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Peer-Mediated Joint Attention Intervention in the Preschool Classroom

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Abstract

Children with autism spectrum disorder (ASD) and other developmental disabilities are at risk of isolation from same-aged peers. Furthermore, research indicates that even in inclusive settings, children with ASD benefit from targeted interventions and support. Among the social communication skills that are frequently absent in children with ASD is joint attention. Joint attention can be defined as shared engagement between two individuals on a third object or event and has been identified as potential pivotal skill for later development of age-appropriate social skills and communication. A growing body of literature documents effective intervention on joint attention skill for young children with ASD; however, few studies document the effects of an intervention mediated by a natural change agent. In the present study, independent concurrent multiple-baseline designs were used to evaluate the impact of a joint attention intervention combined with peer training on the response to joint attention (RJA) behaviors exhibited by seven preschoolers with ASD. Results indicated that RJA behaviors increased overall, the seven peers were able to carry out a simple intervention with fidelity, and that both bids from peers and responses to those bids increased following intervention. Limitations and opportunities for future research are discussed.

Keywords

autism spectrum disorder, joint attention, peer-mediated intervention, preschool

Joint attention is the reciprocal and triadic focus of two individuals on an object and develops typically in infancy during everyday interactions between parent and child. To engage successfully in joint attention, the child must either make a bid for joint attention (e.g., pointing out an object or environmental event) or respond to a bid for joint attention (e.g., following someone else's point; Jones et al., 2006). For example, a mother points out a bird in the tree to her child who then looks at the bird and back at the mother. Joint attention provides the foundation for more complex social behaviors such as perspective-taking and conversational social exchanges (Jones & Carr, 2004). Additional research has shown that joint attention may be important for skills in additional developmental domains such as language and play (Charman, 2003). Skills contingent on joint attention are necessary for appropriate social communication development, and therefore, joint attention may predict social success in preschool and beyond (Sullivan, Mundy, & Mastergeorge, 2015). Research suggests that without targeted intervention on this skill, children with autism spectrum disorder (ASD) and other developmental disabilities may not develop the same quality of later-developing social communication skills (e.g., play, pragmatics; Toth, Munson, Meltzoff, & Dawson, 2006).

Research on joint attention skills for young children with ASD is an emergent area of study in developmental psychology and special education (White et al., 2011). Recent reviews of the literature (e.g., White et al., 2011) have summarized the existent literature on joint attention, and synthesis of these reviews reveals gaps in the growing literature on this topic. For example, a majority of the literature focuses on training of initiation of joint attention (IJA) skills in young children with ASD, when developmental theory indicates that response to joint attention (RJA) develops first in typically developing populations, and may be more predictive of later language learning (Bottema-Beutel, 2016). Furthermore, despite the typical development of joint attention in everyday interactions with parents and caregivers, much of the research takes place with

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interventionists and in clinical, controlled settings, with insufficient data to suggest the gains made generalize to natural environments or change agents (Hansen, Carnett, & Tullis, 2018; White et al., 2011).

Dube, MacDonald, Mansfield, Holcomb, and Ahearn (2004) conceptualized a model of joint attention that described the behavioral mechanisms (i.e., antecedent and consequence variables) controlling a joint attention interaction. This model allows for interventions that target deficits in the entire joint attention behavior chain for children with ASD and hinge on effectiveness of the reinforcing variable (Dube et al., 2004). Hansen, Raulston, Machalicek, and Frantz (2018) examined the effects of a parent training intervention on RJA behaviors in young children with ASD. Hansen and colleagues (2018) evaluated an intervention that trained caregivers to deliver specific bids for joint attention, prompt, and reinforce their children to complete a behavior chain involving looking toward an object and back at the caregiver in a concurrent multiple-baseline design across three caregiver–child dyads. Results indicated that caregivers learned to implement the intervention with fidelity, which increased child RJA (prompted and spontaneous). However, this study occurred in a clinical setting with specific materials arranged to easily evoke RJA behaviors. Also of note was the age of the participants, which ranged from 3 to 6 years. By preschool age, parents are no longer a child's sole or primary social outlet, and peers and classroom teachers are the available communication partners for the majority of a child's day (Snyder, 2012).

Increasing interest and research in inclusive settings has extended the literature on social communication interventions in natural environments (Simpson, de Boer-Ott, & Smith-Myles, 2003). Additional research is being conducted in everyday, naturalistic contexts (e.g., preschool classroom; Dykstra, Boyd, Watson & Crais, 2011). For example, Lawton and Kasari (2012) showed the efficacy of a teacher training approach to increase joint attention and symbolic play skills in the preschool classroom. In another study, Goods and colleagues examined the effect of the Joint Attention Symbolic Play Engagement and Regulation (JASPER) intervention in the preschool context (Goods, Ishijima, Chang, & Kasari, 2013). Yet, there is still a need for more research in applied settings so that skills learned in controlled environments can be generalized to everyday settings such as the preschool classroom or home. In a recent systematic review of social communication interventions, Hansen, Blakely, Dolata, Raulston, and Machalicek (2014) found only 16 studies targeting interventions on social communication goals in inclusive preschool settings for children with ASD. Few of these studies used peers as change agents or embedded intervention directly into play. To identify best practices for social communication intervention for children with ASD in inclusive settings, more research in natural contexts is warranted.

Peer-mediated intervention is an effective and socially valid means to intervene on the core deficits of ASD, such as play and social communication (Wong et al., 2015; Whalon, Conroy, Martinez, & Werch, 2015). Peer-mediated intervention is especially relevant in inclusive settings where children with ASD regularly encounter typically developing peers (Whalon et al., 2015). Recent reviews have identified findings from peer-mediated interventions and interventions that directly involve peers ranging in age from early childhood to high school (e.g., Watkins et al., 2015). Further evidence is needed specifically on peer-mediated interventions for preschool-aged children to identify effective strategies for this unique setting and population.

In the current study, we aim to extend the findings of Hansen et al. (2018) in two ways: (a) to a naturalistic setting, an inclusive preschool classroom, and (b) with new change agents, peers. This study will examine the effect of individualized instructional sessions with an interventionist and peer-mediated sessions in the inclusive preschool classroom on RJA behaviors in seven young children with or at risk of ASD.

