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A systematic review of peer-mediated interventions for children with autism spectrum disorder

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Abstract

Background—Peer mediated intervention (PMI) is a promising practice used to increase social skills in children with autism spectrum disorder (ASD). PMIs engage typically developing peers as social models to improve social initiations, responses, and interactions.

Method—The current study is a systematic review examining PMIs for children and adolescents with ASD conducted using group designs. Five studies met the pre-specified review inclusion criteria: four randomized controlled trials and one pre- and post-test design.

Results—Four of the studies were conducted in school settings, whereas one study was conducted in a camp setting. The studies all reported that participants improved in social skills (e.g., social initiations, social responses, social communication) post intervention. Additionally, sustainment, generalization, and fidelity of implementation were examined.

Conclusion—PMI is a promising approach to address social skills in children with ASD, and this approach can be conducted in meaningful real-world contexts, such as schools. Limitations of the studies as well as future directions are discussed.

Keywords

Peer-mediated interventions; Systematic review; Autism spectrum disorder

1. Introduction

Social impairment is a debilitating core deficit that affects children with autism spectrum disorder (ASD; American Psychiatric Association (APA), 2013). Difficulty reading social cues as well as engaging in interpersonal communication may preclude children with ASD from successfully interacting with their peers, particularly in the school setting (Bauminger, Solomon, & Rogers, 2010). Many studies of school-aged children with ASD have shown a disrupted pattern of social engagement, where children with ASD have fewer reciprocal friendships (Bauminger & Kasari, 2000; Bauminger, Solomon, Aviezer, Heung, Gazit et al., 2008; Bauminger, Solomon, Aviezer, Heung, Brown et al., 2008; Chamberlain, Kasari, & Rotheram-Fuller, 2007), are unengaged with their peers on the playground (Frankel, Goropse, Chang, & Sugar, 2011; Kasari, Locke, Gulsrud, & Rotheram-Fuller, 2011;

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Macintosh & Dissanayake, 2006; Schupp, Simon, & Corbett, 2013), and more peripherally included in smaller social networks (Chamberlain et al., 2007; Locke, Kasari, Rotheram-Fuller, Kretzmann, & Jacobs, 2013; Rotheram-Fuller, Kasari, Chamberlain, & Locke, 2010). To address these concerns, many interventions have been developed to promote and facilitate social interactions.

Research evaluating social skills interventions in children and adolescents with ASD has highlighted peer-mediated interventions (PMI) as one of two most promising intervention methodologies to improve social skills (Bass & Mulick, 2007; Chan et al., 2009; McConnell, 2002; Reichow & Volkmar, 2010; Rogers, 2000). PMIs comprise training typically developing peers (e.g., classmates) on behavioral and social strategies to engage children with ASD (Bellini, Peters, Benner, & Hopf, 2007; Chan et al., 2009; Kasari, Rotheram-Fuller, Locke & Gulsrud, 2012; Rao, Beidel, & Murray, 2008). PMIs can be beneficial for children and adolescents with ASD for several reasons. First, peers can model appropriate social behaviors. Second, peers often are readily accessible in school settings to act as intervention agents, and third, children with ASD can use peers to practice their newly acquired social skills (Chan et al., 2009). Broadly, PMIs have shown improvements in social network inclusion (i.e., number of social connections, peer acceptance, and classroom connectedness), non-verbal social skills (e.g., eye contact, joint attention), play skills (e.g., turn-taking), reciprocal social-communication skills (e.g., conversations, initiations, responses) as well as greater social interaction and increased friendships for children and adolescents with ASD (Bass & Mulick, 2007; Carter & Kennedy, 2006; Jung, Sainato, & Davis, 2008; Kamps, Potucek, Lopez, Kravits, & Kemmerer, 1997; Kasari et al., 2012; Laushey & Heflin, 2000; Owen-DeSchryver, Carr, Cale, & Blakeley-Smith, 2008; Roeyers, 1996; Strain & Kohler, 1995).

