Peer-mediated intervention for pre-schoolers with ASD: Effects on responses and initiations

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Purpose: This study investigates the effects of peer-mediated intervention on the responses and initiations of pre-schoolers (aged 4:2–5:1) with Autism Spectrum Disorder (ASD). Method: A speech-language pathologist and three early childhood educators trained typically-developing peers to facilitate responses and initiations from three pre-schoolers with ASD during playtime. A multiple baseline design across subjects was used to determine the effects of the intervention. Play sessions between the children with ASD and their typically-developing peers were videotaped. Videotapes were analysed using an interval coding system in order to collect information regarding responses and initiations.

Result: All three target children demonstrated improvements in their responses and initiations to their peers during intervention. Moreover, they maintained these gains 4 weeks later and generalized their response and initiation skills to an untrained peer. Social validity data, obtained using unbiased, independent, lay, observers to rate the children’s performance provided external validation of an observable treatment effect (i.e. increased responses and initiations) following intervention.

Conclusion: The results suggest that training typically-developing peers to implement intervention strategies using the collaboration between a speech-language pathologist and early childhood educators may be an effective model of service delivery to enhance peer interaction skills of pre-schoolers with ASD.

Keywords: Autism spectrum disorder, peer-mediated intervention, social interaction

Introduction

This study examines the effects of a peer-mediated intervention on the responses and initiations of three pre-schoolers diagnosed with Autism Spectrum Disorder (ASD). One of the defining features of ASD is difficulty with reciprocal social interactions (Diagnostic and Statistical Manual of Mental Disorders, 5th ed.; DSM-5; American Psychiatric Association, 2013) and children with ASD often display difficulties with responding and initiating within social interactions across all ages and levels of cognitive ability (Tager-Flusberg, Joseph, & Folstein, 2001). Relative to typically-developing peers, children with ASD spend less time in social interactions (Rotheram-Fuller, Kasari, Chamberlain, & Locke, 2010), initiate engagement less often and respond to fewer bids for joint attention from same age peers (Sigman & Ruskin, 1999; Wong & Kasari, 2012).

For pre-schoolers, relevant social interaction skills include initiating interactions and responding to peers’ initiations (Timler, Vogler-Elias, & McGill, 2007). Both initiating and responding skills are considered areas of deficit in children with ASD (Koegel, Vernon, Koegel, Koegel, & Paullin, 2012). It appears that the acquisition of language skills is in itself not sufficient to ensure that children with ASD will not continue to face challenges with social communicative interactions with peers (Koegel et al., 2012). These difficulties often result in an inability to form stable friendships and relationships (Bauminger & Kasari, 2000). Consequently, numerous peer-mediated intervention programs have specifically targeted responding and initiating (e.g. Banda, Hart, & Liu-Gitz, 2010; Conroy, Boyd, Asmus, & Madera, 2007; Owen-DeSchryver, Carr, Cale, & Blakely-Smith, 2008) and interventions to improve these skills have been shown to promote improvement in core deficits of autism, including language learning, entering play with others and participating in collaborative play with peers (Nelson, McDonnell, Johnston, Crompton, & Nelson, 2007).

Peer-mediated interventions involve typically-developing peers who are systematically taught ways of engaging children with ASD in social interactions, thereby helping learners with ASD to acquire new social and communication skills (Fettig, 2013). The theoretical rationale for employing typically-developing peers is the social-cognitive learning theory.
of skill acquisition (Bandura, 1989), which posits that social communication in typically-developing children emerges from and develops within social contexts. According to this view, all cognitive development is socially mediated and dependent on interaction with others and with the environment (Mallory & New, 1994).

Studies involving peer-mediated social skills intervention for younger pre-schoolers with ASD typically report positive findings (Hughett, Kohler, & Raschke, 2013; Katz & Girolametto, 2013; Kohler, Greteman, Raschke, & Highnam, 2007; Laushey & Heflin, 2000). Taken together, the results indicate that, relative to baseline, the pre-schoolers with ASD improved their overall social interaction skills with peers as a result of such intervention. Katz and Girolametto (2013) also reported that, post-intervention, pre-school children’s interactions were longer than at baseline, indicating more extensive involvement in play-focused interactions. However, in these previous studies, no distinction was made between responses and initiations and, thus, there is little information about the mechanisms involved in more extensive interactions. For example, improvements in social skills might yield a higher frequency of responses without concomitant increases in initiation skills. The current study uses the data presented in Katz and Girolametto (2013) to determine the effect of the intervention on both responses and initiations.