Method

Recruitment and Participants

Seven children between the ages of 3 and 5 years who were identified by their preschool teacher to be with or at risk of ASD (i.e., were currently being evaluated for ASD, had an educational or medical label of ASD) were recruited from inclusive preschools serving children with disabilities in the Pacific Northwest region of the United States. Target children were not required to have a formal special education eligibility or medical diagnosis of ASD to meet inclusion criteria of the current study. Target children were eligible if they (a) spent the majority of their school day in an inclusive classroom (i.e., typically developing peers received instruction alongside children with disabilities), (b) had clinically significantly low levels (lower than the mean 0.71 on the joint attention subscale as well as teacher and parent report) of RJA behaviors as measured by the Early Social Communication Scales (ESCS; Mundy et al., 2003), and (c) attended a classroom a minimum of 2 days a week with a good attendance. Following informed consent, the first author administered the Childhood Autism Rating Scale—Second Edition (CARS-2; Schopler, 2010) using an interview and observation format to describe severity of ASD symptoms of the target children. Table 1 depicts the demographic data of target children.

Peers were recruited to participate in dyads with target children. Each peer only participated in one dyad. Peer participants were eligible if they (a) scored within one

Table 1. Demographic Information of Target Children Participants.

Participant	Age	Gender	Class	Peer	Race/ethnicity	ASD diagnosis	CARS-R	RJA
Oliver	5.0	M	B	Lucas	Hispanic/Latino	Educational	32	0
Emily	4.0	F	B	John	Caucasian	Educational	39	0.42
Arthur	4.1	M	A	Martin	NR	Teacher report	23	0.35
Aiden	4.2	M	A	Mario	NR	Educational	38	0.28
Trevor	4.5	M	C	Jacob	Caucasian	Teacher report	23	0.60
Jason	4	M	D	Michael	Hispanic/Latino	In evaluation	32	0.43
Quinn	4.4	M	D	Theo	Caucasian	Educational	33.5	0.50

Note. ASD = autism spectrum disorder; CARS = Childhood Autism Rating Scale, non-autistic 0–25, mild-moderate 25–35, severe 30+; RJA= response to joint attention, typical $M = 0.71$; NR = not reported.

Table 2. Demographic Information of Peer Participants.

Peer participant	Age	Gender	Class	Target child	Race/ethnicity	RJA
Lucas	4.5	M	B	Oliver	Caucasian	0.93
John	3.7	M	B	Emily	Caucasian	1.0
Martin	5.2	M	A	Arthur	Caucasian	1.0
Mario	3.7	M	A	Aiden	NR	0.85
Jacob	3.8	M	C	Trevor	Caucasian	0.84
Michael	5.2	M	D	Jason	Caucasian	0.95
Theo	4.8	M	D	Quinn	Caucasian	0.95

Note. RJA subscale norm = 0.71. RJA = response to joint attention; NR = not reported.

standard deviation of the mean on the ESCS and/or scored within one standard deviation of the mean on the joint attention subscale ($M = 0.71$, $SD = 0.29$) and had higher overall scores than the target child; (b) had strong RJA and IJA skills as measured by the joint attention subscale of the ESCS; (c) attended the classroom setting a minimum of 2 days a week with good attendance and engaged in zero to low levels of challenging behavior (e.g., aggression toward peers); and (d) had a social interest in target child per teacher report. Table 2 depicts the demographic data of peers.

Design

The effects of the intervention package were evaluated using two independent single-case designs: (a) a concurrent multiple baseline across four dyads design and (b) a concurrent multiple probe across three dyads design (Ledford & Gast, 2018). The first design (Graphs 1 and 3) meets the What Works Clearinghouse (WWC) standards (Kratochwill et al., 2010). The second design (Graphs 2 and 4) provides additional demonstrations and meets WWC standards with reservations. The first author, an advanced early childhood special education doctoral candidate with 6 years of experience implementing interventions for children with ASD, was the sole adult interventionist for this study. Data collectors were doctoral students with between 2 and 10 years of research and teaching experience.

Setting

Participants (target children and peers) attended one of four inclusive classrooms. Two dyads (i.e., Oliver and Lucas, and Emily and John) attended Classroom A. Two dyads participated from Classroom B: Arthur and Martin in the morning session and Aiden and Mario in the afternoon session. One dyad, Trevor and Jacob, attended Classroom C, and the last two dyads, Jason and Michael and Quinn and Theo, attended Classroom D. For each of the participants, sessions with the adult interventionist occurred in a hallway or nearby office space.

Sessions with the peer took place in the classroom during either center time or free play at a learning station. Learning stations were specified areas of the classroom typically devoted to a developmental domain. For example, the fine motor station featured teacher-supported activities that encouraged dexterity, such as art projects and small manipulatives. Free play in classrooms involved a free operant arrangement allowing children to choose among several activities often related to a thematic unit (e.g., during the gardening theme bins of dirt with seeds and plastic flowers). There was one head teacher, two to three teaching assistants, and between eight and 10 additional children present in the room during the classroom sessions. All classrooms had typical preschool classroom arrangement with small areas with thematic play areas, child-sized furniture, and age-appropriate materials.

Materials

Novel objects were placed in the environment during all sessions with the adult interventionist to serve as stimuli for joint attention interactions. Objects were rotated in sets of three to minimize preference effects and featured (a) one light up object (i.e., fiber optic lamp, glowing ball, fake jellyfish tank), (b) one silly stuffed animal (i.e., horse in a dress, multicolored pig, big bird), and (c) one flat or paper object (i.e., paper fish, unicorn star, jungle animal decoration). Items were interspersed around the space at a range of 3 to 6 feet from the participant, with a minimum of 2 feet between each object, so it was clear which object the child gaze-shifted toward. In addition, naturally occurring stimuli (e.g., children walking by, child artwork in the hallway) were capitalized on for providing opportunities for joint attention bids. During peer interventionist sessions in baseline, the same items were placed similarly in the designated area of the classroom, within the area and in normal eye range. Once peers entered the intervention phase, they were instructed to choose a location for the objects. If the peer selected a place for the stimuli that put it out of eye range or too close to another object, the adult interventionist would move the item to comply with previous item placement standards.