There have been a number of reviews of social skills interventions (see Bellini et al., 2007; Cappadocia & Weiss, 2011; Chan et al., 2009; Ferraioli & Harris, 2011; Kasari & Patterson, 2012; Rao et al., 2008; Reichow, Steiner, & Volkmar, 2012; Rogers, 2000; Wang, Cui, & Parrila, 2011; Watkins et al., 2015; White, Koenig, & Scahill, 2007; Zhang & Wheeler, 2011). Of those, few have focused on PMIs (see Chan et al., 2009; Ferraioli & Harris, 2011; Wang et al., 2011; Watkins et al., 2015; Zhang & Wheeler, 2011). Single-subject design studies in PMIs have been more extensively studied. Two *meta*-analyses have been conducted examining the efficacy of PMIs (Wang et al., 2011; Zhang & Wheeler, 2011). Both of these studies exclusively examined single-subject designs and found PMIs to be highly effective for children with ASD. Chan et al. (2009) were more comprehensive in their review and summarized all PMI studies from inception to 2009. In their review, peer training methodology and specific intervention components used in 42 PMI studies were discussed. The authors highlighted the main methods of peer training used in each study, such as reinforcement, verbal explanation, modeling, group discussion, and on-going feedback. The review suggests that PMIs for children with ASD may be quite different from study to study, particularly in the targeted skill sets (i.e., academic skills, disruptive behaviors, social skills). While improving different skill sets are essential for the overall quality of life for individuals with ASD, it is with utmost importance that PMIs specifically targeting social skills be further examined, as social impairment is a core deficit affecting individuals with ASD (APA, 2013). More recently, Watkins et al. (2015) extended Chan and colleagues' work and

summarized 14 additional PMI studies that were published between 2008 through 2014. In their review, Watkins et al. (2015) also focused on the intervention characteristics and strategies. They examined the different strategies used in PMIs and discussed how PMIs may be more appropriate for children with ASD who exhibit different characteristics and deficits. Watkins et al. (2015) highlighted various PMI strategies that included initiations by peers, proximity, prompting and reinforcing initiations.

All of the reviews suggest that PMIs are effective in improving social skills in children with ASD. However, only a small number of group designs were included in these reviews, and these reviews primarily included single-subject designs and studies that targeted ancillary skills (e.g., academic achievement, maladaptive behaviors) associated with ASD rather than core social skills deficits. Since PMIs are one of the most promising interventions for children with ASD, we need to better understand for whom PMIs are most effective by examining studies that have rigorously tested PMIs using group designs. Single subject design studies have provided promising results in the effectiveness of PMIs. However, one of the disadvantages of single subject designs is the generalizability of the results to groups of individuals, particularly one that is as heterogeneous as children with ASD. The current review will expand the literature on PMIs by focusing on studies that used experimental group designs for all school age children (preschool to high school) with ASD that targeted social skills. The current review will use Reichow, Volkmar, and Cicchetti's (2008) evaluation protocol to rate the quality of the PMIs using group designs in the past 30 years. Specifically, the current PMI review summarizes the observed social outcomes and focuses on generalization, sustainment, implementation fidelity, and discusses the clinical implications of these studies in school settings.

2. Methods

2.1. Search strategy

A comprehensive search was conducted in June 2015 using three electronic databases (PsycInfo, Educational Resources Information Center (ERIC), and PubMed) covering education, psychology, and medicine. Keyword search terms spanned four areas included those related to autism (autis* or pervasive develop* or Asperger*); social skills (social skill* or social interaction* or social initiations* or social engagement*) and peer mediated intervention (peer*) and school based (school*). A total of 1343 articles were found using this keyword search; but only five studies met the inclusion and exclusion criteria described below.

2.1.1. Inclusion and Exclusion Criteria—A set of inclusion and exclusion criteria was applied to the manuscripts that were obtained from the search. Included studies:

1. Used an experimental group design (all single subject designs were excluded as they previously have been reviewed (see Chan et al., 2009; Watkins et al., 2015).
2. Involved participants of any age diagnosed with ASD including autism, pervasive developmental disorder, or Asperger syndrome.

3. Examined a PMI for which a social skill (e.g., peer engagement, initiations, responses) was the primary outcome.
4. Described a peer-training component as part of the PMI.
5. Were published in English.
6. Were not restricted by publication year.

2.2. Rating method quality

The methodological quality of the studies was rated using Reichow et al.' (2008) evaluation protocol. The protocol included items specific in rating group trials. The protocol included six primary quality indicators (i.e., participant characteristics, independent variable, comparison condition, dependent variable, data analysis, and use of statistical tests) and eight secondary indicators (i.e., random assignment, inter-observer agreement, blind raters, fidelity, attrition, generation and/or sustainment, effect size, and social validity). Two independent raters assessed and double coded all five studies. Cohen's Kappa was used to calculate interrater reliability ($\kappa = 1.00$, $p < 0.001$).

