

*AN INTEREST-BASED INTERVENTION PACKAGE TO INCREASE PEER  
SOCIAL INTERACTION IN YOUNG CHILDREN WITH AUTISM  
SPECTRUM DISORDER*

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The literature suggests that children with autism spectrum disorder (ASD) educated in inclusive settings generally do not interact with typically developing classmates during social activities. This study assessed whether an intervention package consisting of interest-based structured play activities involving adult instruction, modeling, and response to child questions would result in an increase in social interaction with typically developing peers. A multiple baseline design across four participants with an embedded reversal was used to demonstrate the effects of the intervention on social interaction during structured play sessions. Initiations, responses, and interactive play increased for all participants. Generalization to novel peers was observed, and treatment gains were maintained during 6-week follow-up sessions. Recommendations for practitioners working with children with ASD in inclusive settings and potential areas of future research are discussed.

*Key words:* autism spectrum disorder, social interaction, inclusive education, preschool

Social communication deficits and difficulties with social interaction are central to the diagnostic definition of autism spectrum disorder (ASD; American Psychiatric Association, 2013). Individuals with ASD exhibit social deficits that can include difficulties initiating interaction, responding to initiations made by others, and maintaining social engagement (Koegel, Koegel, Fredeen, & Gengoux 2008; Volkmar, Carter, Grossman, & Klin, 1997). These deficits can lead to challenging behavior, academic difficulties, and withdrawal and isolation from the peer group (Camargo, Rispoli, Ganz, Hong, Davis, & Mason, 2014; Lang, Regester, Rispoli, & Camargo, 2010).

Compared to the other core deficits associated with ASD, social deficits may improve less as the child ages (Anderson, Liang, & Lord, 2014; Bauminger, 2002), and improvements in social skills are often identified as top treatment concerns for children with ASD (e.g., Lang, Machalicek, Rispoli, & Regester, 2009; Pituch et al., 2011).

Because including students with ASD in settings with typically developing peers has become a recommended educational practice, children with ASD are spending more of their day in inclusive environments (Camargo et al., 2014; Watkins et al., 2015). Despite opportunities to engage with typically developing peers in inclusive settings, researchers have found limited interaction and social acceptance between children with ASD and their typically developing classmates (McConnell, 2002; Odom et al., 2006; Pierce & Schreibman, 1997). Given the difficulties children with ASD have with social interaction, teachers in inclusive classroom settings must employ interventions to increase peer interaction between these groups.

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Behavioral strategies such as modeling, prompting, and contingent reinforcement result in increases in play and social interaction for young children with ASD (Camargo et al., 2014; Lang, O'Reilly, et al., 2009). Such strategies are often components of evidence-based intervention packages, including peer-mediated interventions (e.g., Ganz & Flores, 2008; Katz & Girolametto, 2013), video modeling (e.g., Bugghey, Hoopes, Sherberger, & Williams, 2011; Maione & Miranda, 2006), and social-skills training (e.g., Leaf et al., 2009). Preferred interests of the child with ASD are often also incorporated into these interventions to enhance performance by providing a reinforcing context for play and interaction (e.g., Baker, Koegel, & Koegel, 1998; Jung & Sainato, 2015; Jung, Sainato, & Davis, 2008; Katz & Girolametto, 2013; Koegel, Fredeen et al., 2012; Koegel, Kim, Koegel, & Schwartzman, 2013; Koegel, Vernon, Koegel, Koegel, & Paullin, 2012b).

However, established multicomponent interventions may be difficult to implement in inclusive settings due to limited resources and insufficient teacher training (Pazey, Gevarter, Hamrick, & Rojeski, 2014; Segall & Campbell, 2012). Many multicomponent interventions require extensive staff training and follow-up support sessions (e.g., Katz & Girolametto, 2013), the creation of novel or specialized materials (e.g., Baker et al., 1998), or the use of multiple intervention strategies such as script training, visual supports, peer-mediated instruction, and adult prompting (e.g., Ganz & Flores, 2008). Practitioners in inclusive classrooms may find such packages inefficient. Therefore, multicomponent interventions that can be reasonably implemented by practitioners in inclusive settings are needed, and studies conducted within the natural classroom context that rigorously assess both the effectiveness and social validity of the intervention are warranted (Jung & Sainato, 2015).

Therefore, the purpose of the current study was to investigate whether an intervention package consisting of interest-based structured play activities and brief sessions of adult instruction, modeling, and response to child questions would result in an increase in peer social interaction without the need for more intensive intervention strategies. Specifically, we sought to assess whether (a) the intervention package would increase peer interaction for a variety of participant profiles, ranging from mild to severe ASD diagnoses, (b) the intervention results would generalize to novel peers and maintain following the intervention, and (c) the results of the intervention would be socially valid in an inclusive classroom.

## METHOD

### *Participants*

Four children with a diagnosis of ASD (hereafter referred to as participants) and four typically developing children (hereafter referred to as peers) participated in the study. English was the primary home and school language of all participants and peers. Participants were diagnosed with ASD by an independent qualified expert (e.g., developmental pediatrician or neurologist) prior to this study. All participants received special-education services and had social-communication-related individual educational program goals, but they had not received an intervention specifically targeting social interaction with their peers. Teacher report and researcher observation indicated that participants interacted infrequently with peers during free-play activities.

Typically developing peers were chosen based on age-appropriate verbal and social skills and a history of complying with teacher directions and offering to help classmates, and they were paired with participants based upon teacher and support staff recommendation (Harper, Symon, & Frea, 2008; Odom & Strain, 1984). At the time of the study, no

typically developing male students were enrolled in the classroom, so same gender pairings were not possible for all participants. Typical peer partners were four girls ranging in age from 46 to 62 months and were matched to participants close in age.

Arjun was a South Asian American male and was 65 months at the start of the study. He scored a 30.5 on the Childhood Autism Rating Scale, second edition (CARS-2; Schopler, Van Bourgondien, Wellman, & Love, 2010) indicating mild-to-moderate symptoms of ASD. Arjun had well developed verbal skills, spoke in complete sentences of four to six words, and demonstrated functional play skills. He initiated interaction frequently with adults, but his interactions with peers consisted primarily of responses to their initiations. Arjun occasionally engaged in stereotyped motor behaviors including hand flapping and bouncing up and down while seated.