Cause and effect games were chosen to be the activity during most sessions. At the beginning of each session, participants were given the choice between the available games, including the following: (a) Don't Break the Ice™, (b) Jumping Jack™, (c) Hungry Hungry Hippos™, (d) Pop Up Pirate™, (e) Let's Go Fishin'™, and (f) Connect Four™. During peer sessions, target children selected the game they would play with the peer, or for classrooms where intervention took place during free play, the target child could also select from free play activities (e.g., sensory bin, block area). Learning centers included the "joint attention center," which consisted of the interventionist, peer, and target child engaging in play activities (e.g., sensory table, blocks, game) identified by prior preference assessment. Multiple-stimulus without replacement (MSWO) preference assessments as outlined by Carr, Nicolson, and Higbee (2000) were administered to both the target child and peer participants prior to baseline to identify mutually moderately preferred stimuli and games. A hierarchy of preference for all participants was established for both the joint attention stimuli and games. Stimuli and games that were moderately ranked (i.e., not the highest preferred and not the least preferred) were chosen. This was done to minimize the risk of participants being distracted.

General Procedures

Each total session was 30 min in duration. Each 30-min session included a 10-min session with the adult interventionist and target child (out in the hall), immediately followed by a 5- to 10-min session with the adult interventionist and peer interventionist (out in the hall). The last 10 min of the 30-min session was in the classroom with the target child and peer interventionist. Outside in the hall and within the classroom, joint attention stimuli were arranged to be within sight of the peer and target child. In the event of a peer absence, the adult interventionist portion of the study was still conducted.

Baseline with adult interventionist. The adult interventionist delivered intermittent joint attention bids and no systematic instruction (e.g., no prompts) in baseline. Specifically, while playing with the child, the adult interventionist delivered bids for joint attention at a rate of approximately once every 1 to 2 min (a minimum of five bids made per session). Bids were a simple point and/or gaze shift toward the object or event (e.g., toward a poster on the wall), with a verbal directive (e.g., Look at that dog!). If the child responded to the joint attention bid, the interventionist briefly commented on the object (e.g., "Yes, that's a blue light"), but no other programmed consequences were delivered. Small edibles were offered on a variable ratio-2 (VR-2) schedule following child compliance, such as staying at the table and following basic instructions (i.e., a reinforcer was delivered after the child completed 1–2 compliance requests correctly).

Baseline with peer. During baseline sessions with peer, the target child and peer engaged in an activity at the "joint attention center" within their classroom. The adult interventionist was present but only interacted with the dyad to ensure that participants remained in the designated area and to resolve any conflicts (e.g., sharing of materials). In the classroom, the adult interventionist provided edible reinforcement on a VR-2 to both participants for compliance. The peer was not prompted to point out the new objects to the target child during baseline; however, data were collected on rare instances of initiations of joint attention. For example, in one instance, a peer participant pointed to a picture of himself, said the target child's name, and then said, "Look!"

Intervention with adult interventionist. A least-to-most prompting hierarchy and edible reinforcement (VR-1 schedule) were used to teach joint attention skills. The prompting hierarchy involved (a) a gaze shift, (b) a gaze shift and point, (c) a partial physical prompt (i.e., child was tapped on the shoulder and asked to look), and (d) a full physical prompt (i.e., child's body was physically moved toward stimuli). The interventionist used a 3- to 5-s time delay. During intervention sessions, naturalistic teaching strategies were used such as remaining face-to-face with the child and expanding on the child's interests. A preferred edible was delivered once the child had engaged in the entire joint attention behavior chain (i.e., looked at the item and back at the interventionist).

Peer training. Peer training took place in the hallway and consisted of a social narrative, including (a) how to get the target child's attention and (b) how to direct attention toward an object/event (i.e., IJA) and social attention contingent on the child's RJA bids (e.g., "Let's play with the cool light"). The social narrative contained modified elements of the prompting hierarchy used by the interventionist. For example, the social story included the text, "When we want our friends to look at something, we can point at it," with visual supports. Directly following the social narrative, the peer was asked to answer simple comprehension questions (i.e., What do you do to show your friends cool things? What if your friend doesn't look?). If peer participants were not able to answer these questions, picture cards illustrating the correct answer to each comprehension question were used to prompt peer responding. The adult interventionist also asked the peer to "Show me how you'll show your friend what you see," and used modeling, feedback, social praise, and tangible reinforcers to teach the peer how to deliver a bid for joint attention. These sessions occurred before each peer-mediated intervention session and lasted approximately 5 to 10 min.

Peer-mediated intervention. Intervention sessions with the peer took place in the same environment as baseline sessions with the peer (i.e., classroom) within 15 min of intervention with adult interventionist. As in baseline, the adult interventionist was present to support play. The adult interventionist verbally reminded the peer to make a joint attention bid approximately once every 2 to 3 min if needed.

Response Measurement and Reliability

Adult intervention data. Target child data were collected as converted percentage of interventionist bids with a prompted or spontaneous joint attention response across a 10-min interval with bids presented approximately once every 1 to 2 min (i.e., a minimum of five bids per session). Data were graphed on the number of adult interventionist bids with a joint attention response divided by total adult interventionist bids and multiplied by 100 to calculate a percentage of bids with child RJA. Data were collected on level of interventionist prompt necessary to evoke a target child response, as well as the topography of joint attention behavior (e.g., gaze shift, head turn, body reorient). Least-to-most prompting was used as necessary within each teaching session. The least intrusive prompt (natural cue) was a gaze shift with verbal description (e.g., Look! A blue light!), followed by a gestural prompt (e.g., point and label), a partial physical prompt (e.g., tap shoulder, look!), and a full physical (e.g., turn child's body to face the object). Joint attention behaviors were operationally defined to include (a) eye gaze shift that occurred within 30 s of the bid and sustained for a minimum of 2 s, (b) head turn that occurred within 30 s of the bid and ended in the child turning his or her head until the object was in view, and/or (c) body reoriented which involved the child moving toward object until she or he was within 2 feet of object or the object was clearly in view. Gaze shifts, head turns, or body reorients toward the object or event after 30 s were not counted. Gaze shifts, head turns, or body reorients that did not terminate with the child looking at the object were not counted.

