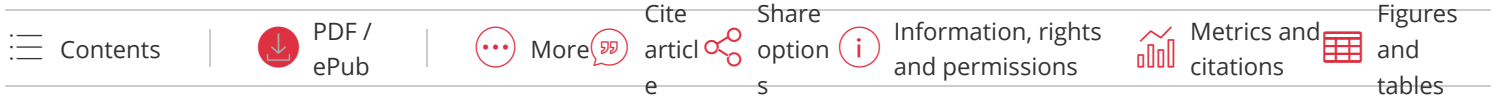


Impact Factor: **4.091**5-Year Impact Factor: **5.587**

Abstract

Individuals with autism spectrum disorders (ASD) often have difficulties initiating and maintaining reciprocal conversations with others. In this study, we examined if an interdependent group contingency would improve reciprocal conversation of children with ASD when they were paired as conversational partners. We also assessed children's social preference through their choices between spending time with their peers or by themselves. In a multiple-baseline design, we found that the group contingency immediately produced independent reciprocal conversational responses, sustained conversational exchanges, and increased preference for peers across all participants. Improvements were further maintained even after the group contingency was removed and novel peers were introduced.

Impairments in social, communication, and pragmatic skills are common in children with autism spectrum disorder (ASD; e.g., [Hale & Tager-Flusberg, 2005](#); [Jones & Schwartz, 2009](#); [L. K. Koegel et al., 2014](#)). Specifically, their conversation is often characterized by brief responses, acontextual speech, a lack of information sharing, and few conversational exchanges ([Jones & Schwartz, 2009](#); [L. K. Koegel et al., 2014](#)). These challenges may be related to their difficulties in reciprocal social conversation, where they need to initiate, respond to, and establish a to-and-fro pattern of reciprocity to sustain the conversation ([Hale & Tager-Flusberg, 2005](#); [Jones & Schwartz, 2009](#)). If unaddressed, these deficits can limit the opportunities for children with ASD to engage in social reciprocity and interaction and, in turn, interfere with their friendship development ([Kasari et al., 2012](#); [Locke et al., 2013](#)), increasing the likelihood of social withdrawal and isolation that may persist into adulthood ([Bambara et al., 2018](#); [L. K. Koegel et al., 2014](#)). Targeting reciprocal social conversation in early intervention for children with ASD may be important for establishing their current and future social relationships.

A number of studies to date have explored instructional procedures to improve social conversations of individuals with ASD. For example, in a review by [Hughes et al. \(2012\)](#), they found direct instruction, problem-solving instruction, social stories, and self-management have been used to address various conversational components (e.g., initiation, responsiveness, conversational turns, etc.) for secondary students with ASD and related developmental disabilities. More recently, [Bambara et al. \(2016\)](#) examined the effects of a peer-mediated instruction on reciprocal conversational components (e.g., initiations, responsiveness, and question asking) in adolescents with ASD and found all their participants with ASD had improved performance.

Reciprocal Social Conversation Framework for Children With ASD

Few studies, however, have addressed reciprocal conversation in children with ASD. Among them, [L. K. Koegel et al. \(2014\)](#) used a reciprocal conversation framework consisting of (a) on-topic question answering, (b) response elaboration, and (c) reciprocal question asking, which may promote a to-and-fro conversational exchange pattern. They taught two children and one adolescent with ASD to self-monitor the three components. During the intervention, while an adult conversational partner asked the participants a series of researcher-prepared questions, the participants used a sheet to record if they had completed all three components. L. K. Koegel et al. found improvement across targets and participants. Despite a decreased performance in generalization probes, their participants still demonstrated higher levels of correct responses during generalization and follow-up probes than the baseline. However, because an adult served as their conversational partner, it was difficult to assess if the improvement also generalized to their peers.

Interdependent Group Contingency to Promote Communication Skills

While adults can improve reciprocal conversations of children with ASD, arranging similar-age peers as conversational partners, as in [Bambara et al. \(2016\)](#), may be more appropriate as it further promotes children's with ASD social initiation and interaction with their peers ([R. L. Koegel et al., 2012](#)). Given that typically developing peers may not be present where children with ASD receive early behavioral interventions, children with ASD can serve as conversational partners for each other. In this case, practitioners may be able to improve the reciprocal conversational skills of two children at the same time. One intervention that could simultaneously address behaviors of multiple children is an interdependent group contingency ([Litow & Pumory, 1975](#)). In an interdependent group contingency, rewards are delivered to a group of individuals based on their group performance. That is, the response contingencies are in effect for all members of a group at the same time. For example, a teacher may require each student in a class to complete a worksheet before a reward can be delivered to all students in the class. In a meta-analysis by [Little et al. \(2015\)](#), the interdependent group contingency was found effective in addressing a variety of targets with school-age children, including academic performance, social interactions, and physical activities as well as disruptive and on-task behaviors. Similarly, [Pokorski et al. \(2017\)](#) reviewed studies that recruited preschool-age children and found the interdependent group contingencies effective in improving targets, including social interaction, compliance, and inappropriate behavior.

Few interdependent group contingency studies targeted the social communication skills of children with disabilities. [Lefebvre and Strain \(1989\)](#) examined the effects of the interdependent group contingency on the frequency of verbal initiations and responses of three children with disabilities. One child among their participants demonstrated the behaviors associated with ASD. Triads were arranged and included two typically developing peers and one target child. Prior to their group-contingency sessions, children in the triads were verbally instructed to demonstrate the social interactions to a predetermined criterion before they could receive the reward they voted on. Using an ABAB design, Lefebvre and Strain showed that their participants with disabilities increased their social initiations and responses when the group contingency was in effect. [Kohler et al. \(1995\)](#) also examined the effects of the interdependent group contingency on social initiations and responses of three children with ASD and six of their typically developing peers using the ABAB design.

PDF

Help

Privacy

to [Lefebvre and Strain \(1989\)](#), Kohler et al. found an increased level of interactions between children with ASD and their peers when the group contingency was in place. They further observed that the group contingency was also effective in increasing supportive prompts delivered by the typically developing children to promote social interactions of their peers with ASD. Given its effects on social communication and interaction of multiple children in a group, it may be possible for the interdependent group contingency to effectively improve reciprocal conversation of children with ASD even if they are the only group members.

Interdependent Group Contingency and Social Preference

Besides its direct effects on the target behavior, the interdependent group contingency is also known to produce collateral benefits. In a meta-analysis by [Smith et al. \(2019\)](#), they found reduced shyness and social withdrawal of children as rated by their peers in four studies. Smith et al. hypothesized that the reduced social withdrawal might be due, in part, to the social interaction and cooperation among children as promoted by the group contingency. This finding may be particularly relevant to children with ASD. Although heterogeneity exists among them, researchers have often reported their lack of social preference or motivation for social interaction (e.g., [Call et al., 2013](#); [Deckers et al., 2017](#); [Gale et al., 2019](#)). Increased preference for peers may be beneficial as it could lead to a higher likelihood for children with ASD to initiate social interactions, further fostering their friendship and social development as well as reducing the risks of social isolation.

Despite the large sample size in the four studies reviewed by [Smith et al. \(2019\)](#), none of them reported the inclusion of children with ASD or related developmental disabilities. Thus, it is unclear if any children with ASD participated in these studies and, if so, to what extent their social preference changed. Furthermore, while peer ratings may be more feasible for larger sample sizes, this instrument measures peer perception and, therefore, is subject to individual bias and may not be accurate in detecting ongoing changes in social preference of individual target children ([Kazdin, 2011](#)). Instead, a direct assessment that allows children to make choices may be more valid and reliable in revealing individual social preference.

Another potential factor that may influence social preference in a group contingency is the reward selection. [Pokorski et al. \(2017\)](#) found that activities (e.g., dance party and classroom games) have often been used as rewards during the interdependent group contingency. It is possible that peers (i.e., previously neutral stimuli) can be paired with the reward activities (i.e., reinforcers) to become conditioned reinforcers. Indeed, as one of the steps to gain instructional control, practitioners are commonly advised to associate themselves with reinforcers, such as fun activities, to condition themselves as reinforcers (e.g., [Barbera & Rasmussen, 2006](#); [Sundberg & Partington, 1998](#)). Similarly, [Taylor et al. \(2005\)](#) comment that teaching children with ASD to respond to requests from their peers may establish their peers as conditioned reinforcers. Thus, arranging rewards that require interactions between children would likely produce an increase in social preference of children with ASD for their peers as a result of pairing.