Emmett was a White American male and was 54 months at the start of the study. He scored a 32.5 on the CARS-2, indicating mild-to-moderate symptoms of ASD. Emmett had limited verbal communication skills and could make requests to adults using two- to three-word phrases (e.g., "chase me!"). He sought out adult attention regularly but interacted infrequently with peers. Emmett's play tended to be solitary, and his language during play was often imitative and echoic (e.g., reciting scripted phrases from his favorite movies).

Austin was a White American male and was 57 months at the start of the study. He scored a 45 on the CARS-2, indicating severe symptoms of ASD. Austin had limited verbal communication skills and rarely exhibited meaningful speech. In response to a teacher asking what he wanted, Austin could verbally approximate a one-word response (e.g., "car" or "block"). He demonstrated restricted patterns of behavior involving objects (i.e., repetitively organizing, lining up, rotating and sorting small items) and body movement (i.e., rotating his

hand in front of his face, kicking legs and waving arms). He primarily used toys to engage in stereotypy.

Julia was a Chinese Mexican American female and was 74 months at the start of the study. She scored a 50 on the CARS-2, indicating severe symptoms of ASD. She did not demonstrate functional verbal speech. Julia rarely initiated to adults or peers, and she responded to initiations from adults after prompting. For example, when prompted by her teacher, she could use picture symbols to make requests (e.g., watch a video). During playtime, Julia engaged in solitary or restrictive and repetitive behaviors. She often engaged with toys and objects by exploring their sensory features.

Members of the research team (first and third authors) served as facilitators during play sessions. They did not serve other roles at the school. Appropriate institutional board approval and informed consent was obtained for the study.

### *Setting and Materials*

Sessions were conducted in a private community school for students with disabilities that offered an inclusive early childhood preschool setting. The inclusive preschool classroom served both typically developing students and students with disabilities. The class had five students with developmental disabilities, six typically developing peers, one lead teacher, and two assistant teachers. The room was approximately 17.5' x 20'. The front half of the room contained a round table and a rectangular table for group and seatwork, as well as a sensory table filled with sand. The back half of the room consisted of a play area delineated by a rug surrounded with shelves of toys and a reading area delineated by another rug surrounded by cushions and pillows. All baseline and intervention sessions with each participant and peer dyad took place within the play area of the classroom. The teacher, assistants, and

other students were in close proximity with the participant and peer dyad during all sessions but were engaged in other activities within the classroom (e.g., one-to-one teaching, small-group work, free play). Students rotated between these different activities, including playtime, during the course of the morning.

### *Dependent Variables*

Dependent variables included frequency of participant initiations directed to a peer and frequency of participant responses immediately following the peer's initiation. Initiations were operationally defined as any verbal, nonverbal, or motor behaviors directed toward a typically developing peer such as greetings, asking questions, commenting, sharing materials, or helping behaviors (Tsao & Odom, 2006). Examples of social initiations included verbal phrases such as "let's play," "watch this," or "your turn," and nonverbal or motor behaviors such as the participant leading the peer to play materials, handing a peer a toy to play with, sharing materials, or gesturing for a peer to take a turn. A smile or a look did not qualify as an initiation if there was no additional verbal or physical contact. Social responses were defined as a reply within 5 s to an initiation made by a typically developing peer, such as looking when their name was called, following a peer's direction or request, answering a peer's question, accepting materials given by the peer, or head nodding after a peer's comment (Tsao & Odom, 2006).

Behaviors could be recorded as either initiations or responses and were mutually exclusive. We observed some negative interactions during the course of the study but did not code them because they occurred only infrequently, and classroom staff reported that negative interactions such as disruptive verbal or motor behavior (i.e., hitting, pushing, kicking, or biting clearly directed toward a peer) were not typical of these participants.

The secondary dependent variable was the duration of interactive play between the participant and peer during play sessions. Interactive play was defined as the child being engaged in a play activity (e.g., pushing a toy truck, playing a game, using art materials) within approximately 2 m of a peer and interacting either verbally (e.g., commenting to the peer, asking questions, giving directions) or nonverbally (e.g., taking turns, looking at the peer when the peer is talking, following the peer's direction or request, sharing play materials; cf. Hundert, Rowe, & Harrison, 2014).

### *Data Collection and Analysis*

Special-education graduate students trained in collecting direct observation data performed all data collection. During each session, a frequency count of initiations and responses was recorded as they occurred by hand and subsequently graphed. The duration of interactive play was calculated from all available video recordings of sessions and subsequently graphed. Due to a technological error, not all sessions were available for coding of interactive play.

Nonoverlap of all pairs (NAP), a nonparametric effect size measure suitable for single-case research designs, was calculated. NAP provides a complete nonoverlap index that measures the percentage of improvement of all pairwise comparisons across phases (e.g., baseline phase and intervention phase). Strengths of NAP include its ease of use, reflection of visual nonoverlap, and its statistical power (Parker, Vannest, & Davis, 2011). NAP effect sizes are considered large if above .93, moderate if ranging from .66 to .92, and small if below .65. We used a web-based tool to calculate effect sizes (Vannest, Parker, & Gonen, 2011).

### *Experimental Design*

A concurrent multiple baseline across participants with an embedded ABAB design was

used to evaluate the effects of the preferred activity intervention on participants' overall levels of interactions, initiations, and responses (Kennedy, 2005). Conditions included baseline, preferred play activity, generalization, and maintenance.