Several peer-mediated intervention studies focused specifically on improving the rate of responsiveness in pre-schoolers with ASD. For example, Kalyva and Avramidis (2005) examined a peer-mediated intervention designed to improve the ability of children with ASD to respond to peers during play. The results indicated that the children with ASD increased their frequency of successful responses after intervention. Similar results were reported by McGrath, Bosch, Sullivan, and Fuqua (2003), who trained a pre-school-age child with ASD to respond to the initiations of peers. These results are consistent with previous research suggesting that initiating interaction may be a relative weakness compared to responding to bids for joint attention or joint action (Houghton, Schuchard, Lewis, & Thompson, 2013; Koegel, Carter, & Koegel, 2003; MacDonald, Anderson, Dube, Geckeler, Green, Holcomb, et al., 2006).

Researchers have suggested that the lack of self-initiated interactions may limit social and verbal learning opportunities (Koegel, Koegel, Harrower, & Carter, 1999). Indeed, initiations have been identified as a prognostic marker of positive outcomes for children with ASD (Koegel, Bradshaw, Ashbaugh, & Koegel, 2014). To date, however, few peer-mediated intervention studies have reported information concerning facilitating initiations in children with ASD and the impact of interventions on initiations is less consistent than that found for responses (e.g. Conroy et al., 2007; Nelson et al., 2007). Thus, Nelson et al. (2007) instructed four pre-schoolers with autism and their typically-developing peers to use the “Keys to Play” strategy, which entails the use of a specific strategy to enter a play situation. The results revealed that all four pre-schoolers increased the percentage of unprompted initiations to enter into play situations with their trained peers. In contrast, Conroy et al. (2007) measured the effects of an intervention targeting the initiation skills of a 4-year old child with ASD. They found that this child gained only minimally in terms of the number of his initiations, but did engage in longer sustained social interactions with his typically-developing peers. Taken together, these prior studies demonstrate that intervention targeting initiations may facilitate an increase in initiation skills and an important question for future research concerns whether these results can be replicated and expanded.

Two pressing issues for research on interventions for children with ASD that are addressed in the current study concern the measurement of generalization and social validity of the intervention effects. First, the existing research in the field of autism often fails to measure generalization of peer interaction skills to other interaction partners (Bass & Mulick, 2007; Matson, Matson, & Rivet, 2007; McConnell, 2002). Timler et al. (2007) suggest that, in order to be considered effective, interventions must show generalization of skills during “authentic interactions with peers” (p. 167). Second, most intervention studies of children with ASD do not consider measures of social/ecological validity. Matson et al. (2007) reviewed 79 interventions aimed at enhancing social skills with children with ASD and reported that only 10% of the studies considered social validity. Social validity is important because it provides an external judgement on the importance of intervention outcomes (Hurley, Webby, & Feurer, 2010).

To address these gaps in the literature, the current study examined the effects of a peer-mediated intervention on the responses and initiations of three preschoolers diagnosed with ASD. The study uses the data presented in Katz and Girolametto (2013) to determine the specific discourse mechanisms (i.e. responses and initiations) that may have yielded the extended interactions reported in the previous study. A multiple baseline single-subject design measured children’s responses and initiations in two naturalistic play contexts. A speech-language pathologist (the first author) and three early childhood educators trained typically-developing peers to engage children with ASD in play within their child-care classrooms. Generalization of the skills learned was measured by collecting data on subsequent responses and initiations with an untrained peer. Also, social validity of the intervention was measured, using guidelines recommended by Foster and Mash (1999). These guidelines include asking
independent judges whether there is a meaningful difference in the behaviour of the children with ASD before and after intervention.

Method

In the intervention presented in this study, a speech language pathologist and three early childhood educators trained typically-developing peers to engage children with ASD in play. Three pre-school children with ASD and nine peers participated. The peer intervention took place in early childhood classrooms during play sessions with blocks and play dough. A single-subject multiple baseline design across subjects was used to determine the effects of the intervention. The broad methods of this study were detailed in Katz and Girolametto (2013) and are described concisely here. This study expands on this earlier work by examining data concerning the responses and initiations of three children with ASD to two trained typically-developing peers and the generalization of these discourse skills to untrained typically-developing peers. This study was granted approval from the Ethics Review Office of the University of Toronto.

Participants

Subjects were recruited by asking speech-language pathologists, psychological associates and resource teachers in the Greater Toronto Area to describe the study to parents of suitable candidates and suggest their child’s participation. After obtaining parental consent, supervisors of the relevant childcare centres were asked to request consent from the early childhood educators who would potentially be involved. All the early childhood educators of the children who were considered for the study expressed interest and willingness to be involved in this study.