Peer intervention data. Data were graphed on the frequency of peer IJA to target child (i.e., how many bids were made in a 10-min period), as well as topography of child bid. A peer behavior was considered a bid for joint attention if the child (a) looked at an item or event and labeled it (e.g., Tiger) or other vocal response (e.g., Ahh!), (b) used an index finger or one or more hands to point/gesture toward an item, (c) attempted to show an item to peer (e.g., brought item closer to peer), or (d) led peer to item. Peer responses to adult interventionist prompts that did not attempt to gain the attention of the target child (e.g., the peer brought the item to the interventionist or showed the interventionist) were not counted. Additional data were collected on peer task fidelity using a five-item peer task fidelity checklist (i.e., peer provides sufficient bids for IJA, peer repeats bid if target child does not respond, peer stays in play area, peer engages in same materials as target child, peer reinforces response to bids). Data were collected for response to peer bids using the same operational definitions and procedures as in sessions with the adult interventionist.

All data were collected in vivo by a trained data collector, with video recording for interobserver agreement (IOA) captured using a MacBook Pro® laptop computer with the Quicktime® program. A data collector was present at all sessions to take data on interventionist treatment fidelity and child behavior. Adult interventionist procedural fidelity, child data, and peer interventionist treatment fidelity data were taken in vivo with pen, paper data sheets, and smartphone timers. For five of the seven participants, IOA was collected from videos by a second independent trained observer. Both parents of the target children in Classroom B did not provide consent for videos. For that reason, IOA was conducted on those children's data in vivo by a second independent observer. IOA was calculated point by point for 57% of baseline sessions. IOA was 87.5% (range = 75%–100%) during baseline. IOA was calculated for 35.4% of intervention sessions; IOA was 96.0% (range = 81%–100%) for these sessions.

Procedural and Treatment Fidelity

Interventionist procedural fidelity. Interventionist procedural fidelity was gathered for 100% of sessions by an independent observer, using checklists created by the first author. During baseline, interventionist procedural fidelity was collected

using a nine-item task fidelity checklist. The baseline task fidelity checklist ensured that the interventionist did not use teaching procedures and provided bids for joint attention. Baseline adult interventionist treatment fidelity was an average of 97.3% across all participants (range = 88%–100%). During intervention, interventionist procedural fidelity was collected using a 10-item task fidelity checklist. Interventionist procedural fidelity monitored use of the correct prompting hierarchy, time delay, and reinforcement procedures. Mean interventionist procedural fidelity for intervention with the target child was 98.85% (range = 88%–100%). Interventionist procedural fidelity for peer training using the social narrative was 100%.

Peer interventionist treatment fidelity. During baseline, all participants scored 16.7 % on the treatment fidelity checklist for all sessions (i.e., the peer participants did not receive any points on the five-item task fidelity checklist except for the item "peer remains in the play area"). During intervention, peer participants had an overall average of 79.8% (range = 50%–100%).

Social Validity

Social validity was measured using an author-modified version of the Treatment Acceptability Rating Form–Revised (TARF-R; Reimers & Wacker, 1988). The TARF-R is a brief (20 question) Likert scale questionnaire and was completed by teachers after the intervention was complete. This form asked teachers to rate their perceptions of the utility, acceptability, and feasibility of these intervention goals, procedures, and outcomes. For example, the questionnaire asked, "How acceptable did you find this joint attention intervention for your classroom?" The lowest scores were on the item "how well did the student use the skills gained from this intervention in the classroom." Anecdotal teacher reports indicated that they did directly observe the intervention and so were unsure whether the results were evident in the classroom.

Data Analysis

Line graphs were examined using visual analysis for immediacy effect, level, trend, variability, overlap, and vertical analysis. Following visual analysis, Tau-U was calculated for all A-B comparisons using the calculator available at singlecaseresearch.org. Tau-U is a nonoverlap measure with some limited ability to control for trend in baseline (Parker, Vannest, & Davis, 2011). Weighted, averaged Tau-U was calculated across tiers within graphs.

Results

Results of Sessions With the Adult Interventionist

Figure 1 displays the data of adult interventionist sessions for the first design (multiple baseline). Data indicated a strong functional relation because of change in level and trend for all four participants with no overlapping data. Arthur's independent responding in baseline averaged 39.8% (range = 33%–42%), and during intervention Arthur independently responded to an average of 73.9% of bids for joint attention (range = 50%–100%). Emily's baseline data indicated some initial upward trend. Emily's mean score during baseline was 30% (range = 15%–38%). Following intervention, Emily's independent responding showed an immediate increase in level with an average of 84% of bids for joint attention (range = 75%–100%). Oliver's baseline data indicated high levels of variability, but had an average of 30% (range = 13%–46%). Oliver's intervention data had a mean of 92% (range = 80%–100%). Finally, Jason had a low overall baseline (range = 0%–27%) with some upward trend. Jason's intervention average was 54% (range = 45%–75%). A vertical analysis revealed no change in baseline data concurrent with intervention in other tiers. Weighted, averaged Tau-U across tiers was 1.0 (strong effect for all participants).

Figure 2 displays the data for the adult interventionist session for the second design (multiple probe) which had three participants. Participant dyads "Trevor and Jacob" and "Quinn and Theo" had consistent absences and scheduling difficulties, so data were taken on a probe schedule. Visual analysis of this multiple-probe design indicated three basic effects across three points in time. There were no overlapping data between baseline and intervention phases. Aiden's baseline data initially showed substantial increasing trend. However, prior to intervention, a decreasing trend was observed. Aiden's level of RJA behaviors during baseline had a mean of 37% (range = 20%–60%). Following intervention, Aiden's independent RJA was at a mean of 74.20% (range = 67%–86%). Trevor had high initial independent responding in baseline with a mean of 44% (range = 18%–54.8%). Following intervention, Trevor's data had a mean of 76% (range = 56%–86%). Finally, Quinn's baseline data had an average of 48% (range = 31%–58%). Quinn responded independently to bids from the interventionist during intervention at a mean of 73% (range = 61%–88%). Weighted, averaged Tau-U was 1.0 across tiers, suggesting a strong effect.