### *Baseline*

Baseline sessions were 10 min in duration and consisted of "business as usual" free play in the classroom. The facilitator directed the participant and peer dyad to the play area of the classroom and told them "it's time to play." The participant and peer were allowed to select any of the toys that were available on the shelves surrounding the play area or to select other items within the classroom and bring them to the play area rug. Items available during baseline free play sessions included toys typical to the classroom such as blocks, puzzles, kitchen and cooking toys, animal and people figurines, stuffed animals, Mr. Potato Head<sup>®</sup>, board games, dolls, a doll house, a farm play set, a police play set, a fire station play set, counters differing in color and size, colored pencils and paper, and paint stampers. Items related to the participants' preferred activities were available in baseline but not directly embedded into a structured play activity involving peers, nor were the children instructed to play with particular materials. The children were given no social skills instruction and no prompting or reinforcement was provided for any social interaction behaviors exhibited by either the participant or peer. If the participant or peer left the play area, the facilitator redirected the child back to the play area for the remainder of the session. When the 10-min session was complete, the facilitator announced that play time was over and instructed the children to rotate to a new activity within the classroom.

### *Intervention*

An age-appropriate play-based activity was designed around each participant's preferred or

restricted interest. Researchers interviewed the classroom teacher, parents, and other school staff to identify activities in which the participants most frequently engaged (Koegel, Fredeen *et al.*, 2012; Koegel *et al.*, 2013; Koegel, Vernon *et al.*, 2012). Of the identified preferred activities based on researcher observation and teacher and parent report, we then selected those activities that would also potentially be appealing to typically developing peers, as indicated by the teacher and school staff. For example, Julia was observed and reported to frequently play segments of Disney songs repeatedly on an iPad<sup>®</sup>. She was also observed and reported to frequently draw and scribble with markers, pens, or colored pencils in a notebook. Of these activities, the teacher suggested that coloring and drawing would be more appealing to a typically developing classmate. After mutually appealing preferred interests were identified for each participant and peer, individualized play activities were then developed. Each structured play activity used materials and items typically found in an early childhood education setting and did not require the development of novel or specialized materials. The preferred play activities are described below.

Arjun frequently played with transportation-related toys (e.g., cars, trucks, trains, train tracks, road signs). His structured play activities included making roads out of tape and driving different vehicles over them, directing traffic using street signs, building railroad tracks, playing "red light, green light" with toy cars, and using transportation play sets within these contexts. Emmett often played with Legos<sup>®</sup> and frequently watched the Lego<sup>®</sup> movie. His structured play activities included matching games with Lego<sup>®</sup> characters; building towers, castles, robots, etc. using over-sized Lego<sup>®</sup> blocks; and gross motor activities incorporating Lego<sup>®</sup> figures (e.g., hitting a balloon back and forth using a paddle he and his peer decorated with Lego<sup>®</sup> characters). Austin exhibited repetitive behaviors that involved lining up items by

shape, size, or color. His structured play activities that were also appealing to his peers were games that utilized these visual spatial strengths and included games such as Connect Four<sup>®</sup>, Kerplunk<sup>®</sup>, and stacking wooden beads of different shapes and colors on a pole to create a variety of patterns. Julia frequently colored and used various art materials during the school day. Her structured play activities included crafts, coloring paper dolls featuring popular storybook characters, and creating collages using markers, crayons, glitter, and stickers. The different structured play activities based on the participants' preferred interest were rotated across sessions.

The intervention was introduced sequentially across participants so that Arjun received the intervention first, followed by Emmett, then Austin, and then Julia. The participant and peer were directed to the play area of the classroom, and the facilitator introduced the interest-based play activity. Other play items that were available in baseline sessions were present during intervention sessions, but the children were instructed that they would be engaging in a specific play activity during this time. For example, the facilitator would tell the participant and peer dyad that "today you are going to play a Lego<sup>®</sup> game" or "this morning you're going to color and play with Anna and Elsa paper dolls". The facilitator was responsible for the organization of the materials and providing a brief demonstration of the preferred play activity to the participant and peer through modeling and verbal explanation that lasted approximately 2-3 min. Adult modeling and verbal explanation of an activity was provided only upon the first introduction of a new play activity. For example, the first time Arjun and his peer partner played "red light, green light" with toy cars, this activity was verbally explained and modeled by the facilitator. Upon subsequent sessions of this game, the facilitator announced the activity, but modeling and explanation were not provided.

After the activity was introduced, the facilitator moved away from the play rug and did not direct the activity during the 10-min play session. If a child engaged with additional items within the context of the structured play activity, the facilitator did not intervene. For example, as Arjun and his peer were building roadways for vehicles to drive across, the facilitator did not intervene when the peer picked up a stuffed cat from the shelf and walked it across the road. If the participant or peer indicated a desire to engage in a different activity, the facilitator reminded the children that they were playing with the specific activity at that time.

If requested, the facilitator clarified instructions, answered questions posed by the participant or peer as it pertained to the activity, or announced the next step of an activity (Koegel, Fredeen et al., 2012; Koegel et al., 2013; Koegel, Vernon et al., 2012). For example, if requested, the facilitator might provide clarification of instructions within the context of "red light, green light" (e.g., "Yellow light means slow down"), remind the children what to do next to complete a craft (e.g., "The next step is to cut out the paper dolls"), or respond to a question posed by a child (e.g., if asked for assistance, help put together the Connect Four<sup>®</sup> frame). The facilitator did not provide any prompts or reinforcement for social interaction or provide any social skills instruction or feedback to the participant or peer at any time before, during, or after the play session. The facilitator intervened during the preferred play activity only if problem behavior from the participant or peer arose (e.g., hitting, pushing, name calling, crying, or other aggressive acts). Problem behavior occurred infrequently throughout the study, and the facilitator intervened only in rare instances such as when Arjun grabbed a toy away from the peer, resulting in the peer crying. In such instances, the facilitator reminded Arjun of classroom expectations (e.g., hands to self and ask the friend

for a turn with the toy or wait until the friend is finished).

### *Generalization and Maintenance*

Generalization with novel peers was assessed throughout all phases of the study. Generalization sessions in baseline consisted of “business as usual” free play sessions with a novel peer. Generalization sessions in treatment consisted of the preferred interest play activity with a novel peer, with the facilitator clarifying and modeling the activity, answering participant or peer questions as related to the activity, and announcing the next step of an activity as necessary. To assess the durability of the preferred activity intervention, maintenance probes were collected 6 weeks following the conclusion of the intervention. Maintenance sessions were identical to those during treatment and were conducted both with the usual peer partner and with a novel partner.

