement such as proximity to peers, variability by activity and preferences (e.g., Kern & Aldridge, 2006; Licciardello, Harchik, & Luiselli, 2008), and entry level behaviors of participants.

Two outlying baseline data points warrant further discussion. During Andy's 11th baseline session, peer initiations were observed during 90% of intervals, which far exceeds the peer initiation baseline mean of 22.7%. During this session, a single female peer spent most of her recess chasing Andy, calling his name, and tickling him. Data show that Andy responded to his peers during 20% of intervals, and these were primarily requests for the peer to "Stop." During the fifth session for Donny, communicative acts were observed in 100% of intervals. The peer data represented the behavior of a single peer. During this observation, Donny and Sheldon spent their recess at the edge of the playground, away from other peers, engaged in an argument over the video game Angry Birds.

Finally, the limitation imposed by the small number of participants and the variability in the data prevented further analyses using statistical methods. The multiple baseline single case design was the only method for establishing experimental control.

2.18. Conclusions and implications for future research

Findings from the study provide evidence for the use of peer mediated interventions during recess settings for children with ASD. Further research is needed to continue development of a technology of socially valid, feasible, and effective peer-mediated interventions that target the recess and other highly social settings (Harper et al., 2008; Lang et al., 2011). The PNRI was based on the teaching and positive reinforcement of appropriate social skills. Prior to intervention, adult–child interaction generally consisted of reprimands for inappropriate behavior. The PNRI was shown to be effective in increasing reciprocal communication between children with autism and their peers at recess. However, it was an intervention package comprised of several components working together (direct instruction, priming, prompting, peer-mediation, contingent reinforcement and a token economy). While each of these strategies has been demonstrated to impact behavior, the small number of participants in this study precluded the ability to conduct a component analysis. Future research, including a component analysis, might reveal that certain components of the intervention were unnecessary, or that different combinations result in different effects. Such a component analysis would be useful in streamlining future PMI recess interventions.

The present study provided strong evidence that a multiple component intervention including direct instruction, priming, prompting, peer-mediation, contingent reinforcement, and token economies can improve the social communication behaviors that take place between children with autism and their peers at recess. The use of such interventions during recess is paramount in consideration of the relative amount of opportunity for social interaction that recess provides and the sophistication of skills that it requires (Harper et al., 2008). Early intervention in settings with peers that result in improvements in social behaviors may impact those life trajectories from one of isolation and loneliness to one of participation and friendship. More research in the area, including longitudinal and group design studies, are needed to contribute to developing a technology of practical interventions that can be applied in school settings.