The Present Study

Although group contingencies are well researched and regularly used in the school settings ([Pokorski et al., 2017](#)), no group-contingency studies to our knowledge have addressed reciprocal social conversation and social preference of children with ASD, especially when they are the only members in the group. The interdependent group contingency could be an efficient procedure to promote conversational skills of

multiple children with ASD at the same time, particularly when typically developing peers are not available. Thus, the first purpose of the study was to assess if an interdependent group contingency increases reciprocal conversation of children with ASD when paired as conversational partners. We adopted the reciprocal conversation framework by [L. K. Koegel et al. \(2014\)](#). Each reciprocal conversational response in this study also comprised three components: answering the question, on-topic elaboration, and a follow-up question. Children in a dyad were each given seven opportunities to demonstrate the reciprocal conversational responses, and each child needed to perform at least six responses before a reward was delivered. Because each reciprocal conversational response started with an answer and ended with a question, we expected the children to continue their conversational exchanges. If no question was asked, we prepared questions that they could use to ask their peers. Because the participants' conversational exchanges would end each time they did not initiate a question using this framework, we also examined the effects of the interdependent group contingency on the number of questions initiated by the participants relative to the questions provided by the instructor as a measure for their continued conversational exchanges. In this case, the more questions from the participants and the fewer questions provided by the instructor, the longer their independent conversational exchanges were.

The interdependent group contingency could be an efficient procedure to promote conversational skills of multiple children with ASD at the same time

The second purpose of the study was to examine if children's preference for their peers was affected by the interdependent group contingency. Instead of using peer rating as reported in [Smith et al. \(2019\)](#), we directly measured the preference by asking our participants to select whether they would like to spend some time with their peers (i.e., peer option) or by themselves (i.e., alone option). We further arranged the rewards that specifically required interactions between the children to foster the pairing process. Thus, we addressed the following two research questions in the present study:

1. What are the effects of an interdependent group contingency on reciprocal social conversations of dyads that consisted of only children with ASD?
2. What are the effects of the interdependent group contingency on children's social preference?

Method

Participants

Five boys and two girls participated in this study. All participants were recruited from a center in China that provided early behavioral intervention programs for children with ASD. Six participants were diagnosed with ASD by pediatricians in the local hospitals based on the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; [American Psychiatric Association, 2013](#)) and received behavioral services at the center. In addition to their diagnosis, we selected participants who, per their behavior therapists, were able to answer questions, expand their sentences, and ask questions when instructed in order to examine the effects of the interdependent group contingency without the influence of any additional interventions required to

PDF

Help

each component. After the six participants had enrolled in the study, we assigned them to form three conversational dyads. The remaining participant was a typically developing girl who attended the center's inclusive group-instruction sessions. Next is detailed participant information.

Dyad 1

Two boys, Feng and Wang, formed Dyad 1. Both boys attended the same kindergarten in addition to the center at the time of the study. They were often placed in the same classroom in their kindergarten and also met each other at the center. However, they had not been seen engaging in social interactions with each other. Feng was 5 years 5 months old and had been receiving behavioral interventions for approximately 3 years. He had a relatively advanced command of language with a vocabulary comparable to his typically developing peers. For example, he could describe objects, pictures, and people fluently with correct adjectives and adverbs. He was also able to request information using *wh*- questions and use sentences of eight to 10 words. Additionally, he could answer questions about his experiences as well as past, current, and future events. However, his therapists and parents reported that he often avoided interaction with his peers. Wang was 5 years 8 months old and had received behavioral services for more than 3 years. Although his language skills were not as sophisticated as Feng's, Wang was able to speak sentences of four or five words and ask *wh*- questions. He could also answer questions about events at different points of time. Although both participants were able to answer peer questions, they rarely initiated questions to their peers, asked follow-up questions, or continued on-topic conversations independently.

Dyad 2

Similar to Dyad 1, two boys formed Dyad 2. Dan was 6 years old and Lang was 5 years 10 months old. Both boys were attending kindergarten in addition to the center. Dan had behavioral services for approximately 3 years, and Lang had been receiving behavioral interventions for less than 2 years. Both boys had a similar level of verbal repertoire. Specifically, they were able to describe objects, pictures, videos, and events; ask information using *wh*- words; use sentences of six to eight words; and answer questions about their experiences using various responses. Their parents and therapists at the center reported that although they could answer peer questions, they rarely asked their peers questions, and they were not able to continue their conversations independently.

Dyad 3

Dyad 3 consisted of a girl and a boy. Tan was an 8-year-old girl. She was attending elementary school and came to the center for social-skill training during weekends. She had a relatively sophisticated command of language as compared to the other five participants. For example, she could use sentences of more than 10 words to describe environmental events, make verbal requests for tangibles and information, tell a simple story that she had previously read or heard, and answer questions using different responses. She could also maintain conversations briefly but needed additional directions to elaborate on a comment or initiate questions to her peers. Ken was a 4-and-half-year-old boy. He was attending kindergarten for a half-day inclusive program and the center-based behavioral programs for the remainder of the day. Prior to the study, he had been receiving behavioral intervention programs for 6 months. He could label objects and events around him, make verbal requests using three to five words, and answer questions relating to event

different points of time. He was also able to answer peer questions but did not sustain conversations or ask his peer questions.

Typically developing peer

Mei was a 6-year-old typically developing girl. She attended the center’s inclusive group sessions as a peer for facilitating school readiness and social skills of children with ASD. According to the center staff, she was interested in socializing with her peers with ASD and often made attempts to interact with them. Mei attended the group sessions with five of the participants (Feng, Wang, Dan, Lang, and Tan) but her interactions with them were limited to being a peer model. Additionally, Mei had not interacted with Ken before the study.

Instructor and setting

A behavior therapist at the center implemented all the sessions. She had approximately 6 years of experience working with children with ASD and had conducted both one-on-one and group-based interventions before the study. All sessions were conducted in the instructional rooms used for behavioral interventions. Each room was measured approximately 8.2 ft by 11.5 ft and had a table, a couple of chairs, and a whiteboard. The instructional rooms also contained items that our participants could engage with (e.g., paper, crayons, children’s books, etc.).

Materials

Instructor-prepared questions

We prepared a total of 28 questions before the start of the study (see [Table 1](#)). These questions were used to start a conversation when the participants did not initiate a question during a session. We asked each participant’s parents and therapists to come up with a list of the questions and then randomly selected 28 questions that all participants were able to answer. These 28 questions were further divided into two sets of 14 questions: the intervention question set used during the interdependent group-contingency phase and the generalization question set to assess if participants continued to perform their responses when we changed questions.

Table 1. Instructor-Prepared Questions.

Intervention question set	Generalization question set
<ol style="list-style-type: none"> 1. Which cartoon do you watch? 2. What are your favorite animals? 3. What snack do you like the least? 4. What vehicles do you like to ride in? 5. What veggies do you eat? 6. What reward do you want from the teacher? 7. What do you do if you are lost? 8. What makes you happy? 9. Where do you like to shop? 10. What do you like to drink? 11. What animals do you like the least? 12. Where do you want to go on holiday? 	<ol style="list-style-type: none"> 1. What do you like to learn? 2. What fruit do you like the least? 3. Where do you go on the weekends? 4. What do you do at home? 5. What pets do you have? 6. What is your favorite season? 7. Which restaurants do you often go to? 8. What do you want to do when you grow up? 9. Whom do you listen to at home? 10. What do you feel if you are not well? 11. What are your favorite toys? 12. What kind of dishes do you like the least?

PDF
Help

Intervention question set

Generalization question set

13. What kind of weather do you like?
14. Which sports do you like?

13. Where were you injured before?
14. Which snack do you like?

Scoring chart

We used a scoring chart during the interdependent group contingency (see [Figure 1](#)). The chart consisted of participants' names in a dyad and the three components in each reciprocal conversational response: answer the question, elaborate your answer, and ask a question (see dependent measures below for the operational definitions). During the intervention, we marked either a check or a cross for each component to indicate correct or incorrect performance regardless of whether it was independent or prompted. Finally, we also drew either a happy or sad face for a correct or incorrect reciprocal conversational response.

	Feng	Wang	Feng	Wang	Feng	Wang	Feng	Wang	Feng	Wang	Feng	Wang	Feng	Wang
answer the question	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
elaborate your answer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
ask a question	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓
reciprocal conversational response	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😞	😊	😊	😊

Figure 1. A completed scoring chart for Dyad 1 in Session 18. A check represents a correct component, and a cross represents an incorrect component performed by a participant. A happy face represents a reciprocal conversational response completed correctly, and a sad face represents a response completed with at least one incorrect component.

Rewards

We arranged interaction rewards as the consequences after both participants in each dyad met the predetermined performance criterion (i.e., six out of seven opportunities). For the reward options, we interviewed each participant's parents and therapists and obtained a list of food items, toys, and games that served as reinforcers during their behavioral interventions. Prior to each group-contingency session, we presented an array of three to five reward options for both participants to vote on. Regardless of their choices, we arranged these rewards to require social interaction. For example, we used the games that required multiple players. If the children chose snacks or toys, they were given each other's preferred items. In this case, they must request their preferred items from their peers and share their peers' preferred items.

PDF
Help

Social preference evaluation pictures

To facilitate social preference evaluation, we printed a picture of the instruction room for the alone option and pictures of the six participants for the peer option. During the social preference evaluations, we presented a picture of the instruction room and a picture of the peer in the dyad for the participants to choose from.