Children. The characteristics of the children with ASD are summarized in Table 1. The participants of this study included three pre-school-age children with ASD between 4;1–5;1 years of age who had attended full time child care for at least 12 months. The diagnosis of ASD was made by an independent psychologist or developmental paediatrician using the Autism Diagnostic Observation Schedule (ADOS; Lord, Risi, Lambrecht, Cook, Leventhal, DiLavore, Pickles, & Rutter (2000). The Autism Diagnostic Observation Schedule (Lord, et al., 2000). Module 2 of the ADOS for individuals with some phrase speech. Cut-off score for autism spectrum = 8; cut-off score for autism = 12. Module 1 of the ADOS for individuals who do not consistently use phrase speech. Cut-off score for autism spectrum = 7; cut-off score for autism = 12. IQ Composite Score on the Brief IQ screener of the Leiter International Performance Scale–R (Roid & Miller, 1997). Standard scores on The Preschool Language Scales – 4th ed. (PLS-4) (Zimmerman, et al., 2002). Standard scores on the socialization scales of the Vineland Adaptive Behavior Scales (VABS) (Sparrow, Balla, & Cichetti, 1984).
Jacob was 4 years and 1 month old. He engaged primarily in solitary play, although he was able to play alongside other children. Jacob used one- and two-word utterances mainly to make requests and did not initiate interactions with his peers or respond to peer initiations. Furthermore, Jacob did not share play materials with peers and he did not take turns while playing.

Joey was 5 years and 1 month old. He engaged in solitary play and during free-play time outside he repeatedly ran laps around the playground. He did not initiate interactions or respond to his peers’ attempts to engage him. Joey did not readily share toys and did not engage in social interactions. Most of Joey’s utterances were not directed at anyone in particular and were not communicative in nature. During solitary play he described play sequences to himself in a very quiet voice. Interactive utterances made during play were almost exclusively requests.

Three typically-developing peers were nominated by the early childhood educators to serve as peer interventionists for each child with ASD. These children were in the same classroom as the child with ASD and had (a) typical language development, (b) typical social skills as determined by the Social Interaction Assessment Scale completed by their educators (adapted from McConnell & Odom, 1999) and (c) previously expressed interest in interacting with the child with ASD, as reported by the early childhood educator. These criteria for peer interventionists are consistent with those expressed by several researchers (e.g. Odom & Strain, 1986; Sperry, Neitzel, & Engelhardt-Wells, 2010). Two peers were randomly chosen to be trained as peer interventionists. The third peer was not trained and was involved in the study only for the purpose of collecting data regarding the generalization of skills across peers. Peer characteristics are presented in Table II.

Table II. Characteristics of typically-developing peers.

| Characteristics          | Peers for Lily | Peers for Jacob | Peers for Joey |
|--------------------------|----------------|-----------------|----------------|
|                          | P1 | P2 | P3     | P1 | P2 | P3 | P1 | P2 | P3 |
| Age                      | 4:0 | 4:7 | 5:3   | 4:11 | 5:4 | 3:8 | 5:6 | 4:9 | 4:9 |
| Gender                   | F  | F  | F     | F  | M  | F  | M  | F  | M  |
| Language SS (PLS-4)¹    | 106 | 104 | 109   | 109 | 113 | 102 | 107 | 125 | 101 |
| Auditory Comprehension  | 107 | 95  | 102   | 106 | 108 | 121 | 101 | 119 | 119 |

¹Standard scores on The Pre-school Language Scales–4 (Zimmerman et al., 2002).

Early childhood educators. Three female early childhood educators with at least 5 years of experience in childcare and 6 months experience with a child who had special needs participated in this study. The educators worked in different childcare centres and had a pre-school-aged child with ASD integrated into their classrooms. All had completed a 2-year college diploma in early childhood education from a Canadian institution and held the primary position of responsibility for curriculum planning for the child with ASD.

Settings and materials

The study took place in three licensed childcare centres. The materials used were an intervention manual (see Supplementary Appendix to be found online at http://informahealthcare.com/doi/abs/10.3110/17549507.2015.1024166), a storybook (Franklin’s New Friend, Bourgeois, 1997), puppets of the two main characters in the storybook and two picture communication boards depicting strategies to promote responses and initiations. The book “Franklin’s New Friend” (Bourgeois, 1997) was chosen because the story addresses the themes of friendship, peer interactions and peer support that are intrinsic to the social skills training. The two picture communication boards were developed using Boardmaker–Picture Communication Symbols computer program (Mayer-Johnson Co., 1995)¹. Boards were printed on 8 11 inch poster boards. Board 1 included coloured pictures of five strategies that children could use in order to initiate interactions with their peers (“I want to play”; “Please help”; “Come play”; “Give a toy”; and “Tap the shoulder”). Board 2 included pictures of five strategies that could extend and maintain social interactions (“Let’s play more”; “Good job!”; “My turn/your turn”; “Do it again”; and “I like that!”). The materials also included blocks with toys (i.e. people figures, vehicles) and play dough with utensils (i.e. mixers, spatulas, cookie cutters, pizza cutter).