### *Interobserver Agreement*

Graduate students trained in behavioral interventions independently recorded data used to calculate interobserver agreement. Interobserver agreement for initiations and responses was calculated across 73% of all sessions using a total-agreement approach (Kennedy, 2005). The total number of initiations or responses recorded by each observer was summed, the smaller total was divided by the larger total, and the amount was multiplied by 100%. Mean interobserver agreement for initiations was 96.9% (range 67%-100%) across participants. Mean interobserver agreement for responses was 98.5% (range 79%-100%) across participants.

Interobserver agreement for duration of interactive play was calculated using a total-agreement approach (Kennedy, 2005) for 48% of video-recorded sessions, which was a total of 22% of all intervention sessions, across all phases of the study. The observers

independently viewed the recorded sessions, and the duration of interactive play recorded by each observer in a session was totaled, the smaller total was divided by the larger total, and the amount was multiplied by 100%. Mean interobserver agreement for duration of interactive play was 94% (range = 81% - 100%) across participants.

### *Procedural Fidelity*

Data collectors recorded procedural fidelity (i.e., the accuracy of the facilitators’ implementation of the preferred activity intervention) for 86.5% of treatment sessions across all participants. Fidelity was scored using a dichotomous checklist that included four essential components of treatment (i.e., facilitator introduces the appropriate preferred play activity; answers questions from the participant or peer only if it pertains to the activity; does not instruct, prompt, or reinforce social interaction behaviors between the participant and peer; and intervenes during the preferred play activity only if problem behavior from the participant or peer arises). Procedural fidelity was determined by dividing the number of checklist items scored as correct by the total number of checklist items and multiplying by 100%. Procedural fidelity was 100% for all participants.

### *Social Validity Assessment*

Three types of social validation measures were used in this study: comparisons of participant initiations to those of typically developing peers, teacher evaluations of intervention feasibility, and unbiased-observer ratings of participant social behavior during baseline and intervention. The four typically developing peers in the study provided a normative range of peer initiations during play sessions. Each typical peer was observed three times with another typical peer of their choosing (not the targeted peers with ASD) during 10-min play sessions. Initiations exhibited by typically

developing peers were recorded in the same manner as the data for the participants with ASD. Overall frequency of initiations was recorded, and the mean number and standard deviation of initiations per play session ( $M = 13.7$ ,  $SD = 9$ ) were used to estimate a normative range of social initiations.

Post intervention, the classroom teacher provided feedback regarding the acceptability and feasibility of the treatment package using a survey created by the researchers for this intervention. The teacher used a Likert-type scale to answer questions regarding her ability to use the intervention strategy in the classroom without the assistance of researchers, how likely it was that she would incorporate this intervention into the typical classroom routine, whether she viewed this intervention as an effective way to increase social interaction between students, and if the participants were included more frequently in classroom activities following the completion of the intervention. Space was also provided on the survey for the teacher to leave additional feedback on any other aspect of the intervention.

To determine the social significance of the behavior change, a convenience sample (Pedhazur & Schmelkin, 1991) of 18 undergraduate preservice teachers at a university was surveyed following the conclusion of the intervention. The preservice teachers had taken foundational education courses, had general knowledge about disability matters, and had two semesters of teaching experience through internships in public schools. The ages of the preservice teachers ranged from 20 to 25 ( $M = 21$ ). The preservice teachers viewed 2-min video clips that contained (a) a segment of the participant during an intervention session with the preferred activity incorporated during play time with a peer and (b) a segment of the participant during a baseline session with a peer, without the preferred activity. The segments were selected because the researchers considered them representative of the

participants' performance (Lancioni et al., 2006). The order of the baseline and intervention segments was randomly determined. The preservice teachers were not aware of the purpose of the intervention, nor was the disability of the participant disclosed. Using a five-point Likert-type scale, raters answered questions (listed in Table 1) regarding the participant's social interaction with the typical peer, the quality of the participant's play as compared to other children his age, and whether a teacher would find the interaction acceptable in the classroom. Mean and standard deviation were calculated for each item across all participants, and the mean scores across all items for each participant was provided. A nonparametric Wilcoxon signed-rank test was then used to examine the statistical significance of the difference in Likert scale ratings between baseline and intervention conditions for all participants.

## RESULTS

Figure 1 displays the frequency of participant initiations and responses in each session. In baseline, Arjun averaged 2 initiations (range = 0 - 5) to a peer and 1.1 responses (range = 0 - 4) to a peer's initiation per play session (closed characters in Figure 1). During intervention, Arjun averaged 10.1 initiations (range = 4 - 15) and 10.9 responses (range = 7 - 25). Overall, 48.1% of Arjun's peer interactions during intervention were initiations and 51.9% were responses. These percentages remained generally stable throughout treatment. During

Table 1  
Social Validity Assessment Questions

- |    |  |
|----|--|
| 1. | The target child and his peer participate appropriately in a shared social activity. |
| 2. | The target child interacts regularly with his peer during the play session.          |
| 3. | The target child displays play skills typical for his age.                           |
| 4. | The children appear to enjoy playing together.                                       |
| 5. | A teacher would find this interaction agreeable/likeable.                            |