Dependent Measures

We arranged three dependent measures to examine the effects of interdependent group contingency on the reciprocal conversation. First, we measured the percentage of independent reciprocal conversational responses and components performed correctly by each participant across sessions. As in [L. K. Koegel et al. \(2014\)](#), each correct reciprocal conversational response consisted of three components. Each participant needed to (a) give an on-topic answer to their peer's question, (b) elaborate their answer while staying on topic, and (c) ask their peer an on-topic question. On-topic answer, elaboration, and question asking were operationalized as responding with information corresponding to the question from the peer (peer initiated or instructor provided), adding more information relevant to the preceding component (i.e., answer), and presenting a question to the peer related to a preceding component (i.e., answer or elaboration) or the peer's initial question, respectively. Additionally, participants needed to perform the component within 5 s following a preceding component or peer question. For example, if a peer asked the question, "What animals do you like?" the participant should give an answer connected to the animals (e.g., "I like rabbits") within 5 s of the peer question and provide additional information corresponding to their answer (e.g., "They are furry to touch" or "They are cute"). Last, the participant needed to ask a question relevant to their elaboration (e.g., "What furry animals do you like?"), answer (e.g., "Do you like the rabbits?"), or the initial peer question (e.g., "What about you?").

During the study, we recorded a plus sign (+) for a component that was independently performed within 5 s of the preceding component or peer question and for a reciprocal conversational response when all three components were performed independently. If a participant did not independently perform at least one component or did not stay on topic, a minus sign (-) was recorded for that component and subsequently for the entire reciprocal conversational response with one exception. That is, if a participant indicated that they did not want to continue a topic (e.g., "I don't want to talk about this"), wanted to change a topic (e.g., "Let's change a topic"), and asked a question of a new topic, we also consider this response correct because this would still represent an example of natural conversational exchanges when a change of topic is desired. However, topic changing did not occur frequently. The participants requested to change the topic a maximum of two times in a session. When calculating the percentages, we included only the responses and components that participants performed independently in the numerators. As such, the dependent measures were independent of the scoring chart.

Second, we recorded the number of questions provided by the instructor and initiated by the participants. The fewer questions provided by the instructor and the more questions initiated by the participants during the conversation, the more sustained their independent conversational exchanges were.

Last, to examine children's social preference, we conducted social preference evaluations after each baseline and intervention session (excluding peer-generalization and follow-up probes). As each participant chose between spending time with their peers and spending time by themselves, we recorded their cumulative selections of peers.

Experimental Design

We used a concurrent multiple-baseline design ([Kazdin, 2011](#)) across the three dyads to examine the effects of our intervention on the reciprocal conversation and social preference of our participants. We further included two a priori procedures to strengthen internal validity. First, we randomized the order in which the c

received the intervention (e.g., [Christ, 2007](#)). Second, the intervention start points for the three dyads were predetermined (e.g., [Horner & Swoboda, 2014](#)). We required seven baseline sessions for Dyad 1, among which five sessions were allocated for the intervention question set and two for the generalization question set. For Dyad 2, we required an additional four baseline sessions with three for the intervention set and one for the generalization set after the intervention for Dyad 1 had started. Likewise, after Dyad 2 started receiving the intervention, an additional four baseline sessions for Dyad 3 were arranged in the same manner as Dyad 2. For all baselines, the last two sessions probed the performance using the generalization question set followed by the probe for the intervention set.

Procedure

Baseline

Each baseline session consisted of 14 opportunities for the participants to make reciprocal conversational responses with seven opportunities per participant. Before each baseline session, we arranged the two participants in a dyad to sit in front of each other in the instructional room and let them know that they needed to chat with each other. Depending on the session, we shuffled the 14 instructor-prepared questions in either set and provided a question to one of the participants so that the conversation could be initiated. The participant who asked the initial question in each session alternated across the sessions.

Once a participant asked the first question, the session started. We collected the data as described in the dependent measure. Only independent performance was scored as "+," and incorrect, prompted, or missed performance was scored as "-." If a participant did not ask a follow-up question, we provided the next instructor-prepared question so that the session could continue. If we did not use all the questions in a set during a session, the remaining questions in that set were first used in the following sessions before they were reused. The procedure was the same for both participants, and each session ended once all 14 opportunities were exhausted. We did not provide prompts or feedback throughout the baseline. If a participant interrupted the other's response, we asked the participant to wait and the peer to repeat the response.

Interdependent group contingency

The procedure for the interdependent group contingency was the same as the baseline sessions except for the following. First, the group-contingency sessions included a reward at the end of the session contingent on participant responding. Specifically, before each session, we presented three to five reward options to each dyad and asked the participants to select one. Delivery of the reward was contingent on at least six correct reciprocal conversational responses (85.7% correct) from both participants regardless of whether they were independent or prompted. Second, we further presented the scoring chart on the whiteboard and placed it next to the participants at the beginning of each session. It was removed in the last three sessions of this phase. In addition, at the beginning of the first three sessions, we pointed to the scoring chart and verbally instructed the participants how we would use the scoring chart and explained the criterion for receiving the reward. Verbal instruction was removed after three sessions. Last, only instructor-prepared questions were used during the group-contingency sessions.

During each group-contingency session, if a participant correctly completed any of the three components, we marked a check on the scoring chart for that component. A cross was marked for each missed or inc

component (e.g., no responding within 5 s or off topic). We did not provide immediate feedback for components to avoid interrupting the conversation. After the participants completed the 14 opportunities, we pointed to and asked the participants to look at their performance on the chart (e.g., "Let's look at how you did!"). If a participant completed all three components correctly, we praised the participant and drew a happy face on the chart (e.g., "Yay! You got all of them! Here is a happy face!"). However, for each incorrect reciprocal conversational response, we provided feedback and drew a sad face (e.g., "You didn't get all of them"). If both participants met the criterion, we praised and told them that they completed at least six correct responses. We then delivered their chosen reward. If at least one participant did not reach the criterion, we provided feedback to both participants (e.g., "Remember that both of you need to get six happy faces! Let's work harder next time and get rewarded") and praised the participant who met the criterion when applicable.

To help participant responding meet the contingency criterion and contact the reward, we further provided immediate verbal and gestural prompts in the first group-contingency session. That is, we pointed to each component on the scoring chart and verbally presented one-word prompts (i.e., "answer," "elaborate," and "ask") to the participant immediately after the peer question or the preceding component. Starting the second session, a 5-s constant delay was added to the prompts (e.g., [Walker, 2008](#)). After a peer question or a component, we waited for 5 s for the participant to complete a subsequent component independently before we delivered the prompts. As long as the components and reciprocal conversational responses were correct, independently or upon prompting, we marked a check on the scoring chart for the component and a happy face for the response.

Once both participants in a dyad had met the performance criterion independently for two consecutive sessions, we stopped providing the prompts. When the participants in each dyad had independently met the criterion for a total of seven sessions (i.e., five sessions after the prompt removal), we stopped using the scoring chart but kept the group contingency. Data collection during the group-contingency phase was the same as that during baseline.

Generalization and follow-up probes

We arranged three types of generalization probes following the group-contingency sessions to assess if our participants continued to perform the reciprocal conversation skill beyond the questions used during group contingency and the peers in the existing dyads. In addition, these probes were conducted similarly to the baseline sessions to examine the participant performance without the interdependent group contingency. First, we provided questions in the generalization question set to examine if the participants could continue to perform the reciprocal conversational responses (and the three components) when a different set of instructor-prepared questions (i.e., question-generalization probes) was used to start the session and provided to the participants when they did not initiate questions. Second, we reassigned our participants to form three new dyads during Sessions 33 and 34 to examine their performance of reciprocal conversational responses with novel peers with ASD. In Session 33, the three dyads were Feng and Tan, Wang and Lang, and Dan and Ken. The three dyads in Session 34 consisted of Feng and Dan, Wang and Tan, and Lang and Ken. Additionally, we also paired them with the typically developing girl, Mei, in Sessions 33 and 34. The procedure for both types of peer-generalization probes was the same as the question-generalization probes, but we stopped providing questions at the beginning of the session unless they did not start the conversation.

also arranged the follow-up probes consisting of the initial dyads 4 weeks after the last peer-generalization probe. The follow-up procedure was the same as the peer-generalization probe.

Social Preference Evaluation

We conducted the social preference evaluations to assess if our participants preferred to spend time by themselves (alone option) or with peers (peer option) after each group-contingency session when the participants were in their initial dyads except for the follow-up probes. We did not conduct the evaluations after the participants were paired with novel peers due to insufficient interactions between the children in the reassigned dyads and potential novelty effect as a result of new conversational partners.