Experimental design

A single-subject multiple baseline design across three participants was used to evaluate the effects of intervention on the children’s responses and initiations in naturalistic play sessions. The design incorporated

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non-concurrent multiple baselines (Watson & Workman, 1981). The need for this design arises from the fact that, in applied research such as this one, subjects are typically not available at the same time and, therefore, intervention cannot be administered simultaneously to all subjects. As detailed below, the design allows the comparison of pre- and post-intervention measures of each child, thus facilitating an examination of the relationship between treatment and behaviour changes (e.g. Koegel et al., 2012).

**Procedures**

**Baseline.** Each of the three participants with ASD was randomly assigned to a baseline length of 2, 3 or 4 weeks. However, due to scheduling problems at the childcare centres (e.g. vacations, special programming, absences) their baselines were, in effect, 2, 4 and 5 weeks long. Baseline data were collected for each child’s interactions with each of the three peers in two naturalistic play contexts (i.e. play dough, block play). For each child with ASD, the first peer in the play session was chosen randomly.† Thereafter, the order was counterbalanced. During baseline, each peer was told that he/she had been chosen to be a “special friend” for the play session and that he/she was to try to engage their friend (the child with ASD) in play. No further directions or prompts were given. Sessions lasted 20 minutes: 10 minutes with blocks and 10 minutes with play dough. All sessions were videotaped using a hand-held Panasonic Digital Camcorder.

**Intervention program.** The intervention program, which is described in detail in Katz and Girolametto (2013), consisted of four consecutive components: (a) two training sessions for educators; (b) five half-hour social skills training sessions for children which took place immediately after baseline measures were completed; (c) 12 20-minute play sessions during which the educators supervised the children’s participation; and (d) four follow-up and support sessions for the educators.

The educators’ training took place during two 30-minute sessions in the staff room at the childcare centre. The first author gave educators an intervention manual which included an overview of the intervention program, a description of the intervention, instructions for each of the stages of the intervention and the specific scripts to be used during the intervention. Also, educators were given the storybook and two Social Skills Communication Boards. The storybook introduced the children to the concept of playing together and suggested ways of interacting with peers to develop a friendship.

The second component of the intervention comprised of half-hour social skills training sessions for the children with ASD and two peers which were administered on 5 consecutive days. These sessions took place in the pre-school room at the childcare centre and were scheduled for times that the other pre-school children were in the playground or in a different room with another adult. The first author and the educator co-lead these sessions. The first two social skills training sessions involved reading the storybook, Franklin’s New Friend (Bourgeois, 1997) and giving each child an opportunity to re-enact the story using puppets. During the remaining sessions the children were introduced to strategies to initiate (e.g. “I want to play”; “please help”) and respond (e.g. “my turn/your turn”; “I like that!”) using the two communication boards.

The third component of the program consisted of 12 20-minute implementation play sessions that were supervised by the early childhood educator, of which 10 minutes were with blocks and 10 minutes were with play dough (the order was counterbalanced). These play sessions took place 3-times a week for 4 weeks and were videotaped by the first author. Each child with ASD participated in a total of six implementation play sessions with each of the trained peers. For the play sessions, the educator invited the child with ASD and one trained peer to play together and remained present to facilitate the 20-minute play interaction. Communication boards were placed in the play area and, as per the intervention protocol, whenever there was a period of ~30 seconds with no joint interaction, the educator prompted the children to use a specific strategy on the communication board (e.g. “Joey, do you want a block? What can you say?”).

The fourth component of the program included follow-up and support sessions for the early childhood educators which took place following completion of the implementation play sessions. The early childhood educator continued pairing the child with ASD with a trained peer for specific play times 3-times a week in the classroom, in order to maintain the skills learned. The first author provided four telephone meetings with the early childhood educators to answer questions and to encourage the continued pairing of the child with ASD with a trained peer. Educators were instructed to refrain from providing prompts during these sessions.

**Maintenance and generalization.** Approximately 4 weeks after the implementation play sessions were completed, two 20-minute play sessions were videotaped to collect data regarding the maintenance of response and initiation skills. In addition, a 20-minute play session was videotaped with the untrained peer to collect data regarding the generalization of response and initiation skills. Maintenance and generalization sessions were identical in format to

† Each peer’s name was written on a piece of paper which was folded so the name could not be seen. The early childhood educator chose one paper and thereby selected the first peer.
the baseline sessions; that is, the children were asked to play together without any direction or prompting from adults.

**Dependent variables**

In order to derive the first two dependent variables used in this study, an interval coding system (Bordens & Abbott, 1999) was applied to all play sessions. Interval coding was chosen over momentary time sampling since it allows continuous observation of the children’s behaviour through whole intervals and captures data that are generally representative of the children’s interactions (Billingsley, Deitz, Tanta, & White, 2005). In order to facilitate interval coding, each videotaped session was divided into 100 6-second intervals, using a visual signal to indicate the beginning and end of each segment. The first author or a trained research assistant reviewed the videotapes and entered a code (i.e. response, initiation or non-interactive) every 6 seconds for a total of 200 intervals per 20 minute session (play dough and blocks combined). Detailed definitions for the dependent variables can be found in the Child Intervention Code (see the Appendix to be found online at http://informahealthcare.com/doi/abs/10.3109/17549507.2015.1024166).