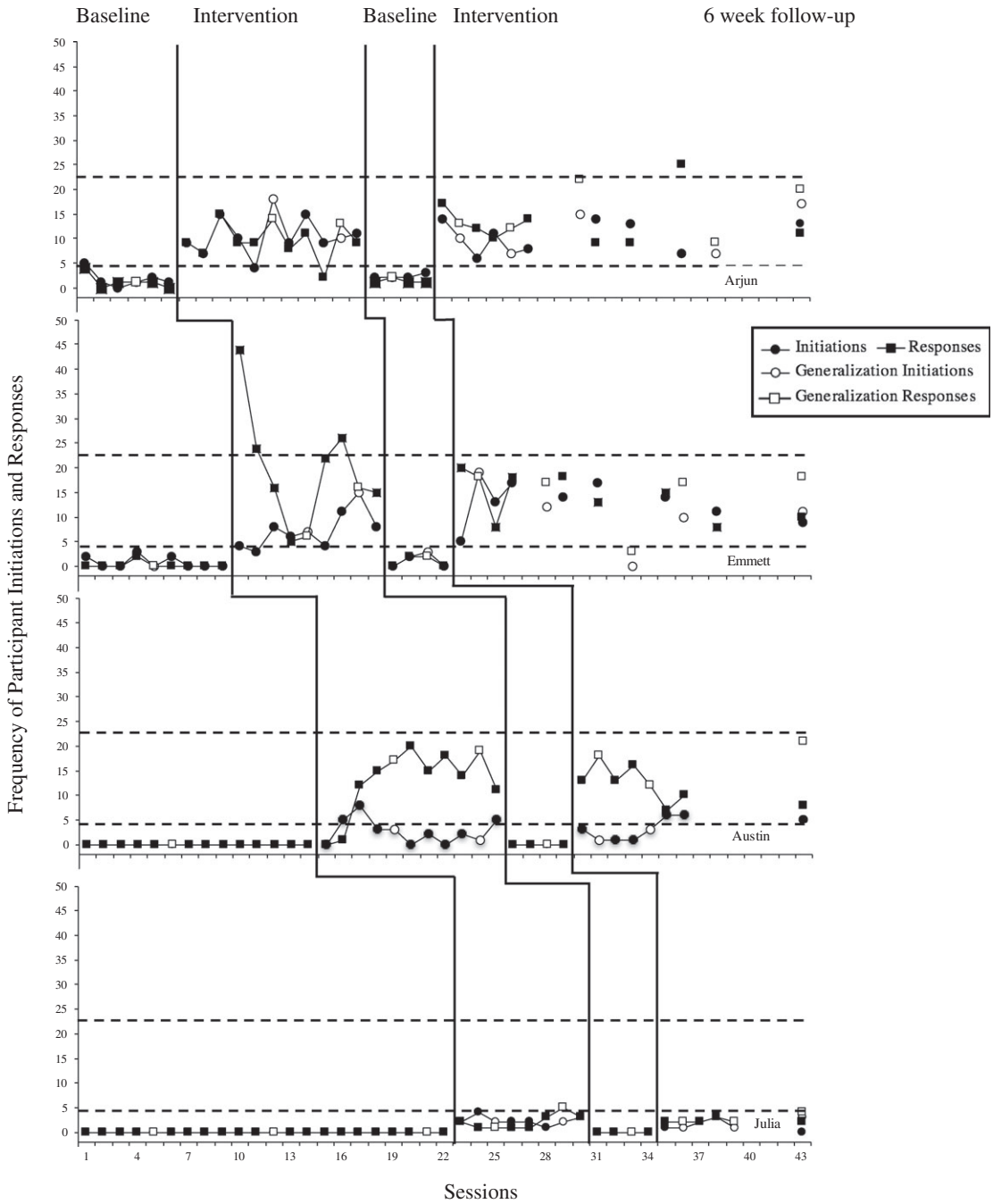


Figure 1. Frequency of participant initiations (closed circles) and responses (closed squares) directed to peer per play session. Open circles indicate initiations to a novel peer during generalization sessions. Open squares indicate responses to a novel peer during generalization sessions. Horizontal dashed lines indicate the normative range of peer initiations.

baseline generalization sessions (open characters in Figure 1), Arjun averaged 1.5 initiations (range = 1 – 2) and 1.5 responses (range = 1 – 2). During intervention generalization sessions, Arjun averaged 11.2 initiations (range = 7 – 18) and 13.8 responses (range = 9 – 22). At the 6-week follow-up with both the typical peer partner and a novel peer, Arjun averaged 15 initiations (range = 13 – 17) and 15.5 responses (range = 11 – 20). Overall, Arjun initiated within the peer normative range for 23 of 24 intervention sessions (96%), including generalization and maintenance sessions.

In baseline, Emmett averaged 0.9 initiations (range = 0 – 3) to a peer and 0.4 responses (range = 0 – 2) to a peer's initiation per play session. During intervention, Emmett averaged 9.6 initiations (range = 3 – 17) and 18 responses (range = 5 – 44). Overall, 34.8% of Emmett's peer interactions during intervention were initiations and 65.2% were responses. Initially, Emmett frequently responded to peers and rarely initiated interactions. However, as the intervention progressed, his initiations to peers increased greatly. By session 24, the number of initiations and responses were roughly equal per session. During baseline generalization sessions, Emmett averaged 1.5 initiations (range = 0 – 3) and 1 response (range = 0 – 2). During intervention generalization sessions, Emmett averaged 10.6 initiations (range = 0 – 19) and 13.6 responses (range = 3 – 18). At the 6-week follow-up with both the typical peer partner and a novel peer, Emmett averaged 10 initiations (range = 9 – 11) and 14 responses (range = 10 – 18). Overall, Emmett initiated within the peer normative range for 18 of 22 intervention sessions (82%), including generalization and maintenance sessions.

In baseline, Austin did not initiate or respond to peers. During intervention, Austin averaged 3 initiations (range = 0 – 8) to a peer and 11.8 responses (range = 0 – 20) to a peer's initiation. Overall, 20.3% of Austin's peer interactions during intervention were initiations

and 79.7% were responses. Austin exhibited more responses than initiations throughout the intervention, although initiations increased as the intervention progressed. During baseline generalization sessions, Austin exhibited zero initiations and responses to novel peers. During intervention generalization sessions, Austin averaged 2 initiations (range = 1 – 3) and 17.4 responses (range = 12 – 21). At the 6-week follow-up with both the typical peer partner and a novel peer, Austin averaged 3.5 initiations (range = 2 – 5) and 14.5 responses (range = 8 – 21). Overall, Austin initiated within the peer normative range for 6 of 20 intervention sessions (30%), including generalization and maintenance sessions.

In baseline, Julia did not initiate or respond to peers. During intervention, Julia averaged 2.2 initiations (range = 0 – 4) to a peer and 2 responses (range = 1 – 3) to a peer's initiation. Overall, 52.6% of Julia's peer interactions during intervention were initiations and 47.3% were responses. These percentages remained stable throughout the intervention. During baseline generalization sessions, Julia exhibited zero initiations and responses to novel peers. During intervention generalization sessions, Julia averaged 1.8 initiations (range = 1 – 3) and 2.8 responses (range = 1 – 5). At the 6-week follow-up, Julia averaged 1.5 initiations (range = 0 – 3) and 3 responses (range = 2 – 4). Julia did not initiate within the peer normative range during any intervention, generalization, or maintenance sessions.