A concurrent-chains procedure (e.g., [Hanley et al., 1997](#)) was used to evaluate our participants' social preference. Immediately before each evaluation, we arranged one forced-choice trial for each option. Each forced-choice trial started with two pictures presented in front of a participant. The picture of the instructional room represented the alone option, and the peer picture was associated with the peer option. We told the participant that they needed to select between spending time by themselves or with peers. We then physically guided them to select one of the pictures and took them to experience the selection (e.g., "Let's select ___; you can spend some time with ___"). After the participant had been exposed to one alternative, we repeated the process and guided our participant to select and experience the other option. The order of the selections alternated between the sessions. During their exposure to the alone option, we took the participant to their instructional room and let them know that they would spend some time there. We also told them that they could use the items in the instructional room. Exposure to the peer option was the same except that the peer in the dyad joined the participant. Experience of each option lasted for 3 min during which we monitored their activities outside of the instructional room. Once the participant had chosen both pictures and experienced both options, social preference evaluation started. We presented the two pictures and asked the participant to pick one, and then we took the participant to experience their choice for 3 min.

Procedural Integrity and Interobserver Agreement

A behavior therapist with 5 years of experience working with children with ASD conducted procedural integrity (PI) and interobserver agreement (IOA). We developed procedural checklists of the essential steps of the baseline, interdependent group contingency, generalization, and follow-up sessions. We then trained the behavior therapist on how to conduct PI and IOA using the checklists. We videotaped all sessions across the study except for the follow-up probe for Dan and Lang (due to equipment malfunction). The therapist observed the videos and collected PI and IOA data for 100% of the baseline sessions, a minimum of 93.3% of the group-contingency sessions, and 100% of the generalization and follow-up probes of the recorded sessions for all participants.

We calculated PI by dividing the number of correctly implemented steps by the total number of steps. Across the participants, minimum mean PI was 95.2% (range 88.1%–100%) and 97% (range 83.8%–100%) for the baseline and group-contingency sessions, respectively. For generalization and follow-up probes, PI was 100% across participants except for Wang. Mean PI for him was 99.2% (range 94.7%–100%).

IOA was calculated using the point-by-point agreement and Cohen's kappa for reciprocal conversational responses and its components. Across all participants and phases, the agreement was 100% and over

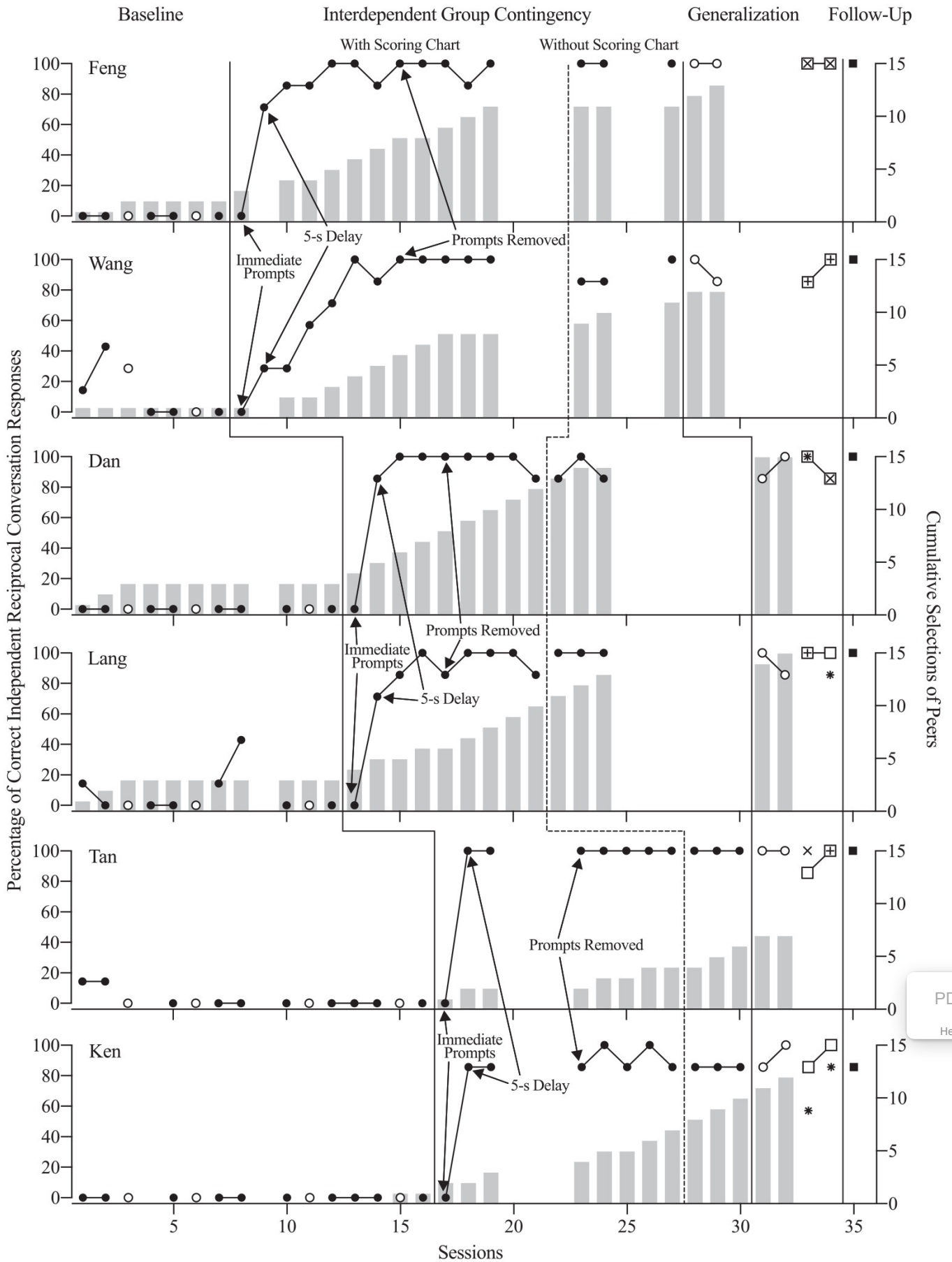
kappa was 1.0 for reciprocal conversational responses. For component performance, average agreement across phases and participants was 99.8% (range 99%–100%) for answer, 99.6% (range 96%–100%) for elaboration, and 99.8% (range 98%–100%) for question asking. Mean kappa was 0.98 (range 0.85–1.0) for answer, 0.99 (range 0.92–1.0) for elaboration, and 0.97 (range 0.66–1.0) for question asking across phases and participants. The number of questions provided by the instructor and initiated by the participants in the dyads as well as participants' selections in each session were also compared between the observers (i.e., agree or disagree for the session). The agreement was 100% and kappa was calculated at 1.0 for both measures.

Results

Reciprocal Conversational Responses and Components

A functional relation was demonstrated between the interdependent group contingency and improved independent reciprocal conversational responses across our participants (see [Figure 2](#)). During baseline, data for reciprocal conversational responses were stable with either flat or decreasing trends across participants. Feng, Dan, and Ken did not perform any correct conversational responses, whereas mean levels for Wang, Lang, and Tan were 12.3% (range 0%–42.9%), 6.5% (range 0%–42.9%), and 2.04% (range 0%–14.3%). Analysis of their component performance during baseline (see [Figure 3](#)) revealed that although all participants answered the peer questions consistently, they had either a stable baseline with a low level of elaboration and question asking or decreasing performance on these two components. Overall, they elaborated only an average of 10.2% to 51% of their answers and asked follow-up questions for an average of 2% to 26.5% of the opportunities.

Electronic Filing: Received, Clerk's Office 12/27/2022



PDF

Help

Figure 2. Percentage of correct independent reciprocal conversational responses by each participant and their cumulative selections of peers. All symbols represent the correct reciprocal conversational responses. Bars indicate the cumulative selections of peers. Filled (•) and empty circles (○) represent responses under intervention and generalization question sets, respectively. In peer-generalization probes, two participants in a reassigned dyad share the same symbol: pluses (+), crosses (×), or asterisks (*). Empty squares (□) indicate conversation with the typically developing peer. Filled squares (■) indicate follow-up probes.