**Responses.** The first dependent variable was the proportion of responses expressed as a percentage of all coded intervals. Responses were defined as eye-gaze, gesture or verbalization that were directed towards the peer or a referent named by the peer that occurred within two observational intervals (i.e. within 12 seconds) of the initiating event. Responses were coded if they occurred within two coding intervals. Any interaction that occurred after the two observational intervals was coded as an initiation. Negative responses, which included all verbal or physical actions that are uncomplimentary, rejecting or physically harmful in nature, were also recorded. However, fewer than 0.7% of responses were negative and these were not included in the total number of responses.

**Initiations.** The second dependent variable was the proportion of initiations expressed as a percentage of the intervals remaining after responses were eliminated (Nelson et al., 2007). This was done because, as children’s responses increase, the opportunities available for initiations decrease (Conroy et al., 2007). An initiation was defined as a behaviour that began an interaction and was not elicited or prompted by the peer’s behaviour during the two immediately preceding coding intervals. Initiations included invitations to play (e.g. the child with ASD specified an activity, suggested a play idea or directed the peer to engage in an activity-related play behaviour), offers of objects and requests for an object or help. Fewer than 1% of the initiations were negative and these were not included in the total number of initiations.

**Social validity.** Social validity of the intervention was obtained from unbiased, independent observers (Hayes & Haas, 1988). Five undergraduate students in a language development class at a community college were asked to view two 2-minute video recordings: of which one was selected randomly from the baseline and one was selected randomly from the maintenance sessions of each target child. The recordings were randomly ordered. The students, who were blind to the experimental condition and purpose of the study, were asked to respond to questions about the observed frequency of the target children’s responses and initiations.

**Treatment fidelity**

As described in Katz and Girolametto (2013), fidelity was measured for the five social skills training sessions to determine whether the intervention was administered consistently and in accordance with the manual. The results revealed 100% compliance in all five social skills training sessions, indicating that the training sessions were delivered consistently to all children. Furthermore, the educators’ adherence to the protocol regarding prompts and praise was evaluated by examining the recordings of all videotaped sessions and analysing the frequency of the educator’s prompts and praises. Results revealed that educators provided prompts and praise as instructed; that is, they complied 100% of the time.

**Inter-rater agreement**

To ensure the reliability of the interval coding system, 20% of all videotaped play sessions were selected using a computer-generated random number table. Sessions were selected randomly for each participant and coded independently by the first author and a trained assistant. Inter-rater reliability was calculated using point-by-point agreement. This is considered an accurate estimate of reliability when responses are scored using time interval coding procedures (Hegde, 1994; Kazdin, 1982). The percentage agreement was 91% for responses \((n = 1322)\), 85% for initiations \((n = 306)\) and 95% for non-interactive \((n = 2295)\). The average inter-rater reliability for responses, initiations and non-interactive combined was 92.8% \((n = 3923)\). The percentage agreement for prompts and praise was 100% \((n = 156)\).

**Result**

For the analysis presented here the child’s responses and initiations were measured by averaging across the play contexts of play dough and block play (10 minutes each). The effectiveness of the intervention was examined by comparing the children’s performance in the different phases of data collection, that is during baseline, during the last three
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Implementation sessions and during the maintenance sessions. The data for the first three implementation sessions were not included in the analysis. Up to and including the third session, less than 50% of the implementation had been administered and it was felt that using these data would not meaningfully capture the effect of the intervention. Average data for all six implementation sessions is presented in Table III. The effectiveness of the intervention was also examined by calculating the percentage of non-overlapping data points (PND), as described by Scruggs and Mastropieri (1998). PND scores are determined by calculating the percentage of intervention data points that do not overlap with the highest baseline data point. Scruggs and Mastropieri suggest that PND scores above 90 represent “very effective” intervention scores, scores from 70–90 represent “effective” interventions, scores from 50–70 are “questionable” and scores below 50 are “ineffective”.

### Effects of intervention on responses

The data points and line graphs in Figure 1 represent the extent to which the child with ASD responded to his/her peer interventionist during the baseline sessions, the implementation play sessions and the maintenance sessions.