3. Results

The systematic search of the literature resulted in 1343 articles. Titles and abstracts of the articles were examined. After removal of irrelevant articles, duplicates, and reviews, a total of five articles were included in the current review. Overall, there were four randomized controlled trials and one pre- and post-test design. In addition, four of the studies were conducted in school settings, whereas one study was conducted in a camp setting. Study characteristics and outcomes are summarized in Tables 1 and 2.

3.1. Methodological quality

The five studies had mixed quality ratings between "strong" and "adequate." Three of the studies received a "strong" quality rating (Kamps et al., 2014; Kasari et al., 2012; Roeyers, 1996). These studies had "high" quality ratings for all primary quality indicators and at least four of the secondary quality indicators. The other two studies were rated as "adequate" and "weak", respectively (Corbett et al., 2014; Kalyva & Avramidis, 2005). The "adequate" rated study met four of the primary quality indicators and at least two of the secondary quality indicators, and the "weak" rated study met fewer than four of the primary indicators. Overall, these studies used manualized treatment or described their intervention in detail, had strong links between their research questions and data analysis, and demonstrated generalization and/or sustainment (maintenance of skills after intervention has ended) of targeted skills.

3.2. Participants receiving intervention

The five PMI studies examined included children from preschool to high school age ($N = 260$). The number of participants in the studies varied widely across the five studies, ranging from a small sample of five participants (Kalyva & Avramidis, 2005) to a large RCT of 95 participants (Kamps et al., 2014). Overall, two studies included fewer than 12 children (Corbett et al., 2014; Kalyva & Avramidis, 2005), and three studies utilized 60 or more

participants (Kamps et al., 2014; Kasari et al., 2012; Roeyers, 1996). Four of the five studies (80%) comprised elementary-aged children with ASD. Only one study examined preschool-age children (Kalyva & Avramidis, 2005), and none of the studies specifically targeted middle or high school age children. Corbett et al. (2014) recruited children between the ages of 8–17, but their program was not specifically designed for adolescents. Additionally, most of the studies enrolled children who had at least average IQs, except for one study (Roeyers, 1996). To participate in these interventions, children were expected to communicate using 2–3 word phrases minimum. Although Roeyers (1996) examined children of varying levels of cognitive ability, including children who had low IQ/DQ scores, cognitive ability was not specifically examined as a moderator for treatment outcomes. Autism diagnosis also was examined differently in each of these studies. The Autism Diagnostic Observation Schedule (ADOS) is used as a gold standard for classifying individuals with ASD, but only two of the five studies used the ADOS to confirm autism research eligibility (Corbett et al., 2014; Kasari et al., 2012). The other three studies used the DSM III (Roeyers, 1996), and school autism eligibility (Kalyva & Avramidis, 2005; Kamps et al., 2014) to confirm children's ASD diagnosis.

3.3. Peer training

For all studies, peers were selected via teacher nomination. Three studies documented that teachers nominated peers who had regular attendance, had appropriate social skills, and were high in social status in the classrooms (Kamps et al., 2014; Kasari et al., 2012; Roeyers, 1996). For one study, peers also had experience interacting with children with ASD (Corbett et al., 2014). Peer models comprised typically developing students who were in the same general education classroom, a grade below or above, as children with ASD. Peers were not specifically matched on gender. In all studies, peers were asked to identify children who were isolated or playing alone and engage that child in an activity or game play. Most of the studies also gave a presentation about ASD except for one study (see Kasari et al., 2012).

All studies used a structured peer-training model to teach specific strategies (e.g., respond to target children, model for target children) to typically developing peers, with the exception of Kalyva and Avramidis (2005). In Kalyva and Avramidis (2005), teachers provided general instruction to typically developing peers to help children with ASD play followed by positive reinforcement. The remaining four studies had a didactic component, modeling by trainers (Corbett et al., 2014; Kamps et al., 2014; Kasari et al., 2012), and role-play or rehearsal with typically developing peers (Kamps et al., 2014; Kasari et al., 2012; Roeyers, 1996).

All the studies included a peer training component and no separate training for just the children with ASD except for Kasari et al. (2012). Typically, peers were trained first, and then placed to interact and socialize with children with ASD. During these socializations, the trainers' main role was to support and facilitate the interactions between children with ASD and the peers. The settings for their interactions varied depending on the study. For example, most of the studies conducted their play indoors in the classrooms, except for Kasari et al. (2012) who conducted their intervention outdoor on the playground.