Figure 2 displays the percentage of the session in which participants engaged in interactive play. In baseline, Arjun engaged in interactive play with his peer for an average of 8% of the 10-min play session (range = 3% – 16%). During intervention, Arjun engaged in interactive play for an average 79% of the play session (range = 66% – 90%). In baseline, Emmett engaged in interactive play with his peer an average of 1.3% of the play session (range = 0% – 5%). During intervention,

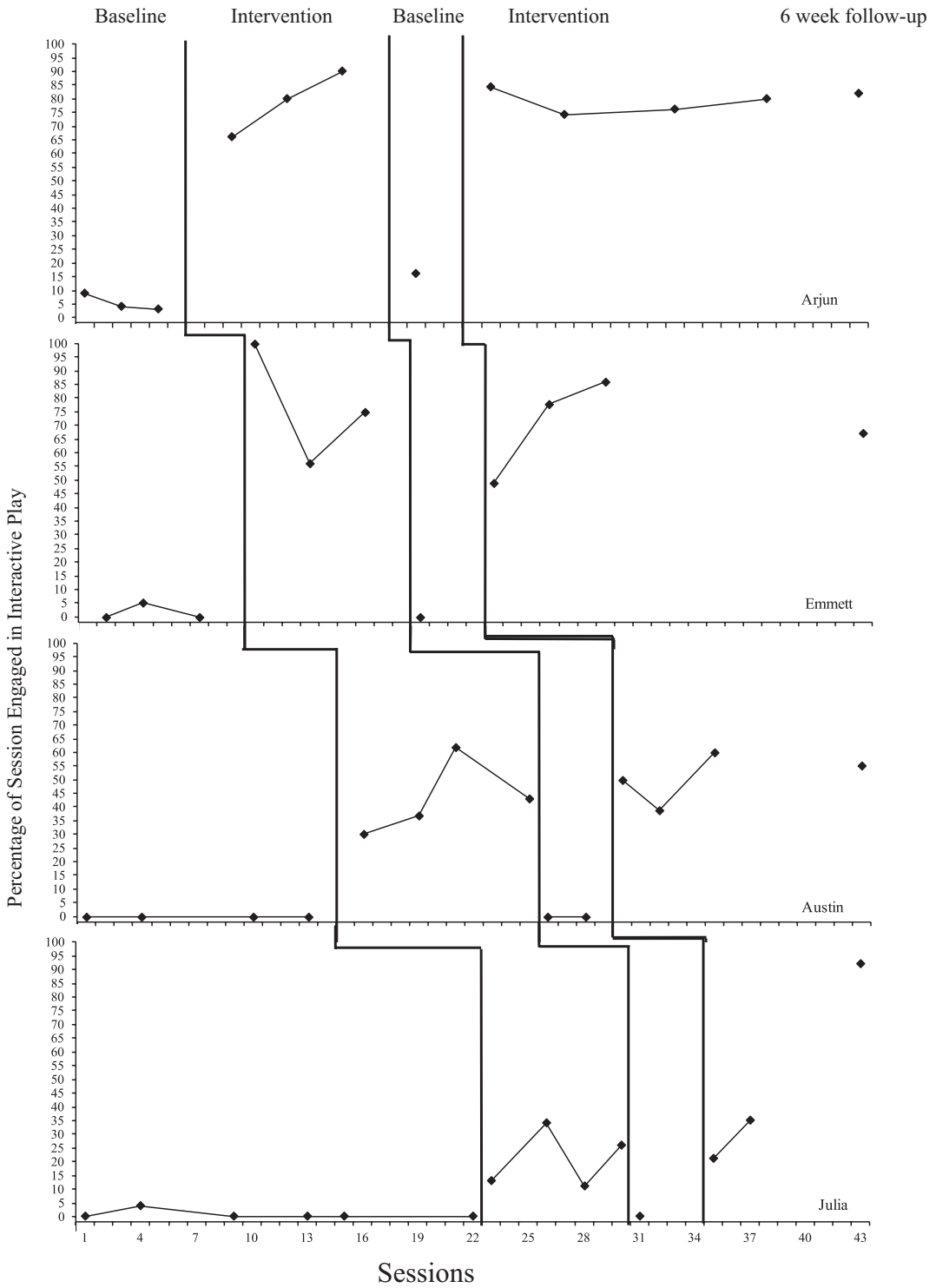


Figure 2. Percentage of the 10-min play session in which the participant and peer engaged in interactive play.

Emmett engaged in interactive play for an average of 73% of the play session (range = 49% – 100%). In baseline, Austin engaged in interactive play with his peer for 0% of the play session. During intervention, Austin engaged in interactive play for an average of 47% of the play session (range = 30% – 62%). In baseline, Julia engaged in interactive play with her peer for an average 0.6% of the play session (range = 0% – 4%). During intervention, Julia engaged in interactive play for an average of 33% of the play session (range = 11% – 92%).

NAP results indicated a very effective intervention, with all results .93 and above. These results compared the amount of behavior change between each baseline and intervention phase, with the inclusion of all generalization and maintenance data. For initiations, NAP results were .99 for Arjun, .97 for Emmett, .93 for Austin, and .97 for Julia. For responses, NAP results were .99 for Arjun, 1.0 for Emmett, .98 for Austin, and 1.0 for Julia. NAP results for interactive play were 1.0 for all participant and peer dyads. Scores for each participant indicated statistically significant ( $p < .0005$ ) effects.