**Lily.** Examination of the data for Lily in Figure 1 indicates that her four baseline measurements with peers were stable, with responses averaging from 11.5% for Peer 1 and 8% for Peer 2. Following the social skills training sessions, Lily participated in six play sessions with Peer 1 and in five play sessions with Peer 2. Lily’s Peer 2 was absent for the sixth play session and an average was calculated for the fourth and fifth play sessions only. With Peer 1, Lily increased her initiations to an average of 44% during the last three play sessions. Lily increased her responses to Peer 2 to an average of 29% during the last two play sessions. Four maintenance sessions were videotaped, two with each of Lily’s trained peers. The first maintenance session took place 5 weeks after the last play session. The second session took place 4 weeks later. At maintenance, Lily’s responses to Peer 1 were 83% and 71%, which represents an average increase of 66% from baseline. With Peer 2, Lily’s responses increased from 22% at the first maintenance session to 48% at the second maintenance session, representing an average increase of 27% from baseline. The percentage of non-overlapping data (PND) revealed that none of Lily’s play or maintenance data points overlapped with any of her baseline data points. Lily, thus, achieved PND scores of 100% for both play and maintenance.

**Jacob.** Four baseline measures were taken for Jacob over a 3-week period prior to intervention (twice with each trained peer). Examination of the data in Figure 1 reveals that Jacob’s measurements were stable, with responses to Peer 1 averaging 16% and responses to Peer 2 averaging 13%. Following the social skills training sessions, Jacob participated in six play sessions with both peers. During the last three play sessions with Peer 1, Jacob increased his responses to an average of 70%, which represented an increase of 54% over baseline measurements. With Peer 2 Jacob increased responses to an average of 43%, which was an increase of 30% from baseline.

### Table III. Percentage of intervals during which children with ASD responded and initiated to their peers in baseline, implementation and maintenance sessions.

| Intervention phases | Lily | Jacob | Joey |
|---------------------|------|-------|------|
| Responded           | P1   | P2    | P3<sup>a</sup> | P1   | P2    | P3<sup>a</sup> | P1   | P2    | P3<sup>a</sup> |
| Baseline<sup>b</sup> | 11.5%| 8%    | 11%  | 16%  | 13%   | 22%  | 3%   | 17%   | 14%  |
| Implementation<sup>c</sup> | 46%  | 29%   | n/a  | 67%  | 36%   | n/a  | 51%  | 51%   | n/a  |
| Maintenance<sup>d</sup> | 77.5%| 35%   | 86.5%| 58%  | —     | 63.5%| 65%  | 39%   | 54.5%|
| Initiated           | P1   | P2    | P3<sup>a</sup> | P1   | P2    | P3<sup>a</sup> | P1   | P2    | P3<sup>a</sup> |
| Baseline<sup>b</sup> | 1.5% | 2%    | 2%   | 6%   | 4.5%  | 3.2% | 2.6% | 7.6%  | 2.3% |
| Implementation<sup>c</sup> | 14%  | 10%   | n/a  | 19%  | 23%   | n/a  | 22.8%| 21%   | n/a  |
| Maintenance<sup>d</sup> | 15%  | 22%   | 33%  | 9.5% | —     | 34.2%| 24%  | 16%   | 7.7% |

<sup>a</sup>P3 was the untrained peer and, therefore, there is no implementation data for this peer.
<sup>b</sup>Average of data for four baseline sessions for Lily and Jacob and six baseline sessions for Joey.
<sup>c</sup>Average of data for six implementation sessions for Lily, Jacob and Joey with Peer 1 and six implementation sessions for Jacob and Joey with Peer 2. Lily had only five implementation sessions with Peer 2.
<sup>d</sup>Average of data for two maintenance sessions for Lily, Jacob and Joey with Peer 1 and two maintenance sessions for Lily and Joey with Peer 2. Jacob had two maintenance sessions with Peer 1 and no maintenance sessions with Peer 2.
measurements. Peer 2 was not available for the maintenance sessions because he left the childcare centre. Hence, maintenance was measured only with Peer 1. At maintenance, Jacob’s responses were 54% and 62%, representing an average increase of 42% from baseline. The percentage of non-overlapping data (PND) was 100% for both play and maintenance. For Peer 2, one out of six play data points overlapped, giving Jacob a PND score of 83%. Generalization data indicate that, during baseline, Jacob responded to his untrained peer 22% of the baseline session and increased his responses to 63.5% during generalization sessions.

**Joey.** The six baseline measurements for Joey took place over a period of 5 weeks. The data depicted in Figure 1 demonstrate that measurements were stable, with responses to Peer 1 averaging 3% and responses to Peer 2 averaging 17%. Following the social skills training, Joey participated in six play sessions with both peers. During the last three play sessions, Joey’s responses increased to an average of 35%, which represents an increase of 52% over baseline, with Peer 1. With Peer 2, Joey’s responses increased to 59%, which represents an increase of 42% over baseline measures. Maintenance sessions for Joey were videotaped four times, twice with each peer. Joey’s responses to Peer 1 during maintenance were 58% and 71%, which is an average increase of 62% over baseline. Joey’s responses to Peer 2 during maintenance were 36% and 42%, which is an average increase of 22% over baseline. The percentage of non-overlapping data (PND) revealed no overlap of any of Joey’s play or maintenance data points with his baseline data points. Joey, thus, achieved PND scores of 100% for both play and maintenance. Generalization data for Joey in Figure 1 indicates that, during baseline, Joey responded to his untrained peer during 14% of the session. During the generalization phase, Joey increased his responses to 54.5%.