3.4. Social outcomes

All studies used a social skills measure, but the type of measure and social outcome widely varied across studies. All studies used direct observations to measure children's social skills, but only two studies used observers who were blinded to children's treatment condition (Kasari et al., 2012; Roeyers, 1996). All of the observation measures examined children's initiations of and responses to social communication; however, these data were collected in different social contexts and used different operational definitions. For example, Kalyva and Avramidis (2005) examined social initiations and responses separately during a one-hour circle time, while Kamps et al. (2014) combined both social initiations and responses (i.e., communicative acts) and observed children during a 10-min free play. Other studies also measured children's joint engagement, conversation, and duration of social interaction (Kasari et al., 2012; Roeyers, 1996).

In addition to observations, two of the studies also used multi-rater (i.e., parents, teachers, and researchers) social skills measures (Corbett et al., 2014; Kasari et al., 2012). Corbett et al. (2014) had parents complete the Social Responsiveness Scale (Constantino & Gruber, 2005), which measures children's social awareness, social communication, and social cognition. Researchers were asked to rate children's social skills using the Developmental Neuropsychological Assessment (NEPSY; Korkman, Kirk, & Kemp, 2007), that measures social perception, and the Companionship Scale (Bauminger, 2007) that assesses children's verbal and nonverbal social behaviors using a 5-point Likert scale (Corbett et al., 2014). Kasari et al. (2012) used the Teacher Perceptions of Social Skills, which measures children's social skills and classroom behaviors (e.g., quality interactions with peers) on a 3-point Likert scale. Data also were collected directly from children. Children were asked to complete a peer nomination measure that examined their social acceptance and social network inclusion before and after treatment as well as during a 3-month follow-up (Kasari et al., 2012). Lastly, two of the studies also reported effect sizes for the social outcomes (Corbett et al., 2014; Kasari et al., 2012). The effect sizes varied depending on the social outcome and ranged from small to large effect size ($d = 0.23$ – 0.74). Of the different social outcomes from the two studies, social awareness had the smallest effect size and total social skills had the largest effect size.

3.5. Implementation fidelity

Various types of implementation fidelity (e.g., adherence, competence, use) were reported in three of the five studies (Corbett et al., 2014; Kamps et al., 2014; Kasari et al., 2012). Of the three studies, implementation fidelity was collected on research staff members that were trained to deliver the intervention within the school or camp setting in two studies (Corbett et al., 2014; Kasari et al., 2012), and only one study measured implementation fidelity on trained school personnel (Kamps et al., 2014). Implementation fidelity was measured using a variety of techniques including coding therapist treatment notes (Kasari et al., 2012), a checklist monitoring tool (Kamps et al., 2014), and pre-and post- training exams, rating scales, and treatment logs (Corbett et al., 2014). Overall, implementation fidelity was high ranging from 86% to 94% fidelity across studies. Lastly, only Corbett et al. (2015) examined peer implementation fidelity.

3.6. Generalization and sustainment

Four studies examined generalization of acquired social skills (Corbett et al., 2014; Kamps et al., 2014; Kasari et al., 2012; Roeyers, 1996), and three of the studies examined sustainment (Kalyva & Avramidis, 2005; Kamps et al., 2014; Kasari et al., 2012). Generalization was examined differently in each of the studies. Two studies used generalization probes during free play with both trained and untrained peers and examined the frequency of children's social interaction and communicative acts (Corbett et al., 2014; Kamps et al., 2014). The other two studies used teacher reports of social skills to measure generalization of skills to different contexts (Kasari et al., 2012; Roeyers, 1996).

Three of the studies examined sustainment although the sustainment period was relatively short. Kalyva and Avramidis (2005) had a 2-month follow up of their participants. Both initiations and responses were examined in the study, but only children's responses to social communication were maintained at follow up. Kasari et al. (2012) had a 3-month follow up where the primary social skills outcomes (i.e., playground engagement and social network inclusion) were sustained; however, teacher-reported social skills were not significant at the follow-up period. Kamps et al. (2014) had a longer sustainment period (Fall to Spring); however, improvement of communicative acts only maintained from Fall to Winter, but not to Spring.

3.7. Evidence-based practice

Using Reichow et al.'s (2008) framework and definition, the evidence demonstrated by the reviewed studies indicates that PMIs have "established evidence based practice." By definition, Reichow et al. (2008) state that treatments have "established evidence-based practice" if they have "at least two group experimental design studies of strong research report strength conducted in separate laboratories by separate research team." (p. 135). There were three studies in this review (Kamps et al., 2014; Kasari et al., 2012; Roeyers, 1996) that were evaluated as being "strong" using Reichow et al. (2008) criteria (Table 3).