PDF

Help

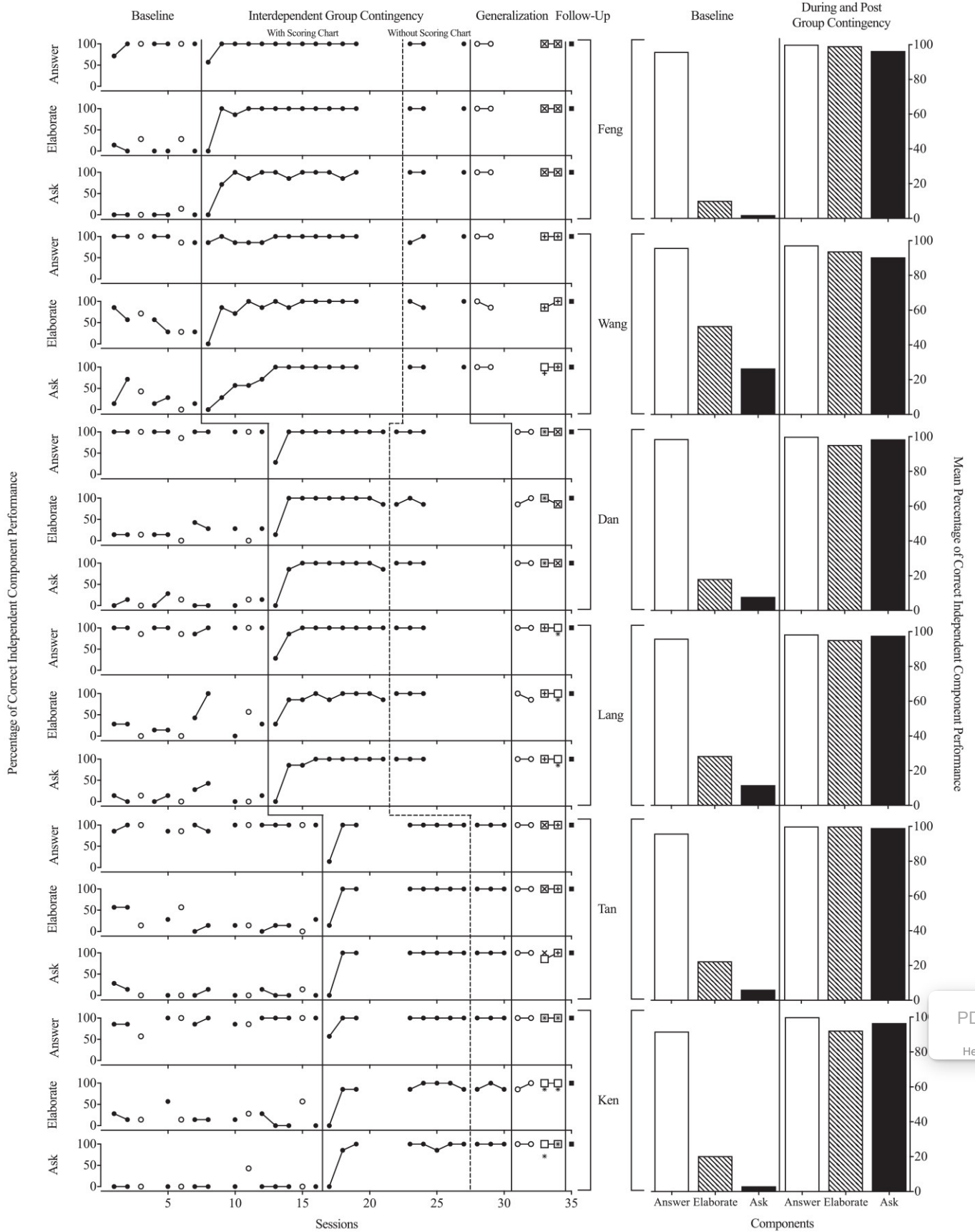


Figure 3. Percentage correct (left panel) and mean percent correct (right panel) for independent component performance. Symbols are identical to those in Figure 2.

PDF
Help

Upon entering the interdependent group contingency, as soon as the 5-s constant delay was added, independent reciprocal responses immediately increased for all participants. Moreover, performance across participants increased until the predetermined criterion was met.

The mean levels of correct responses increased to at least 80.5% during the group-contingency phase. No data point beyond the first intervention session (in which immediate prompts were delivered) overlapped with the baseline sessions for all participants except for Wang. Wang's mean increased from 12.3% to 76.2%, and his first three data points (20% of the group-contingency sessions) overlapped with his baseline phase. After the contingency was removed, our participants continued to perform the reciprocal conversational responses independently during both question- and peer-generalization as well as follow-up probes at levels similar to those during the group-contingency phase. Component data in [Figure 3](#) confirmed the increase in both elaboration and question asking after the group contingency was introduced. Specifically, all participants immediately increased their independent elaboration and question asking once 5-s delay to prompts was implemented. The minimum mean percentages of elaboration and question asking were 92.4% and 90.5% (excluding the first session) across our participants.

Continued Conversation Between Children

We also observed a functional relation between the group contingency and an increased number of questions initiated by the participants and fewer questions provided by the instructor after the group contingency was introduced (see [Figure 4](#)). In other words, their independent conversational exchanges increased after the intervention was in effect. Specifically, during baseline, participants in all three dyads initiated a small number of questions on their own. They needed a minimum of eight questions from the instructor and initiated a maximum of only six questions. The mean number of instructor-provided questions used by Dyad 1 during baseline was 11.9, and they initiated approximately only 2.1 questions per session. Similarly, Dyads 2 and 3 used an average of 12.7 and 13.4 instructor-provided questions and initiated an average of only 1.3 and 0.6 questions during baseline.

Electronic Filing: Received, Clerk's Office 12/27/2022

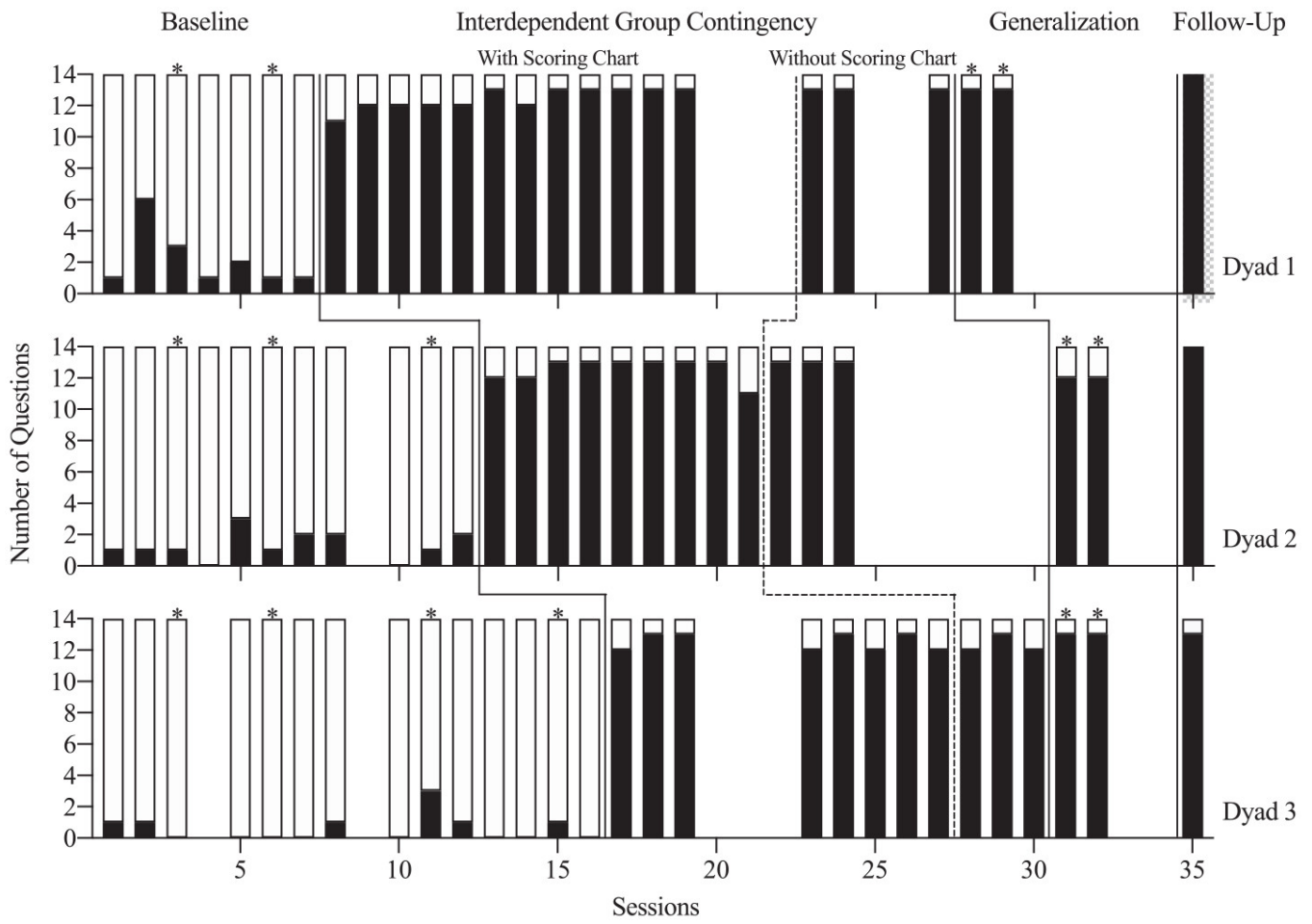


Figure 4. The number of questions provided by the instructor (white) and initiated by the participants (black) in the three initial dyads. Asterisks (*) indicate the sessions started with the generalization-question set.