**Effects of intervention on initiations**

The data points and line graphs in Figure 2 represent the extent to which the child with ASD initiated to his/her peer interventionist during the baseline sessions, the six play sessions and the maintenance sessions.

**Lily.** Examination of the data depicted in Figure 2 indicates that Lily’s baseline measures were stable and consistent, averaging 1.5% for Peer 1 and 2% for Peer 2. During the last three play sessions, Lily initiated interactions to Peer 1 in an average of 20% of the available 6-second intervals. With Peer 2, Lily initiated an average of 12.4%. Four maintenance sessions were videotaped, two with each of Lily’s peers. At maintenance, Lily’s initiations with Peer 1 averaged at 15%, which represents an increase of
13.5% from baseline. Lily’s initiations with Peer 2 averaged 22% during the maintenance sessions, which indicates an increase of 20% from baseline. None of the play or maintenance data points overlapped with any of the baseline data points. Thus, Lily achieved PND scores of 100% for both play and maintenance sessions. Generalization data for Lily in Figure 2 indicates that, during baseline, Lily initiated to her untrained peer during 2% of the available intervals in the session. During the generalization phase, Lily increased her initiations by more than 30% to 33%.

**Jacob.** The data depicted in Figure 2 demonstrate that Jacob’s baseline initiations averaged 6% for Peer 1 and 4.5% for Peer 2. During the last three play sessions, Jacob’s initiations averaged 23.5% with Peer 1 and 31% with Peer 2. At maintenance, Jacob’s average rate of initiation for Peer 1 was 9.5%, which is a small increase of 3.5% from baseline. Jacob’s Peer 2 was not available to participate in maintenance sessions. For Peer 1, two of the eight play and maintenance data points overlapped, giving Jacob a PND score of 75%. For Peer 2, none of the play data points overlapped with the baseline data points, yielding PND scores of 100% for the play sessions with Peer 2. Generalization data for Jacob in Figure 2 indicates that, during baseline, Jacob initiated to his untrained peer during 2.3% of the available intervals in the session. During the generalization phase, Jacob increased his initiations to 7.7%.

**Joey.** The data depicted in Figure 2 demonstrate that Joey’s initiations remained stable during the baseline period and averaged 2.6% for Peer 1 and 7.6 for Peer 2. During the last three play sessions, initiations took place an average of 22.6% of the time with Peer 1 and 24.6% with Peer 2. At maintenance, Joey’s initiations to Peer 1 and Peer 2 increased from baseline to an average of 23.8% and 16%, respectively. For Peer 1 and Peer 2, none of the data points during the play sessions and maintenance overlapped with any baseline data points, giving Joey a PND score of 100% with both peers. Generalization data for Joey indicates that, during baseline, Joey initiated to his untrained peer during 2.3% of the available intervals in the session. During the generalization phase, Joey increased his initiations to 7.7%.

**Social validity of the intervention**

In order to measure the social validity of the intervention, five undergraduate students in a language development class at a community college were asked to view two 2-minute video recordings randomly selected taken from the baseline and maintenance sessions of each target child and to respond to two questions using a 5-point Likert scale (1 very low/not at all; 3 normal for age; 5 very high/very...
often). The questions were (a) “Does this child respond to play invitations?” and (b) “Does this child initiate cooperative play?”. The observers rated all three target children with a score of 1–1.2 for responses and initiations for video recordings filmed during the baseline phase. Improvements were noted during the recordings filmed during the maintenance sessions. Responsiveness ratings were 3.2, 3.8 and 4.2 for Lily, Jacob and Joey, respectively. Initiation ratings were 2.0, 3.8 and 4.0 for Lily, Jacob and Joey, respectively. The observers, therefore, rated the children’s performance higher following intervention, providing external validation of an observable treatment effect.

Discussion

This study explored the use of a peer-mediated intervention to facilitate increases in responses and initiations of pre-schoolers with ASD to typically-developing peers in their classrooms. Whereas the study reported by Katz and Girolametto (2013) looked at overall engagement and length of interactions of pre-schoolers with ASD, the current study considered specific discourse skills; namely, initiations and responses. Indeed, according to Hadley and Rice (1991), participation in an interactive exchange requires basic primary skills that include the ability to initiate an interaction and the ability to appropriately respond and thereby maintain an interaction (p. 1308).