Participants' frequencies of social initiations were compared to those of typically developing classmates, with results indicating that two of the four participants consistently initiated to peers at frequencies within the normative range across intervention sessions (Arjun and Emmett), and that one participant (Austin) initiated at frequencies within the normative range for 30% of intervention sessions. The classroom teacher indicated satisfaction with the intervention, that she would be able to implement the intervention independently within the normal classroom routine, and that she would use this strategy in the future. In addition, she noted that most of her students, both with and without ASD, would likely be able to successfully participate in the intervention. She also expressed that Arjun, Emmett, and Austin were more included in classroom activities throughout the day as a result of the

intervention. For Emmett, she noted that he was "much more interested in the other kids than during preintervention." For Austin, the teacher reported that she had "definitely seen him branch out" and that he was "much more comfortable having other kids in his space than preintervention."

Results of the social validity assessment also indicated that the behavior changes of the participants between baseline and intervention conditions were large enough to be considered socially significant. The survey questions, mean score, standard deviation, and  $p$  values for all items across participants in baseline and intervention conditions are reported in Table 2. Based on the Wilcoxon signed-rank test, statistically significant results ( $p < .005$  for all items) indicated that raters perceived participant interactions to be more positive in intervention conditions than in baseline conditions. Raters observed that all children with ASD participated appropriately in a shared social activity, displayed more typical play skills, interacted more regularly with their peers, seemed to enjoy playing more, and engaged in more agreeable interactions during intervention versus baseline conditions.

The findings of the third social validity assessment corresponded with intervention results. The preservice teachers rated Emmett most highly overall, with scores ranging from 1.1 – 1.7 in baseline and from 4.8 – 4.9 in intervention, which indicates that his interactions during intervention sessions improved to a level considered appropriate and reflective of play skills exhibited by typically developing peers. Raters also found marked differences in the quality of social interaction between baseline and intervention phases for Arjun, with baseline ratings ranging from 1.2 – 2.3 and intervention ratings ranging from 3.8 – 4.5. Arjun received high marks for participating appropriately in a shared social activity (4.5) and interacting regularly with a peer during intervention session (4.2). Scores for Austin also showed great improvement during treatment, and he was rated from

Table 2  
Social Validity Assessment Results for All Participants

Participant	Items	Conditions				<i>p</i> value
		Baseline		Intervention		
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Arjun	1	1.4	0.4	4.5	0.5	<i>p</i> < 0.005
	2	1.2	0.6	4.2	0.6	<i>p</i> < 0.005
	3	2.5	0.8	3.8	0.8	<i>p</i> < 0.005
	4	1.8	0.8	4.1	0.5	<i>p</i> < 0.005
	5	2.3	0.7	4.1	0.5	<i>p</i> < 0.005
	average	1.8	0.9	4.2	0.6	<i>p</i> < 0.005
Emmett	1	1.1	0.3	4.9	0.3	<i>p</i> < 0.005
	2	1.1	0.3	4.9	0.3	<i>p</i> < 0.005
	3	1.6	0.7	4.8	0.4	<i>p</i> < 0.005
	4	1.6	0.8	4.9	0.3	<i>p</i> < 0.005
	5	1.7	0.8	4.8	0.4	<i>p</i> < 0.005
	average	1.4	0.7	4.9	0.4	<i>p</i> < 0.005
Austin	1	1.1	0.2	4.3	1.2	<i>p</i> < 0.005
	2	1.1	0.3	3.3	1.0	<i>p</i> < 0.005
	3	1.5	0.6	3.9	1.0	<i>p</i> < 0.005
	4	1.4	0.7	3.6	0.9	<i>p</i> < 0.005
	5	1.4	0.6	3.8	0.9	<i>p</i> < 0.005
	average	1.3	0.6	3.8	1.1	<i>p</i> < 0.005
Julia	1	1.1	0.6	3.9	0.9	<i>p</i> < 0.005
	2	1.2	0.3	2.2	0.8	<i>p</i> < 0.005
	3	1.4	0.5	2.9	1.0	<i>p</i> < 0.005
	4	1.7	0.7	2.7	0.4	<i>p</i> < 0.005
	5	1.5	0.5	2.9	1.0	<i>p</i> < 0.005
	average	1.4	0.6	2.9	1.0	<i>p</i> < 0.005

*Note:* Survey questions were rated on a Likert-type scale of 1 to 5 representing the least and most positive values, respectively. Raters' (*n* = 18) mean scores (*M*) and standard deviations (*SD*) for survey items between baseline and preferred activity intervention conditions. Wilcoxon signed-rank test was used to evaluate the change (*p* value) between baseline and intervention conditions.

1.1 – 1.5 in baseline to 3.3 – 4.3 in intervention, with ratings for participating appropriately in a shared social activity receiving the highest score. Ratings for Julia increased from 1.1 – 1.7 in baseline to 2.2 – 3.9 in intervention. Although Julia's increases in ratings are more modest compared to the other participants, they do reflect a marked improvement from baseline ratings.

## DISCUSSION

The intervention package consisting of interest-based structured play activities with

adult instruction, modeling, and response to child questions produced large increases in peer social interaction in an inclusive early childhood setting. In addition, increases in social interaction generalized to novel peers and maintained following the completion of the intervention. As demonstrated by the clear reversals between baseline and intervention conditions, these results support research suggesting that children with ASD respond to interventions in which play is systematically structured and, in such a context, may exhibit more complex and varied behaviors (Blanc, Adrien, Roux, & Barthélémy, 2005; Jung &

Sainato, 2013). This study also extends previous research involving the incorporation of preferred or restricted interests of children with ASD into behavioral intervention procedures and demonstrates both the effectiveness and social validity of the treatment package.

The positive intervention results, in addition to favorable social validity findings involving comparisons to typically developing peers, observations from unbiased observers, and teacher feedback further support the use of the treatment package. The intervention did not require intensive training for either participants or peers, and the play sessions did not necessitate extensive adult involvement other than brief periods of modeling, instruction, and availability to answer questions, which allowed the adult to monitor rather than direct the children's interaction (Odom & Watts, 1991). In addition, the intervention took place within the natural environment and fit within the context of the daily routine. This ease of implementation would seem especially attractive to educators in inclusive settings who may not necessarily have specialized training in working with students with ASD (Pazey et al., 2014; Segall & Campbell, 2012).