Results of Peer-Mediated Sessions

Figure 3 displays the data of the peer-mediated intervention for the first design (multiple baseline). Following intervention, Martin provided between three and seven bids for joint attention per session, with an average of five bids per session. Arthur's response to peer data was at zero levels in baseline. Arthur's mean response to peer bids after intervention was 66.1% (range = 38%–80%). During baseline, John provided zero bids for joint attention.

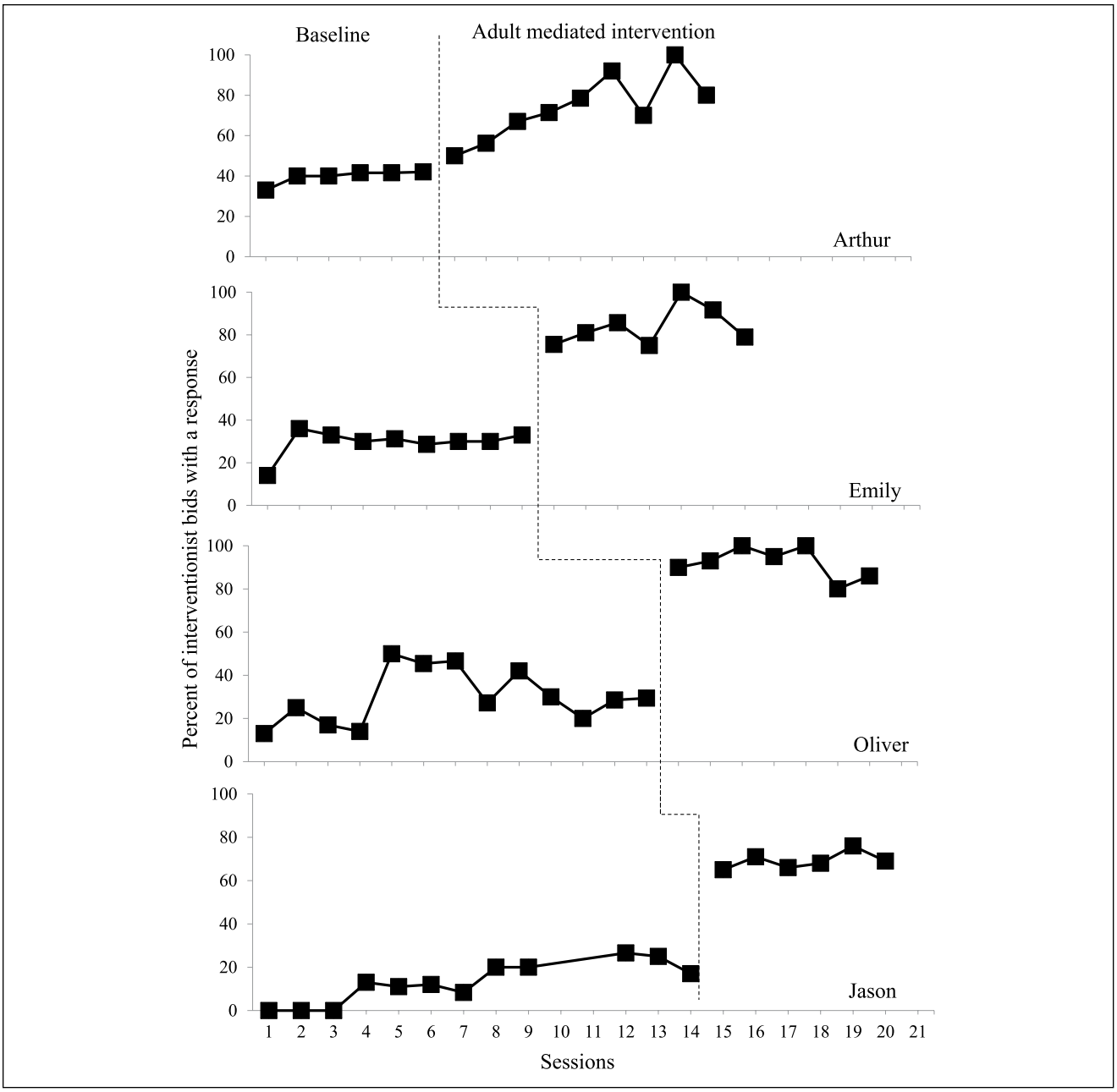

Figure 1. Target child response to adult interventionist bids for Arthur, Emily, Oliver, and Jason.

Following intervention, John initiated between three and five times per session, with an average of four times per session. Emily's response to peer data was at zero levels in baseline. Emily responded to 100% of the bids made by her peer during intervention. Her mean response was 100%. During baseline, Lucas provided just one bid for joint attention, to which Oliver did not respond. Following intervention, Lucas made between three and six bids per session, with an average of four bids per session. Oliver's response to peer bids data was at zero levels in baseline. Oliver's mean response to peer bids for joint attention was 84% in intervention (range = 60%–100%). During baseline, Michael provided zero bids for joint attention. Following intervention, Michael provided between four and five bids for Jason's attention. Jason's response to peer bids data was at zero levels in baseline. Jason's average response to peer bids across these three intervention data points was 58.3% (range = 50%–75%). A vertical analysis indicates no change in baseline data concurrent with intervention data in other tiers. Weighted, averaged Tau-U across tiers was 1.0. During baseline, Martin provided no initiations for joint attention.