Several significant findings emerge from this study. First, following the intervention, the responses of children with ASD increased significantly. Specifically, all three children with ASD substantially improved the frequency of their responses to two trained peers during play sessions and maintained these gains in responses at the maintenance test time, which occurred 4–7 weeks after the intervention. This finding lends support to previous studies that have shown increases in responses following participation in peer-mediated interventions (e.g. Kalyva & Avramides, 2005; McGrath et al., 2003).

Second, following the intervention, all three children with ASD substantially increased the frequency of their initiations to their two trained typically-developing peers during play sessions. Moreover, they also maintained these gains in initiations. Initiating interactions is considered a crucial social skill (Beilinson & Olswang, 2003), and children with autism often have particular difficulty imparting a desire to enter play activities (Nelson et al., 2007). As posited by Weiss and Harris (2001), making initiations toward peers is critical because it “ensures that children with autism have skills in orchestrating interactions and not simply in responding to the overtures of others” (p. 291). It is of interest to note that the data reveal that the rates of initiation achieved as a result of this intervention appear to be of the same order of magnitude as the rates of initiation of typically-developing children (e.g. Davis, Brady, Hamilton, McEvoy, & Williams, 1994; Gena & Kymissis, 2001). Given that difficulties with initiating interactions with others is considered a critical marker of one of the core deficits in ASD (DSM-5), the finding that children with ASD were able to increase their initiations to initiation levels of typically-developing children is particularly notable. Indeed, the results regarding the increase in initiations of the children with ASD add substantially to our appreciation of evidence-based interventions in this area.

Third, following the intervention, the children with ASD generalized their increases in the frequency of both responses and initiations to untrained peers in their classrooms. Generalization of skills acquired is considered an important feature of an effective intervention (Timler et al., 2007). Indeed, it is the ultimate goal of this type of intervention to ensure that the target children are able to use their newly acquired skills to interact within their natural social contexts (Rogers, 2000) and not only with a restricted set of trained peers. However, many previous studies do not report measures of generalization to untrained peers (e.g. Banda et al., 2010; Hugheitt et al., 2013; Kohler et al., 2007). The fact that the target children were able to generalize their responses and initiations to untrained peers suggests that peer-mediated intervention may be useful in enhancing such interaction skills with a wide range of play partners.

Finally, this study measured the social validity of the intervention and the findings. Independent, lay observers rated randomly-presented videotapes of the children’s interactions and consistently rated the post-intervention videotapes as displaying increased responses and initiations. Measuring the social validity of an intervention is crucial because it represents an external common-sense measure of the efficacy of the treatment (Foster & Mash, 1999). Social validity measures inform parents and practitioners about the transparency with which others can perceive changes in children. The subjective measure of social validity confirmed the clinical importance of the findings of this study.

Limitations and future directions

A number of limitations and recommendations for future research may be of interest. First, it would be useful to repeat this intervention with more children with ASD. Although replication of outcomes across three children is considered to be a benchmark of successful intervention in single subject designs (McReynolds & Kearns, 1983; Tawney & Gast, 1984), the characteristics of the target children in this study may restrict its generality. A further limitation of the
current research is that it was conducted in the children’s classrooms without other children present. This study might be extended by investigating the effect of the intervention when presented in a typical classroom situation that includes other pre-schoolers. It would also be of interest to assess generalization with more than one typically-developing peer. Further research might consider children of different age groups and/or with different developmental patterns. In addition, this intervention would benefit from considering the effect of using a higher number of typically-developing children as peer-interventionists. Because there are usually many peers in each integrated classroom, it would be important for future studies to engage the entire peer group to provide consistent environments for the child with ASD and other children with disabilities in the same classroom. Finally, the long-term effect of the intervention on the children’s responses and initiations is of great interest and could constitute a useful extension of this research.

Conclusion

In conclusion, the first main implication of the current study is that children with ASD were found to have increased and maintained their response and initiation skills following a brief intervention. The children’s gains in responses and, in particular, initiations address one of the core deficits in ASD, namely social interaction impairments (DSM-5). These findings are significant because children with ASD who engage in interactions more frequently in turn elicit more linguistic and social feedback from their peers from which they can learn (Rotheram-Fuller et al., 2010).

The second main implication is that a consultation and collaboration between a speech-language pathologist and the children’s early childhood educators may be an essential component of the service delivery model of the peer-mediated intervention. The two professionals co-taught the social skills program (i.e. five sessions) and delivered the intervention together during the intervention phase. The reported findings in the current study regarding both responses and initiations are, therefore, encouraging and supportive of the usefulness of the intervention model and provide a notable addition to the body of evidence-based interventions in this area.

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**Supplementary material available online**

Supplementary Appendix to be found online at [http://informahealthcare.com/doi/abs/10.3109/17549507.2015.1024166](http://informahealthcare.com/doi/abs/10.3109/17549507.2015.1024166).