After the interdependent group contingency was introduced, our data showed an immediate increase in the number of questions initiated by the participants and a decrease in instructor-provided questions across all dyads. The number of participant-initiated questions was stable during the group-contingency phase with mean levels of 12.5, 12.7, and 12.5 in the three dyads, whereas they used an average of only 1.5, 1.3, and 1.5 instructor-provided questions. In addition, after we stopped providing the first questions during peer-generalization and follow-up probes, all dyads, including the reassigned dyads, did not require any instructor-provided questions throughout the sessions except for Dan and Ken (reassigned dyad) in Session 33 (i.e., a peer-generalization probe) and Tan and Ken (Dyad 3) in the follow-up probe, during which the two dyads each used one instructor-provided question.

Social Preference

[Figure 2](#) depicts the cumulative selections of peers. Our data demonstrated steeper slopes for selecting peers across all participants only after group contingency was introduced as compared to baseline sessions. That is, all participants selected their peers more often as a function of interdependent group contingency. Specifically, Feng and Wang in Dyad 1 chose to spend time with each other for 28.6% and 14.3% of the

baseline sessions, respectively. Both children increased their selections of peers to 68.8% of the sessions after group contingency was introduced. Similarly, whereas both Dan and Lang in Dyad 2 selected each other for 27.3% of their baseline sessions, their selections of peers increased to 85.7% of the group-contingency sessions. Last, Tan in Dyad 3 did not select her peer at all during baseline, whereas Ken selected Tan once (i.e., 7.1% of the baseline sessions). After the group contingency was introduced, Tan's and Ken's selections of each other increased to 53.8% and 84.6% of the sessions.

Discussion

Given the challenges in reciprocal social conversation in individuals with ASD, our findings extended the literature by demonstrating the effects of the interdependent group contingency on improved reciprocal conversational responses of children with ASD when paired as dyads. The improvement was further maintained even when novel peers were introduced and after 4 weeks had passed. We also noted that our participants required fewer instructor-prepared questions during their conversation as compared to baseline, indicating that they were more likely to continue conversational exchanges independently during and after the intervention. Last, the interdependent group contingency also appeared effective in increasing social preference for peers among our participants.

Notably, even though our participants all had the component skills required for the reciprocal conversational responses prior to the study, they rarely demonstrated reciprocity through elaboration and question asking during the baseline; they either stopped talking or interrupted their peer. Consistent with this observation are a number of previous reports. [Jones and Schwartz \(2009\)](#) found that even if children with ASD have acquired advanced expressive language skills, their conversational deficits could still persist. Likewise, both [Palmen et al. \(2008\)](#) and [L. K. Koegel et al. \(2014\)](#) maintain that the challenges in conversational skills of individuals with ASD are more likely a performance deficit than a skill deficit. Thus, it appears that interventions, such as the interdependent group contingency in this study, may be required to improve reciprocal conversational skills even for children who seem to have an advanced verbal repertoire.

it appears that interventions, such as the interdependent group contingency in this study, may be required to improve reciprocal conversational skills

Interdependent Group Contingency and Reciprocal Social Conversation

While previous group-contingency studies arranged triads of one child with ASD and two typically developing peers to improve the social communication skills of children with ASD (e.g., [Kohler et al., 1995](#); [Lefebvre & Strain, 1989](#)), the groups in this study consisted of only children with ASD. Despite our different arrangement, the interdependent group contingency was still effective in increasing reciprocal conversation targets for all participants, and the effects were immediate as our participants started to demonstrate independent responses as soon as we started delaying the prompts for 5 s. Because the responses from both children in each dyad were simultaneously improved and maintained, the interdependent group contingency seemed more efficient than instructions that target one child at a time (e.g., one-on-one instruction). Future

investigations of its effects on other social (and academic) skills of children with ASD in groups of varying sizes should be conducted to provide further support for its efficiency in teaching multiple children with ASD.

Additionally, both [Kohler et al. \(1995\)](#) and [Lefebvre and Strain \(1989\)](#) used ABAB design. Initiations and responses from their participants with ASD dropped during the second baseline when the intervention was removed. Although this decrease in performance upon the return to baseline allows for a greater demonstration of experimental control, a concern is raised as to the successful maintenance of these skills in natural settings. Our results, by contrast, demonstrated that all of our participants maintained their performance without the intervention during the generalization and follow-up probes. A plausible account may be the gradual fading of the intervention components in this study. [MacDuff et al. \(2001\)](#) suggest that fading procedures should be used for learners with ASD to promote independent performance and avoid reliance on auxiliary intervention components, such as the prompts and the scoring chart in this study. Instead of a complete return to baseline, we systematically faded prompts and the scoring chart one at a time, through which performance was sustained when these auxiliary components were no longer provided.

We did not, however, arrange gradual thinning of reinforcement (e.g., by providing rewards for every other session) before completely removing the rewards. Given its role for promoting skill maintenance in children with ASD (e.g., [Hagopian et al., 2011](#)), we were somewhat surprised to find that our participants still performed at levels comparable to their group-contingency phase after the removal of rewards. This seemed to indicate that perhaps some natural social reinforcers, such as peer responding and attention, might be responsible for maintaining their reciprocal conversation. To put it simply, children might have found talking to each other reinforcing when they were able to independently continue their reciprocal conversation.

Continued Conversational Exchanges in the Reciprocal Conversation Framework

Previously, [L. K. Koegel et al. \(2014\)](#) found that their participants with ASD were more likely to engage in the reciprocal to-and-fro conversational exchanges after the self-management intervention, as rated by their naive observers. Increased to-and-fro responses, in theory, should produce continuous conversational exchanges between children with ASD and their conversational partners. Because L. K. Koegel et al. had their adult conversational partner ask the participants a series of researcher-prepared questions, the conversation between a participant and the conversational partner restarted each time a new question was asked. Therefore, direct observation of continued reciprocity of their participants was difficult. In the present study, when children with ASD were paired in dyads as conversational partners, the group contingency was also effectively placed on the continuous conversational exchanges between the participants in each dyad. The each instructor-provided question used during their conversation would lead to the last component (i.e., question asking) marked incorrect on the scoring chart. As a result, no dyads in this study required more than two instructor-provided questions during their conversation besides the initial question for the sessions. Notably, we also observed that the participants did not reuse the exact questions provided by the instructor. If a similar question was initiated, they either added more content or altered the words in the question (see also the [online supplemental table](#) for a list of topics). Overall, our results presented additional evidence that the three basic reciprocal conversational components may allow children with ASD to sustain their conversational exchanges with their peers and may be some of the prerequisite skills for social reciprocity.

the three basic reciprocal conversational components may allow children with ASD to sustain their conversational exchanges with their peers

Social Preference

As a secondary effect of the interdependent group contingency, [Smith et al. \(2019\)](#) found reduced social withdrawal of target children as rated by their peers in four studies. Similarly, all children with ASD in this study increased their selections of the peer option over the alone option after the interdependent group contingency was introduced. Anecdotally, we noted that our participants often interacted with each other after their selections even though interaction was not required. For example, some participants took turns drawing on the whiteboard, asked each other questions when reading books, and even talked to each other using the reciprocal conversational components. Although this study was not set out to examine the exact relation between social preference and interaction, our observation appeared to indicate that increased social preference may be a necessary component for furthering the social interactions and conversational exchanges outside of the intervention setting.

Moreover, although peer ratings as a measure for social preference may be appropriate in certain circumstances (e.g., large sample size), their reliability and validity are questionable (e.g., [Kazdin, 2011](#)). We addressed this concern by arranging a direct assessment procedure that required our participants to choose and experience the two options through their selections of corresponding pictures. This evaluation procedure has been predominantly used to reveal the individual preference of treatments (e.g., [Hanley et al., 1997](#); [Yuan et al., 2019](#)) and behavioral targets (e.g., [Winborn-Kemmerer et al., 2009](#)). Our study further supported its utility in assessing social preference. Instead of conducting the preference evaluations only after the interventions have been completed (e.g., [Hanley et al., 1997](#); [Winborn-Kemmerer et al., 2009](#)), we arranged repeated evaluations throughout the baseline and group-contingency phases. As a result, this procedure seemed sensitive in detecting changes in social preference over time as a function of our intervention and thus may be useful in future investigations on the effects of interventions on changes in individual preference.

this procedure seemed sensitive in detecting changes in social preference over time as a function of our intervention

Limitations and Directions for Future Research

The current study should be interpreted with its limitations. First, our participants all had relatively advanced verbal repertoire when compared to their peers with ASD. However, individuals with ASD function at different levels ([Jeste & Geschwind, 2014](#)). Thus, future replications need to examine if our data would also be obtained with other children with ASD. Relatedly, we assigned our participants into the dyads based on their schedules. Thus, it was difficult to assess if the effects were moderated by participant characteristics, such as interests. To further enhance internal integrity, randomization at participant level could control for participant characteristics. Alternatively, an argument could also be made for pairing children with shared interests as this arrangement may potentially further enhance the effects and foster friendship (e.g., [R. Koegel et al., 2013](#)).