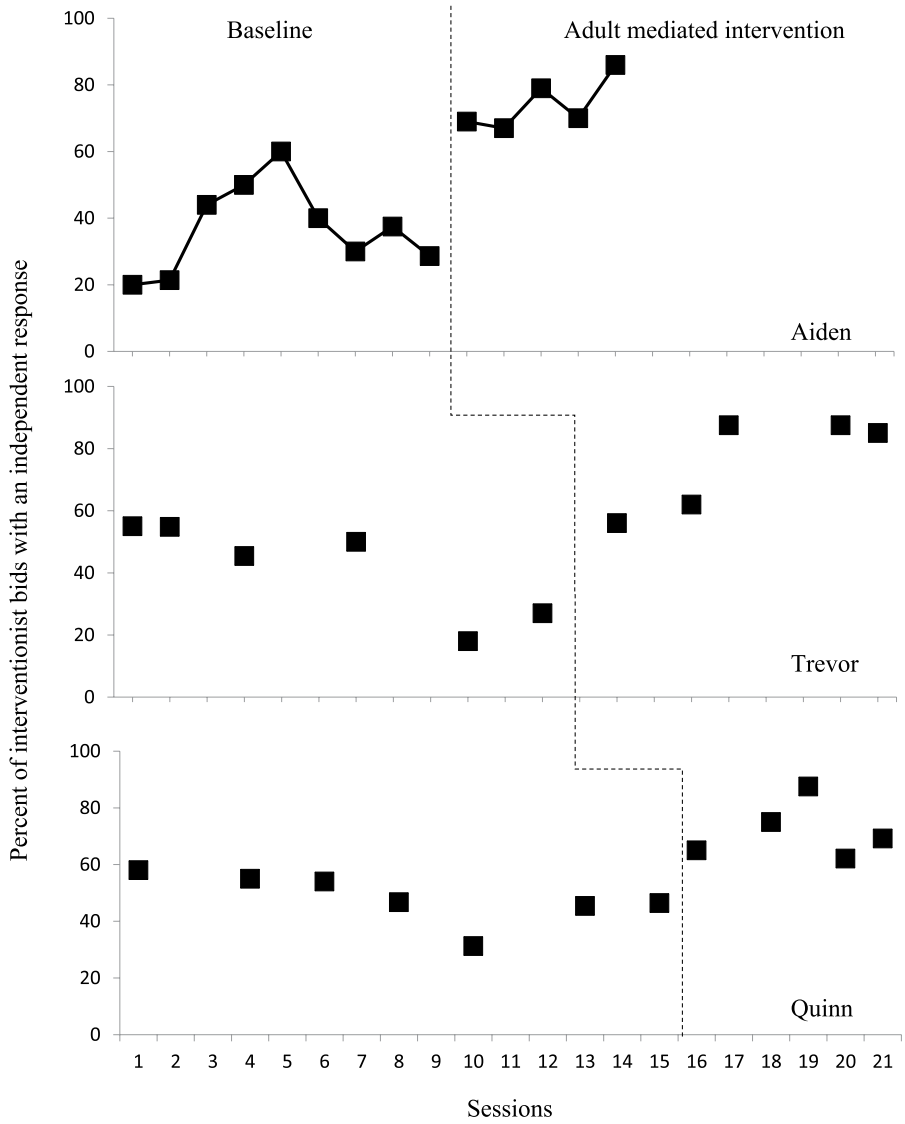

Figure 2. Target child response to adult interventionist bids for Aiden, Trevor, and Quinn.

Figure 4 displays the data of the peer-mediated intervention for the second design (multiple probe). During baseline, Mario provided no bids except during one session where he provided three bids for joint attention, of which Aiden responded to one. Following intervention, Mario provided between four and five bids for joint attention, with an average of four bids per session. Aiden's response to peer bids was at zero levels in baseline. After intervention, Aiden's average RJA was 80% (range = 40%–100%). During baseline, Jacob provided zero bids for joint attention. Following intervention, Jacob provided between three and five bids for joint attention, with an average of three bids per session. Trevor's response to peer bids was at zero levels in baseline. Trevor's response to peer bids averaged 88% (range = 44%–100%). During baseline, Theo provided no bids for joint attention. Following intervention, Theo provided three bids per session for three consecutive sessions. Quinn's response to peer bids was at zero levels during baseline. All three data points collected after intervention were at 100%. Vertical analysis indicates no change in baseline data concurrent with intervention data in other tiers. Weighted, averaged Tau-U across tiers was 1.0.

Social Validity Results

Teacher report of the acceptability and feasibility and overall effectiveness of this intervention were generally high. The average response on a 1- to 5-point Likert-type scale, with 1 being *least acceptable* and 5 being *most acceptable*, was 4.22 (range = 2–5) across all 17 items for all four classroom teachers.