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References

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th ed. text rev.). Washington, DC: Author.
Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1*(1), 91–97.
Baker, M. J., Koegel, R. L., & Koegel, L. K. (1998). Increasing the social behavior of young children with autism using their obsessive behaviors. *Journal of the Association for Persons with Severe Handicaps, 23*(4), 300–308.
Blew, P. A., Schwartz, I. S., & Luce, S. C. (1985). Teaching functional community skills to autistic children using nonhandicapped peer tutors. *Journal of Applied Behavior Analysis, 18*(4), 337–342.
Chiang, H. (2009). Naturalistic observations of elicited expressive communication of children with autism: An analysis of teacher instructions. *Autism, 13*, 165–178.
Constantino, J. (2005). *Social Responsiveness Scale*. Los Angeles, CA: Western Psychological Services.
Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Pearson.
Egel, A. L., Richman, G. S., & Koegel, R. L. (1981). Normal peer models and autistic children's learning. *Journal of Applied Behavior Analysis, 14*, 3–12.
Garrison-Harrell, L., Kamps, D., & Kravits, T. (1997). The effects of peer networks on social-communicative behaviors for students with autism. *Focus on Autism and Other Developmental Disabilities, 12*(4), 241–254.
Goldstein, H., Kaczmarek, L., Pennington, R., & Shafer, K. (1992). Peer-mediated intervention: Attending to, commenting on, and acknowledging the behavior of preschoolers with autism. *Journal of Applied Behavior Analysis, 25*(2), 289–305.
Gonzalez-Lopez, A., & Kamps, D. M. (1997). Social skills training to increase social interactions between children with autism and their typical peers. *Focus on Autism and Other Developmental Disabilities, 12*(1), 2–14.
Haring, & Breen (1992). A peer-mediated social network intervention to enhance the social integration of persons with moderate and severe disabilities. *Journal of Applied Behavior Analysis, 25*(2), 319–333.
Harper, C. B., Symon, J. B. G., & Frea, W. D. (2008). Recess is time-in: Using peers to improve social skills of children with autism. *Journal of Autism and Developmental Disorders, 38*, 815–826.
Ingersoll, B. (2009). Teaching social communication: A comparison of naturalistic behavior and development, social pragmatic approaches for children with autism spectrum disorders. *Journal of Positive Behavior Interventions, 12*, 33–43.
Ingersoll, B., Schreibman, L., & Stahmer, A. (2001). Brief report: Differential treatment outcomes for children with autistic spectrum disorder based on level of peer social avoidance. *Journal of Autism and Developmental Disorders, 31*(3), 343–349.
Ingram, D. H., Dickerson Mayes, S., Troxell, L. B., & Calhoun, S. L. (2007). Assessing children with autism, mental retardation, and typical development using the Playground Observation Checklist. *Autism, 11*(4), 311–319.
Kamps, D. M., Leonard, S. V., Dugan, E. P., Delquadri, J. C., Gershon, B., Wade, L., et al. (1992). Teaching social skills to students with autism to increase peer interactions in an integrated first-grade classroom. *Journal of Applied Behavior Analysis, 25*, 281–288.
Kamps, D. M., Potucek, J., Lopez, A. G., Kravits, T., & Kemmerer, K. (1997). The use of peer networks across multiple settings to improve social interaction with students with autism. *Journal of Behavioral Education, 7*(3), 335–357.
Kamps, D., Royer, J., Dugan, E., Kravits, T., Gonzalez-Lopez, A., Carnazzo, K., et al. (2002). Peer Training to facilitate social interaction for elementary students with autism and their peers. *Exceptional Children, 68*(2), 173–187.
Kamps, D., Thiemann-Bourque, K., Heitzman-Powell, L., Schwartz, I., Cox, N., & Rosenberg, N. (2012). Peer networks project: Improving social-communication, literacy, and adaptive behaviors for young children with ASD. *Poster presented at the 38th annual convention of the association for behavior analysis*.
Kasari, C., Locke, J., Gulsrud, A., & Rotheram-Fuller, E. (2011). Social networks and friendships at school: Comparing children with and without ASD. *Journal of Autism and Developmental Disorders, 41*(5), 533–544.
Kasari, C., Rotheram-Fuller, E., Locke, J., & Gulsrud, A. (2012). Making the connection: randomized controlled trial of social skills at school for children with autism spectrum disorders. *Journal of Child Psychology and Psychiatry, 53*(4), 431–439.
Kennedy, C. (2005). *Single case designs for educational research*. Boston: Pearson/A&B.
Kern, P., & Aldridge, D. (2006). Using embedded music therapy interventions to support outdoor play of young children with autism in an inclusive community-based child care program. *Journal of Music Therapy, 43*, 270–294.
Koegel, L. K., Kuriakose, S., Singh, A. K., & Koegel, R. L. (2012). Improving generalization of peer socialization gains in inclusive school settings using initiations. *Behavior Modification, 36*(3), 361–377.
Koegel, L. K., Koegel, R. L., Harrower, J. K., & Carter, C. M. (1999). Pivotal response intervention I: Overview of approach. *Journal of the Association for Persons with Severe Handicaps, 24*(3), 174–185.
Kohler, F. W., Strain, P. S., Hoyson, M., & Jamieson, B. (1997). Merging naturalistic teaching and peer-based strategies to address the IEP objectives of preschoolers with autism: An examination of structural and child behavior outcomes. *Focus on Autism and Other Developmental Disabilities, 12*(4), 196–206.
Lang, R., Kuriakose, S., Lyons, G., Mulloy, A., Boutot, A., Britt, C., et al. (2011). Use of school recess time in the education and treatment of children with autism spectrum disorders: A systematic review. *Research in Autism Spectrum Disorders, 5*, 1296–1305.
Licciardello, C., Harchik, A., & Luiselli, J. (2008). Social skills intervention for children with Autism during interactive play at a public elementary school. *Education and Treatment of Children, 8*, 1–10.
Light, P. (1988). Context, conservation and conversation. In K. Richardson & S. Sheldon (Eds.), *Cognitive development to adolescence: A reader* (pp. 219–239). Hillsdale, NJ, England: Lawrence Erlbaum Associates, Inc.
Morrison, L., Kamps, D. K., Garcia, J., & Parker, D. (2001). Peer mediation and monitoring strategies to improve initiations and social skills for students with autism. *Journal of Positive Behavior Interventions, 3*(4), 237–250.
Odom, S. L., Chandler, L. K., Ostrosky, M., McConnell, S. R., & Reaney, S. (1992). Fading teacher prompts from peer-initiation interventions for young children with disabilities. *Journal of Applied Behavior Analysis, 25*, 307–317.
Odom, S. L., & Strain, P. S. (1986). A comparison of peer-initiation and teacher-antecedent interventions for promoting reciprocal social interaction of autistic preschoolers. *Journal of Applied Behavior Analysis, 19*, 59–71.
Oke, N., & Shreibman, L. (1990). Training social initiations to a high-functioning autistic child: Assessment of collateral behavior change and generalization in a case study. *Journal of Autism and Developmental Disorders, 20*(4), 479–497.
Ostrosky, M. M., Kaiser, A. P., & Odom, S. L. (1993). Facilitating children's social-communicative interactions through the use of peer-mediated interventions. In A. P. Kaiser, & D. B. Gray (Eds.), *Enhancing children's communication: Research foundations for innovation* (Vol. 2, pp. 159–186). Baltimore: Brookes.
Owen-Deschryver, J. S., Carr, E. G., Cale, S. I., & Blakeley-Smith, A. (2008). Promoting social interactions between students with autism spectrum disorders and their peers in inclusive school settings. *Focus on Autism and Other Developmental Disabilities, 23*(1), 15–28.
Parker, D., & Kamps, D. (2011). Effects of task analysis and self-monitoring for children with autism in multiple social settings. *Focus on Autism and Other Developmental Disabilities, 26*(3), 131–142.
Pierce, K., & Schreibman, L. (1995). Increasing complex social behaviors in children with autism: Effects of peer-implemented pivotal response training. *Journal of Applied Behavior Analysis, 28*(3), 285–295.
Pierce, K., & Schreibman, L. (1997a). Multiple peer use of pivotal response training social behaviors of classmates with autism: Results from trained and untrained peers. *Journal of Applied Behavior Analysis, 30*(1), 157–160.