That three of four participants initiated at frequencies comparable to their typically developing peers within the context of the intervention is a particularly notable finding, as social initiations are generally more difficult to evoke than response behaviors in children with ASD (Pierce & Schreibman, 1997). Because intervention sessions were organized around a joint play activity, peers potentially initiated more frequently, providing additional opportunities for participant responses in this context in comparison to baseline. However, in contrast to responses, participant initiations would seemingly be less affected by opportunities provided by the peer. Thus, increases in participant initiations were likely not due to changes in opportunities for interaction in isolation but were a result of the intervention package.

Given the promising effects of the intervention for participants with a range of functioning, this strategy could potentially be generalizable to participants with diverse characteristics. Although social deficits were present, Arjun exhibited well-developed verbal skills and the least number of autistic symptoms, and his increase in peer social interaction reflects findings of previous studies using similarly high-functioning participants. This study also extends those findings to moderate- and lower-functioning participants. Specifically, the intervention was also highly effective for Emmett, who lacked strong verbal communication skills, as well as for Austin, who exhibited more severe autistic symptoms. In particular, the number of initiations Emmett made to his peer increased considerably as the intervention progressed. This finding reflects results from the literature that suggests preschool children with delayed play skills may increase initiations over time when paired with a highly competent peer partner (e.g., Tanta, Deitz, White, & Billingsley, 2005). Although his interactions were primarily responses to peer initiations (e.g., following a peer direction or request), Austin began to verbally initiate to his peers (e.g., approximating "your turn") during the intervention, a behavior that had not been previously demonstrated, and his number of initiations per session also increased as the intervention progressed.

Although Julia, the participant with the most pronounced delays and autistic symptoms, did not initiate to peers within the normative range, she did clearly produce an increase in social interaction behaviors during intervention compared to baseline conditions, with an especially substantial increase in the amount of time she spent engaged in joint interactive play with her peer. For participants with more substantial social communication deficits, an approach that utilizes strategies such as the picture exchange communication system (PECS; e.g., Jurgens, Anderson, & Moore, 2009) or direct peer training (e.g., English, Goldstein, Shafer, &

Kaczmarek, 1997), along with the intervention package components, may produce even greater gains in peer social interaction and would seem a promising area for future research.

It is interesting to note that the generalization sessions using novel peer partners often resulted in higher levels of social behavior for Arjun than sessions with his usual peer partner. Although we followed recommendations in the literature for selecting typically developing peer partners (i.e., age appropriate verbal and social skills, compliance with teacher directions, and a history of offering to help classmates), and the peer willingly participated in the play activities, the generalization peer partner appeared to enjoy the activities more so than the usual peer partner. This could have perhaps increased the novel peer's motivation to interact with the participant during the play session, thus contributing to higher levels of participant initiations and responses. In addition to the established typical peer selection criteria, practitioners should consider how closely the interests of the peer and participant align and make adjustments accordingly.

Future studies might systematically assess how participant behavior changes as a result of the intervention beyond an increase in initiations, responses, and interactive play. In particular, changes in the quality of the children's interactive play between baseline and intervention conditions were anecdotally observed. For example, during baseline sessions, Arjun engaged mostly in solitary play and onlooker behavior (i.e., observing his peer playing with other materials but not interacting), but within the context of intervention sessions, he engaged in multiple types of interactive play, namely associative play behaviors (i.e., interacting with the peer while playing but not coordinating actions) and cooperative play (i.e., playing with a shared goal and defined roles; Parten, 1932). Similarly, Emmett engaged in mostly unoccupied behavior or solitary play behavior in baseline sessions but exhibited cooperative

interactive play with his peer during intervention sessions. Although the interactive play data provided a measure reflecting this behavior change, future studies might include more nuanced measures of the type of interactive play exhibited by both the participant and peer to provide a more detailed analysis of the interaction.

Future research should also consider whether deficits in social interaction are caused by a skill deficit (i.e., lack of ability) or a performance deficit (lack of interest or motivation) when developing interventions for children with ASD. Deficient social motivation appears in the earliest conceptualizations of autism (e.g., Kanner, 1943), and some research and commentaries suggest that an extreme diminishment in social motivation may constitute a primary deficit of the disorder (Chevallier, Kohls, Troiani, Brodtkin, & Schultz, 2012; Koegel & Koegel, 1995). The results of this study seem to support the social motivation theory of autism, and findings suggest that embedding preferred interests into social activities might potentially increase the motivation of some children with ASD to interact with their peers. Research that further elucidates the relation between social motivation and skill use and development seems warranted.

Some limitations of this study must be noted. Interobserver agreement was calculated using a lenient measure; future research should use more stringent calculations to more strongly support results. In addition, although this study resulted in improved social behavior for all participants, a notable limitation is the lack of assessment of generalization across different types of organized play activities other than the interest-based play activities used in the intervention. Future studies should investigate if the participants' increases in social interaction extend across settings and to other types of organized play activities that include adult modeling, verbal explanation, and response to child questions but do not incorporate

preferred interests. This study is also potentially limited by the lack of a stimulus preference assessment to determine the participants' interests. Although many practitioners working with children with ASD may not have knowledge of preference assessments (Graff & Karsten, 2012), research has demonstrated that indirect methods of preference identification such as those used in this study may not identify the most highly preferred item, which could influence intervention effectiveness (e.g., Cote, Thompson, Hanley, & McKerchar, 2007). Therefore, in addition to informant report, future research might use direct preference assessments to identify preferred interests. Finally, positive teacher feedback must be interpreted judiciously as demand characteristics may have influenced these results (Foster & Mash, 1999; Wolf, 1978). Future research should consider ways to reduce possible demand characteristics when seeking practitioner satisfaction with intervention procedures and outcomes.

In summary, this study systematically assessed the effects of an intervention package consisting of interest-based structured play activities with adult modeling, instruction, and response to child questions on peer-to-peer interaction between preschoolers with and without ASD. This intervention approach produced increases in social initiations, responses, and interactive play for participants with a wide range of functioning and these gains generalized to novel peer partners. In addition, the intervention was simple and efficient, fitting easily within the normal classroom routine. Future studies examining the training of preschool educators to implement this strategy in inclusive classroom settings are merited.

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