PDF

Help

In addition, our dyad-level randomization had no power to reject the null hypothesis if a randomization-test procedure is used (see [Levin et al., 2018](#)). Specifically, our randomization scheme with three dyads only yielded $3! = 6$ possible assignments. The significance probability, in this case, was $1/6 = 0.167$. Even though it is the most extreme significance probability, there is no chance to reject the null hypothesis with $\alpha = .01, .05$, or even $.10$ ([Levin et al., 2018](#)). To have sufficient power, researchers in the future need to revise the current randomization scheme (e.g., by arranging additional randomization of intervention start points; [Levin et al., 2018](#)).

Third, we included multiple features (e.g., immediate prompts) in the interdependent group contingency to draw our participants' attention to the target responses so that they could be brought in contact with the contingency immediately. Even though the immediate prompts were provided only for one session and independent responses were observed as soon as the prompts were faded, it is possible that the prompts were required to demonstrate the effects in the current study. Future studies should consider separating the effects of prompts from the group contingency.

Fourth, our findings were somewhat limited to the binary measures of whether a correct reciprocal conversational response and its three components occurred. Although we observed that our participants provided relevant answers, elaborated sometimes extensive responses, and asked appropriate and various follow-up questions, it would also be meaningful to systematically assess the quality of their speech and exchanges. Quality indicators may be necessary to help further improve the social validity of target conversational responses and interventions for children with ASD. Additionally, even though we did not observe other forms of reciprocity from our participants during the study, it may be important for future studies to also include additional reciprocity targets, such as commenting (e.g., [Leach & LaRocque, 2011](#)).

Fifth, we specifically designed the rewards in our interdependent group contingency to require interactions between participants. It was unclear if these interaction rewards were an active ingredient for promoting social preference of children with ASD. A component analysis may be necessary in the future to isolate the effects of interdependent group contingency and interaction rewards on the social preference of children with ASD.

Last, despite our promising social preference results, we did not include typically developing peers to examine possible changes in their preference. Given that children with ASD often face social exclusion in inclusive settings (e.g., [Barnard et al., 2000](#); [Symes & Humphrey, 2010](#)), it may be important to also examine if increases in preference for peers with ASD could also be achieved for typically developing children as a function of current intervention.

Practical Implications

Given that social communication challenges may be the primary deficit in ASD ([Jones & Schwartz, 2009](#)), effective intervention for these targets (e.g., using the reciprocal conversation framework) should be prioritized in early intervention. This study provided some initial evidence of the interdependent group contingency as an efficient procedure in simultaneously improving reciprocal conversation and social preference in two children with ASD when they are the only members in the group.

To facilitate the intervention, we recommend practitioners consider pairing children with common interests during the intervention. Even though we did not control for interests, as discussed, children with common interests may start to engage in conversations faster and their conversations could be more meaningful. Immediate prompts may also be necessary to allow children's responses to contact the reward at the earliest opportunity as reinforcement is crucial for skill acquisition, and prompts should be appropriate to children's skill levels and characteristics. We further recommend gradual fading of the intervention components to promote skill maintenance. Moreover, arranging rewards that require interaction between children may also be necessary to encourage their preference for their peers, which may potentially further the opportunities for social engagement and practice of conversational skills outside of the intervention setting.

ORCID iD

Chengan Yuan 

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.).

[GO TO REFERENCE](#)

[Crossref](#)

[Google Scholar](#)

Bambara L. M., Cole C. L., Kunsch C., Tsai S.-C., Ayad E. (2016). A peer-mediated intervention to improve the conversational skills of high school students with Autism Spectrum Disorder. *Research in Autism Spectrum Disorders*, 27, 29–43. <https://doi.org/10.1016/j.rasd.2016.03.003>

[+ SHOW REFERENCES](#)

[Google Scholar](#)

Bambara L. M., Thomas A., Chovanes J., Cole C. L. (2018). Peer-mediated intervention: Enhancing the social conversational skills of adolescents with autism spectrum disorder. *TEACHING Exceptional Children*, 51(1), 7–17. <https://doi.org/10.1177/0040059918775057>

[GO TO REFERENCE](#)

[Google Scholar](#)

PDF

Help

Barbera M. L., Rasmussen T. (2007). *The verbal behavior approach: How to teach children with autism and related disorders*. Jessica Kingsley.

GO TO REFERENCE

[Google Scholar](#)

Barnard J., Prior A., Potter D. (2000). *Inclusion and autism: Is it working? 1,000 examples of inclusion in education and adult life from the National Autistic Society's members*. National Autistic Society.

GO TO REFERENCE

[Google Scholar](#)

Call N. A., Shillingsburg M. A., Bowen C. N., Reavis A. R., Findley A. J. (2013). Direct assessment of preferences for social interactions in children with autism. *Journal of Applied Behavior Analysis*, 46(4), 821–826.

<https://doi.org/10.1002/jaba.69>

GO TO REFERENCE

[Google Scholar](#)

Christ T. J. (2007). Experimental control and threats to internal validity of concurrent and nonconcurrent multiple baseline designs. *Psychology in the Schools*, 44(5), 451–459. <https://doi.org/10.1002/pits.20237>

GO TO REFERENCE

[Google Scholar](#)

Deckers A., Muris P., Roelofs J. (2017). Being on your own or feeling lonely? Loneliness and other social variables in youths with autism spectrum disorders. *Child Psychiatry & Human Development*, 48(5), 828–839.

<https://doi.org/10.1007/s10578-016-0707-7>

GO TO REFERENCE

[Google Scholar](#)

Gale C. M., Eikeseth S., Klintwall L. (2019). Children with autism show atypical preference for non-social stimuli. *Scientific Reports*, 9(1), 10355. <https://doi.org/10.1038/s41598-019-46705-8>

GO TO REFERENCE

[Google Scholar](#)

PDF

Help

Hagopian L. P., Boelter E. W., Jarmolowicz D. P. (2011). Reinforcement schedule thinning following functional communication training: Review and recommendations. *Behavior Analysis in Practice*, 4(1), 4–16.

<https://doi.org/10.1007/BF03391770>

GO TO REFERENCE

[Google Scholar](#)

Hale C. M., Tager-Flusberg H. (2005). Social communication in children with autism: The relationship between theory of mind and discourse development. *Autism*, 9(2), 157–178. <https://doi.org/10.1177/1362361305051395>

+ SHOW REFERENCES

[Google Scholar](#)

Hanley G. P., Piazza C. C., Fisher W. W., Contrucci S. A., Maglieri K. A. (1997). Evaluation of client preference for function-based treatment packages. *Journal of Applied Behavior Analysis*, 30(3), 459–473.

<https://doi.org/10.1901/jaba.1997.30-459>

+ SHOW REFERENCES

[Google Scholar](#)

Horner R. H., Swoboda C. M. (2014). Visual analysis of single-case intervention research: Conceptual and methodological issues. In Kratochwill T. R., Levin J. R. (Eds.), *Single-case intervention research: Methodological and statistical advances*. (pp. 91–125). American Psychological Association. <https://doi.org/10.1037/14376-004>

GO TO REFERENCE

[Google Scholar](#)

Hughes C., Kaplan L., Bernstein R., Boykin M., Reilly C., Brigham N., Cosgriff J., Heilingoetter J., Harvey M. (2012). Increasing social interaction skills of secondary school students with autism and/or intellectual disability: A review of interventions. *Research and Practice for Persons with Severe Disabilities*, 37(4), 288–307. <https://doi.org/10.2511/027494813805327214>

GO TO REFERENCE

[Google Scholar](#)

Jeste S. S., Geschwind D. H. (2014). Disentangling the heterogeneity of autism spectrum disorder through genetic findings. *Nature Reviews Neurology*, 10(2), 74–81. <https://doi.org/10.1038/nrneurol.2013.278>

GO TO REFERENCE

PDF
Help

[Google Scholar](#)

Jones C. D., Schwartz I. S. (2009). When asking questions is not enough: An observational study of social communication differences in high functioning children with autism. *Journal of Autism and Developmental Disorders*, 39(3), 432–443. <https://doi.org/10.1007/s10803-008-0642-y>

+ SHOW REFERENCES

[Google Scholar](#)

Kasari C., Rotheram-Fuller E., Locke J., Gulsrud A. (2012). Making the connection: Randomized controlled trial of social skills at school for children with autism spectrum disorders: Social skills intervention. *Journal of Child Psychology and Psychiatry*, 53(4), 431–439. <https://doi.org/10.1111/j.1469-7610.2011.02493.x>

GO TO REFERENCE

[Google Scholar](#)

Kazdin A. E. (2011). *Single-case research designs: Methods for clinical and applied settings* (2nd ed.). Oxford University Press.