4. Discussion

In the past few decades, there has been an increase in PMI studies for children with ASD. Despite this increase, many studies utilized single-subject designs, and relatively few have used large randomized controlled field trials. This review points to a current shift in the field in that more studies have started to use group designs in real world community settings. Only one of the group design studies (Roeyers, 1996) in the current review was included in the last published systematic reviews of PMIs (see Chan et al., 2009; Watkins et al., 2015). Notably, three of the five studies in the current review were published in the last five years. Furthermore, most of these studies also demonstrated quality ratings of "high" or "adequate", and that it is possible for children with ASD to make significant changes in their social skills in both school and camp contexts as reported by parents, teachers, researchers, and children and adolescents themselves.

This review highlights the growing need for future research in five critical areas. While the number of PMI studies that use a group design was limited, all of the studies focused on a

select sample of children with ASD — namely, children with average to above average cognitive functioning. It is possible that PMIs could be the most effective for high functioning children with ASD; however, without comparable data on the majority of children with ASD who are not represented in research — particularly children who are minimally verbal and lower functioning — as well as ethnically and culturally diverse samples, it is not possible to profile for whom PMIs are most effective (Kasari & Patterson, 2012). Future research is needed to understand the effectiveness of PMIs particularly for underserved, under resourced, and underrepresented populations.

Second, in our review of the literature, there were no randomized controlled group designs that specifically focused on middle and high school students with ASD. Because the social landscape dramatically changes between elementary and secondary school, there may be fewer established guidelines for selecting peers models for adolescents with ASD. Logistical factors such as changing classroom periods and fewer opportunities for unstructured social interaction in middle and high school settings may influence how peer models are selected to participate and how PMIs are implemented. Nonetheless, middle and high school students with ASD may be most in need of PMIs given the fragility and critical importance of social relationships during adolescence. Future research is needed in this area to determine whether PMIs are appropriate for middle and high school students with ASD and/or whether adaptations (e.g., delivery, selection of peer models) to existing PMIs are needed for successful implementation.

Third, this review provided insight into the components of peer training models that future PMI studies may want to consider. Most of the PMI studies in this review had a didactic component, modeling sessions, and rehearsal practices as part of the peer training. Interestingly, the only study that did not have these components also did not have significant increases in social initiations (but had social responses) from children with ASD. This suggests that peer models may need more structured training to help them intentionally think about, plan, and create opportunities for social interactions to promote social initiations when they interact with children with ASD. This is particularly important for future studies as researchers design their interventions and decide on targeted social outcomes for children with ASD.

Fourth, the discussion of implementation fidelity is notably absent from many PMI studies, particularly those conducted in real world settings (e.g., training school personnel) where implementation fidelity is arguably more important. The type of implementation fidelity measured (e.g., use, adherence, dose, quality of delivery, etc.) and the processes in which implementation fidelity data are collected (e.g., observer rated, self-report) has not been systematically measured across studies. This review highlights the critical need for systematic ways to measure implementation fidelity. Although only one study reported achieving above 80% implementation fidelity when school personnel implemented the intervention, the expectation of achieving 80% implementation fidelity, the level to which we train experts in clinic or university-based studies, in school or other community settings may not be realistic given the barriers and constraints (e.g., inexperienced and untrained school personnel, time, resources, etc.) to implementation observed in the school context (Locke et al., 2015). Perhaps engaging in the core components of the intervention or using

certain evidence-based strategies as opposed to none is a sufficient catalyst for improvement in various social outcomes in schools and other community contexts. There is also very limited fidelity data specifically measuring peer implementation. Measurement of how well peers implemented these strategies will be important considering that peers are the main social partners for children with ASD, particularly on the playground where adults may not be present. Additional research should examine potential mediators and moderators (e.g., child characteristics, teacher fidelity) that may contribute to the effectiveness of peer-mediated interventions. Future research is needed to understand these critical questions related to successful implementation in real-world settings.