Pierce, K., & Schreibman, L. (1997b). Using peer trainers to promote social behavior in autism: Are they effective at enhancing multiple social modalities? *Focus of Autism and Developmental Disabilities, 12*(4), 207–218.
Reichow, B., & Sabornie, E. J. (2009). Brief report: Increasing verbal greeting initiations for a student with autism via a social story intervention. *Journal of Autism and Developmental Disorders, 39*(12), 1740–1743.
Schopler, E., Reichler, R., & Rochen Renner, B. (1988). *Childhood Autism Rating Scale*. Los Angeles, CA: Western Psychological Services.
Schriebman, L., Stahmer, A., & Pierce, K. (1996). Alternative applications of pivotal response training: Teaching symbolic play and social interaction skills. In L. Koegel, R. Koegel, & G. Dunlap (Eds.), *Positive behavioral support: Including people with difficult behavior in the community* (pp. 353–371). Baltimore: Paul H. Brookes.
Stokes, & Baer (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis, 10*(2), 349–367.
Strain, P. S., & Kohler, F. (1999). Peer-mediated interventions for young children with autism: A 20-year retrospective. In P. M. Ghezzi, W. L. Williams, & J. E. Carr (Eds.), *Autism: Behavior analytic perspectives* (pp. 189–211). Reno, NV: Context Press.
Thiemann, K. S., & Goldstein, H. (2004). Effects of peer training and written text cueing on social communication of school-age children with pervasive developmental disorder. *Journal of Speech, Language, and Hearing Research, 47*, 126–144.
Zanolli, K. (1997). The environmental antecedents of spontaneous social behavior. In *Environment and behavior* (pp. 219–228). Boulder, CO: Westview Press.
Zanolli, K., Dagget, J., & Adams, T. (1996). Teaching preschool age autistic children to make spontaneous initiations to peers using priming. *Journal of Autism and Developmental Disorders, 26*(4), 407–422.