+ SHOW REFERENCES

[Google Scholar](#)

Koegel L. K., Park M. N., Koegel R. L. (2014). Using self-management to improve the reciprocal social conversation of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 44(5), 1055–1063. <https://doi.org/10.1007/s10803-013-1956-y>

+ SHOW REFERENCES

[Google Scholar](#)

Koegel R., Kim S., Koegel L., Schwartzman B. (2013). Improving socialization for high school students with ASD by using their preferred interests. *Journal of Autism and Developmental Disorders*, 43(9), 2121–2134. <https://doi.org/10.1007/s10803-013-1765-3>

GO TO REFERENCE

[Google Scholar](#)

Koegel R. L., Fredeen R., Kim S., Danial J., Rubinstein D., Koegel L. (2012). Using perseverative interests to improve interactions between adolescents with autism and their typical peers in school settings. *Jou*

PDF

Help

GO TO REFERENCE

[Google Scholar](#)

Kohler F. W., Strain P. S., Hoyson M., Davis L., Donina W. M., Rapp N. (1995). Using a group-oriented contingency to increase social interactions between children with autism and their peers: A preliminary analysis of corollary supportive behaviors. *Behavior Modification*, 19(1), 10-32.

<https://doi.org/10.1177/01454455950191002>

+ SHOW REFERENCES

[Google Scholar](#)

Leach D., LaRocque M. (2011). Increasing social reciprocity in young children with autism. *Intervention in School and Clinic*, 46(3), 150-156. <https://doi.org/10.1177/1053451209349531>

GO TO REFERENCE

[Google Scholar](#)

Lefebvre D., Strain P. S. (1989). Effects of a group contingency on the frequency of social interactions among autistic and nonhandicapped preschool children: Making LRE efficacious. *Journal of Early Intervention*, 13(4), 329-341. <https://doi.org/10.1177/105381518901300405>

+ SHOW REFERENCES

[Google Scholar](#)

Levin J. R., Ferron J. M., Gafurov B. S. (2018). Comparison of randomization-test procedures for single-case multiple-baseline designs. *Developmental Neurorehabilitation*, 21(5), 290-311.

<https://doi.org/10.1080/17518423.2016.1197708>

+ SHOW REFERENCES

[Google Scholar](#)

Litow L., Pumory D. K. (1975). A brief review of classroom group-oriented contingencies. *Journal of Applied Behavior Analysis*, 8(3), 341-347. <https://doi.org/10.1901/jaba.1975.8-341>

PDF

Help

GO TO REFERENCE

[Google Scholar](#)

Little S. G., Akin-Little A., O'Neill K. (2015). Group contingency interventions with children: 1980–2010. A meta-analysis. *Behavior Modification*, 39(2), 322–341. <https://doi.org/10.1177/0145445514554393>

GO TO REFERENCE

[Google Scholar](#)

Locke J., Kasari C., Rotheram-Fuller E., Kretzmann M., Jacobs J. (2013). Social network changes over the school year among elementary school-aged children with and without an autism spectrum disorder. *School Mental Health*, 5(1), 38–47. <https://doi.org/10.1007/s12310-012-9092-y>

GO TO REFERENCE

[Google Scholar](#)

MacDuff G. S., Krantz P. J., McClannahan L. E. (2001). Prompts and prompt-fading strategies for people with autism. In Maurice C., Green G., Foxx R. M. (Eds.), *Making a difference: Behavioral intervention for autism* (pp. 37–50). PRO-ED.

GO TO REFERENCE

[Google Scholar](#)

Palmen A., Didden R., Arts M. (2008). Improving question asking in high-functioning adolescents with autism spectrum disorders: Effectiveness of small-group training. *Autism*, 12(1), 83–98. <https://doi.org/10.1177/1362361307085265>

GO TO REFERENCE

[Google Scholar](#)

Pokorski E. A., Barton E. E., Ledford J. R. (2017). A review of the use of group contingencies in preschool settings. *Topics in Early Childhood Special Education*, 36(4), 230–241. <https://doi.org/10.1177/0271121416649935>

+ SHOW REFERENCES

[Google Scholar](#)

PDF

Help

Smith S., Barajas K., Ellis B., Moore C., McCauley S., Reichow B. (2019). A meta-analytic review of randomized controlled trials of the good behavior game. *Behavior Modification*. <https://doi.org/10.1177/0145445519878670>

+ SHOW REFERENCES

[Google Scholar](#)

Sundberg M. L., Partington J. W. (1998). *Teaching language to children with autism or other developmental disabilities*. Behavior Analysts.

GO TO REFERENCE

[Google Scholar](#)

Symes W., Humphrey N. (2010). Peer-group indicators of social inclusion among pupils with autistic spectrum disorders (ASD) in mainstream secondary schools: A comparative study. *School Psychology International*, 31(5), 478–494. <https://doi.org/10.1177/0143034310382496>

GO TO REFERENCE

[Google Scholar](#)

Taylor B. A., Hoch H., Potter B., Rodriguez A., Spinnato D., Kalaigian M. (2005). Manipulating establishing operations to promote initiations toward peers in children with autism. *Research in Developmental Disabilities*, 26(4), 385–392. <https://doi.org/10.1016/j.ridd.2004.11.003>

GO TO REFERENCE

[Google Scholar](#)

Walker G. (2008). Constant and progressive time delay procedures for teaching children with autism: A literature review. *Journal of Autism and Developmental Disorders*, 36(2), 261–275. <https://doi.org/10.1007/s10803-007-0390-4>

GO TO REFERENCE

[Google Scholar](#)

Winborn-Kemmerer L., Ringdahl J. E., Wacker D. P., Kitsukawa K. (2009). A demonstration of individual preference for novel mands during functional communication training. *Journal of Applied Behavior Analysis*, 42(1), 185–189. <https://doi.org/10.1901/jaba.2009.42-185>

+ SHOW REFERENCES

PDF

Help

Yuan C., Hua Y., Zhu J. (2019). The role of reinforcement in multiple response repetition error correction and treatment preference of Chinese children with autism. *Journal of Autism and Developmental Disorders*, 49(9), 3704–3715. <https://doi.org/10.1007/s10803-019-04086-x>

[GO TO REFERENCE](#)

[Google Scholar](#)

Supplementary Material

Supplemental Material

Please find the following supplemental material visualised and available to download via Figshare in the display box below. Where there are more than one item, you can scroll through each tab to see each separate item.

Please note all supplemental material carries the same license as the article it is here associated with

- [Supplemental Material](#)

PDF

Help

	A	
1	Topics in the Instructor-Prepared Questions	Topics Related to the Instructor-Prepared Questions
2	Topics presented in the instructor-prepared questions.	The specific topics initiated by the participants, including
3	Cartoon	Various cartoon shows (e.g., Bluey, Chicken Biscuits)
4	Animal	Various animals (e.g., bear, bee, cat, dinosaur, dog)
5	Food (Snack)	Various snacks (e.g., biscuit, cake, candy, chips)
6	Food (Vegetables)	Various vegetables (e.g., carrot, bok choy, green beans)
7	Food (Fruit)	Various fruits (e.g., apple, banana, blueberry, durian)
8	Food (Dishes)	Various dishes (e.g., fish, meat, specific dishes)
9	Vehicles	Various vehicles (e.g., bus, cable car, sedan, car)
10	Rewards	Activities that lead to rewards (e.g., neat handwriting)
11	Being Lost	Location (e.g., on the street); Safety skills related to
12	Happiness	Facial expression
13	Feeling Sick	Symptoms (e.g., bleeding, having a fever, headache)

Topics Summary

Frequency of Topics



File (supplemental_table.xlsx)



Share

Download

DOWNLOAD

Related content

Similar articles:



Restricted access

[Effects of a Multicomponent Peer Mediated Intervention on Social Communication of Preschoolers With Autism Spectrum Disorder](#)

Show details



Restricted access

[Development of Mathematical Practices Through Word Problem-Solving Instruction for Students With Autism Spectrum Disorder](#)

PDF

Help

 Restricted access

[Efficacy of Peer Networks to Increase Social Connections Among High School Students With and Without Autism Spectrum Disorder](#)

Show details ▾

[View more](#)

SAGE recommends:

SAGE Knowledge

Book chapter

[Social Skills Instruction and Generalization Strategies](#)

Show details ▾

SAGE Knowledge

Book chapter

[Alternative Intervention and Home-Based Programmes](#)

Show details ▾

SAGE Research Methods

Book chapter

[Producing Participation](#)

Show details ▾

[View more](#)

PDF

Help

Also from SAGE Publishing

CQ Library

American political resources

Data Planet

A universe of data

SAGE Business Cases

SAGE Campus

Privacy

Electronic Filing: Received, Clerk's Office 12/27/2022
Real-world cases at your fingertips

Online skills and methods courses

SAGE Knowledge

The ultimate social science library

SAGE Research Methods

The ultimate methods library

SAGE Video

Streaming video collections

Technology from SAGE

Make learning and research easier

PDF

Help