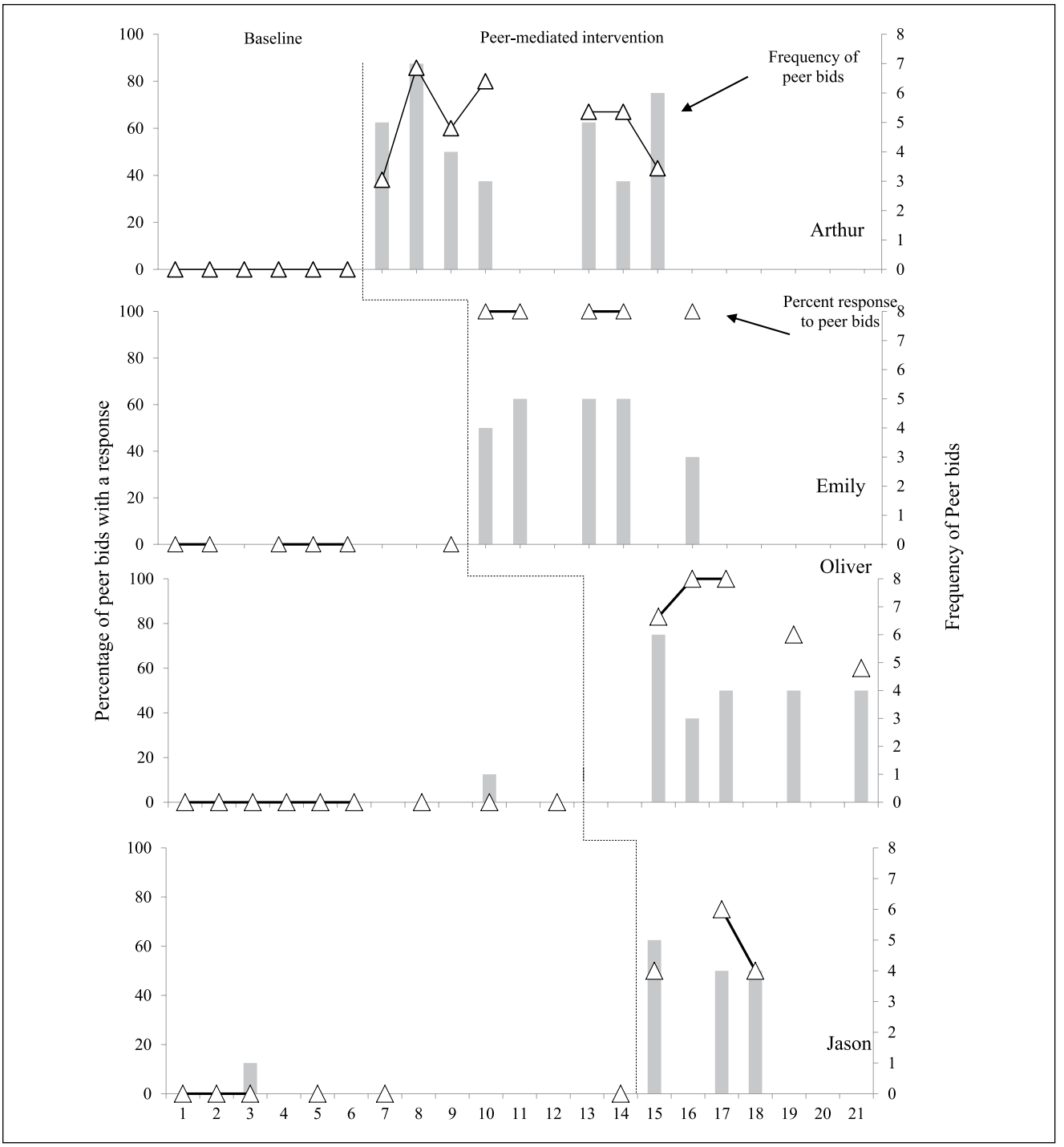

Figure 3. Response to peer bids for Arthur, Emily, Oliver, and Jason.

Discussion

Early social communication skills, comprising skills such as social referencing, social orienting, joint attention, and joint regard, are of interest because they are theoretically linked to later social communication skills (DeQuinzio, Poulson, Townsend, & Taylor, 2016). Despite their pivotal nature, assessment of these skills decreases after the toddler years in lieu of more advanced social communication skills, including taking turns and developing play skills (White et al., 2006). Early childhood teachers and special education practitioners should consider including screening for joint attention and other early social communication skills even if other more advanced social skills are observed. As joint attention is a

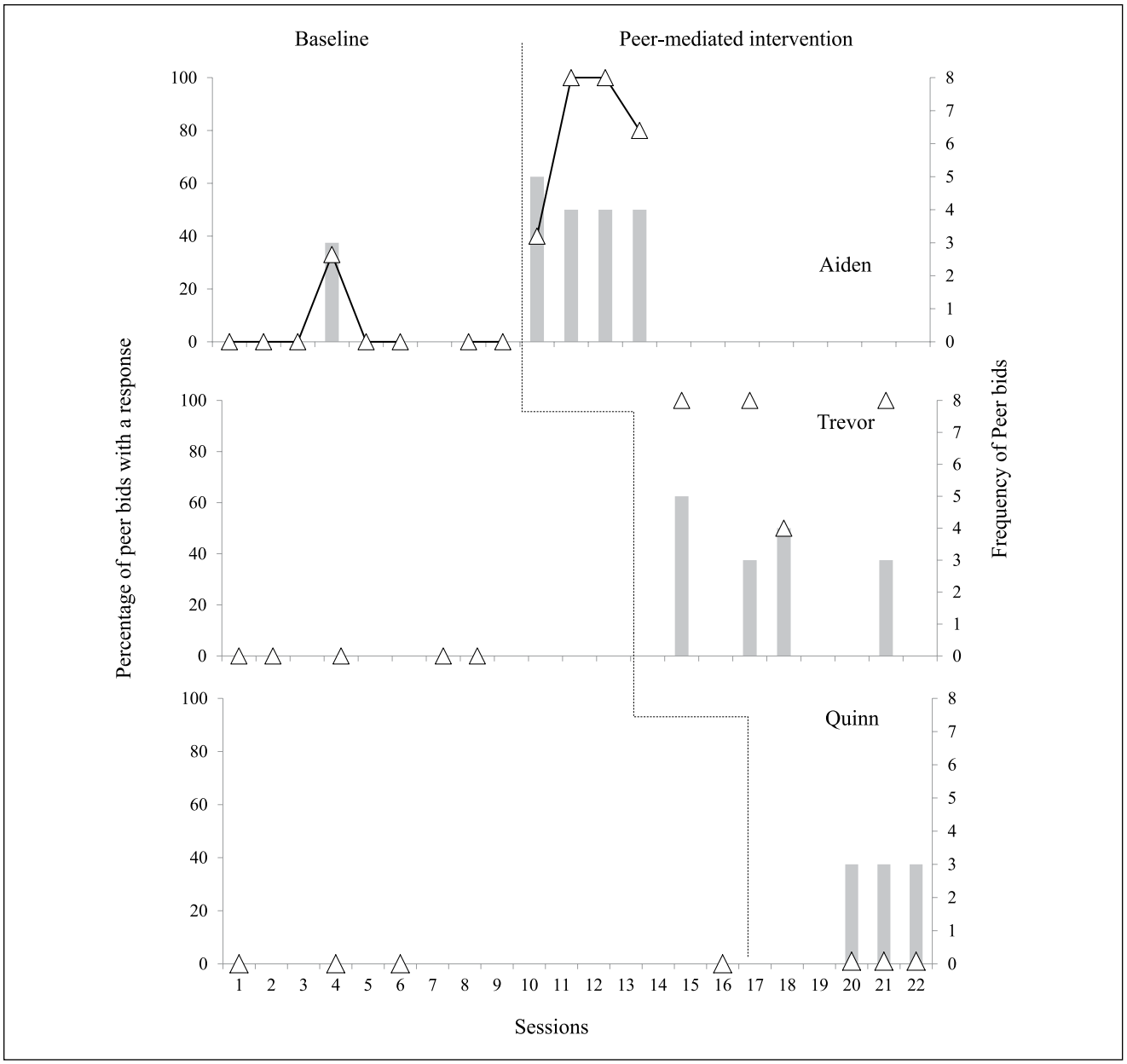

Figure 4. Target child response to peer interventionist bids for Aiden, Trevor, and Quinn.

foundational skill, failing to screen and intervene early may hinder the development of more advanced social skills or contribute to the development of rote communication due to a lack of social opportunities. A large proportion of preschool-aged children with ASD have not yet developed complete joint attention (Sullivan, Mundy, & Mastergeorge, 2015), and research indicates that joint attention skills acquired earlier in childhood are significantly predictive of later preschool success. Early intervention on joint attention may be critical for optimized learning in early childhood settings.

In terms of generalization and maintenance of social communication skills, use of peers as interventionists or involving peers in intervention shows promise (i.e., Watkins et al., 2015). Peers are uniquely able to intervene on and reinforce behaviors that occur naturally and are socially valid (McFadden, Kamps, & Heitzman-Powell, 2014). Friendships and peer networks begin to develop in preschool, and adults may not be privy to idiosyncrasies of the classroom environment. For classrooms providing support in multiple domains for multiple children, training peers to teach skills like joint attention can increase intervention dosage for target children by providing more opportunities to respond. Results of this study add to a previous body of research that indicates peers may be useful to teach ecologically valid early social communication skills.

It is of particular interest that few bids to target children were made by peers during baseline in the current study. There is reason to believe that failure of peers to initiate joint attention to children with ASD, as seen in baseline in this study, could be a result of learning history. From a behavior-analytic perspective, the presence of an interesting event or object could serve as an establishing operation for gaze shifting or IJA behavior because there is a value-altering effect on the reinforcement available for the IJA (e.g., a subsequent gaze shift or comment from another individual, or in the case of preschoolers, a possible play exchange). It may be that children with ASD who have not been supported to learn to respond to joint attention bids are failing to respond consistently, providing insufficient reinforcement for their peers to continue making bids. Over time, failure to respond may extinguish joint attention initiation from peers. The data from the present study suggest that reinforcing peer attempts to make bids to target children may be sufficient to increase overall bids from peers to children with ASD.

The use of peers as natural change agents makes this study novel given the small body of related literature. Peers are a logical choice as interventionists on social communication skills and may provide increased opportunities for intervention because of the time spent with peers in the preschool classroom. Despite the social and ecological validity of using peers as interventionists, the existing body of literature on peer interventionists for this age group is varied in efficacy and rigor. One methodological shortcoming in the literature on peer-mediated intervention for young children is the lack of data collection on peer treatment fidelity and peer characteristics. Peer treatment fidelity during this intervention was somewhat variable (M = 78%, range = 50%–100%), which was likely due largely to the difficulty of capturing consistent peer motivation in a play scenario. Future research should examine the differences in peer fidelity more closely to determine key factors of this intervention. Without an understanding of the fidelity of peer-mediated interventions, it is difficult to interpret results in terms of the efficacy. A recent literature review on peer-mediated interventions for children with ASD found that there was a dearth in data-based interventions using rigorous assessments in this body of literature, including the use of treatment fidelity for peer interventionists (Huber & Carter, 2016). Providing feedback on treatment fidelity proves potentially more difficult with young children, and future research should consider simplified self-monitoring to ensure consistency.

The current study had some limitations. This intervention assessed stimulus control transfer of a RJA behavior from one-on-one sessions with the adult interventionist in a controlled environment to the classroom context with a peer participant. Despite the generalized setting, participation with peers in the classroom was still highly controlled (i.e., took place in a particular part of the classroom, involved one peer, usually centered around one activity). Feedback from classroom teachers included that they would prefer future interventions being more integrated into the activities of the classroom (e.g., involved more than one peer or situated the dyad in a whole-class activity).

Further limitation comes from the presence of the interventionist. Because the interventionist was constant between the hallway sessions with the target child and the "push-in" sessions with the peer, there is no evidence in this study that the gains noted in both settings were not influenced by the presence of the interventionist (i.e., the interventionist served as a discriminative stimulus for target child and peer behavior). Future research should consider training teachers or teacher assistants to prompt peers to initiate joint attention to alleviate the concern that the interventionist was the true discriminative stimulus for RJA behaviors.

The role of reinforcement is an area of need for future research. If we assume the motivating operation that is typically at play during joint attention is absent for children with ASD (i.e., the value of the adult social reinforcement and the rate of child joint attention are not temporarily increased by the interesting event), then it might be necessary to pair delivery of adult social attention with additional primary or secondary reinforcers. In a previous study (Hansen et al., 2018), joint attention was successfully taught only with contingent descriptive praise, but the gains were considerably smaller than those observed in the present study. While some of this variance could be due to the use of parent interventionists who might have been considerably less precise than a trained interventionist, the joint attention skill was still acquired more quickly with a tangible putative reinforcer. Future research should examine conditioning of social interaction as a reinforcer.

Finally, because the literature so clearly illustrates that joint attention is a pivotal social communication skill necessary for improved social functioning, and this study indicates there is promise for use of this intervention in preschool settings, more research on the immediate impact of teaching this skill on other social communication skills is of interest. Future research may examine a comparison between a targeted joint attention intervention and a packaged social communication intervention with more global targets to inform the sequence of social communication development and the proximal impact of instruction on a pivotal skill on later developmental skills. While it is evident that joint attention and other social communication skills are valuable for later social skill development, the exact link is as of yet unexamined.

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