Lastly, the assessment of generalization and sustainment of social skills were under examined in these studies. The targeted social skills (i.e., initiations, responses, social interaction) in these PMIs were intended to help children with ASD develop and maintain meaningful relationships with others. Thus, to make PMIs more relevant and meaningful in school settings, children with ASD should be able to use and sustain these newly acquired social skills in different social contexts and not just within the context where the intervention was conducted. Future research should consider the context in which social outcomes are gathered to fully explore generalization and sustainment of learned skills. In addition, the follow-up periods were relatively short in the three studies that examined sustainment. Despite the limited time frame of conducting research in school settings (Owens et al., 2014), it may be of critical importance to explore long-term sustainment of intervention effects into the next school year and beyond.

5. Conclusion

Although this review only included five articles, there is much to be gleaned from reviews with small sample sizes (Reichow et al., 2012; Spain & Blainey, 2015). This review is consistent with previous review studies in terms of treatment effects (Chan et al., 2009; Watkins et al., 2015), and provides further support of the effectiveness of PMIs for children with ASD by examining group design studies. Though there are populations of children with ASD (e.g., minimally verbal) that PMIs have not targeted, the group designs demonstrated that PMIs are effective for many children with ASD. The range of abilities of these children was more diverse in these group designs than what has been demonstrated in previous single subject design studies. It also provides support that PMIs may be conducted in schools, within the context where the most meaningful gains can be made.

Even though PMIs have an “established evidence base” using Reichow’s protocol, more work still needs to be done in this field. According to Chambless and Hollon (1998), empirically supported interventions should have: 1) a comparison control group; 2) a treatment manual (i.e., fidelity); 3) clearly defined population(s); and 4) reliable and valid assessment outcomes. This review revealed that group and comparison designs are relatively scarce, and very few of the PMI studies measured implementation fidelity ($n = 3$). In addition, studies should use more standardized assessments to capture diagnosis and social skills from multiple informants. The limitations highlighted in this review suggest that PMI approaches are promising to address social skills in children with ASD, but there are many unaddressed and understudied areas (e.g., moderate to severe individuals with ASD, middle

and high school students with ASD, implementation fidelity, and the generalization and maintenance of meaningful social outcomes) that warrant additional research. Future research on PMIs should focus on: 1) addressing more diverse populations of children with ASD, specifically children who are minimally verbal and adolescents with ASD; 2) measuring implementation fidelity; 3) collecting generalization and maintenance data, and 4) examining potential mediators and moderators.

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Table 1

Study characteristics.

Author	# Participants	Grade/Age	# Peers and Characteristics	Intervention Setting and Procedures	Trainer	Peer Training	Treatment Length and Dose
Corbett et al. (2014)	11	K-12 school Ages: 8–17	11 peers from camp; Peers were experienced in working with ASD and severity of participant's symptoms influenced peer matching.	Two weeks of afternoon camp; Day 1: circle time introductions, mock auditions, ice breakers, theater games, imaginative play, role plays, and music and movement; Day 2: roles were assigned to individuals; Day 3–10: Interactive theater games, character development, and role play and rehearsals; Day 11–12: technical and dress rehearsals; Day 13–14: Culmination.	Research staff	Peers were provided with three days of clinical presentation of ASD and behavioral intervention techniques. Behavioral techniques were presented using live and video examples. Strategies included: positive reinforcement, modeling, shaping, fading, redirection, prompting, and extinction. Ten core objectives were directly taught, modeled, incorporated into case scenarios, and supervised. Core objectives and target behaviors include: providing social support, creating an enjoyable environment, modeling warm social interaction, enhance motivation, engaging in directed communication, using nonverbal communication, engaging in imaginative play, using empathic responding, supporting active learning, and advancing individual learning.	2 weeks (SENSE Theatre summer camp); 4h/day
Kalyva and Avramidis (2005)	5	Preschool Ages: 3–4	25 peers (15 girls and 10 boys) were nominated by the teacher	All children participated in the general circle time; children with ASD and selected peers participated in "circle of friends" at the end of class. Each child was presented with the same toy for him/her to imitate the teacher.	Teachers	The teachers informed the peers (in the absence of the child with ASD) that the aim of the circle was to help the focus child learn how to ask someone to play. The teachers verbally praised the peers for their contribution to the intervention.	3 months; 12 sessions; 30min/day
Kamps et al. (2014)	95	K-1 Ages: 5–6	4–6 peers per target child from child's general education classroom or within one grade level. Peers were selected based on good school attendance, high social status, age appropriate social skills, and willingness to participate.	Sessions took place in the classroom; children were provided with one age-appropriate Table top activity; non-treatment social probes were conducted outside of classroom and included three different games and activities.	School Staff	Peer Network Intervention included both children with ASD and their peers. Intervention included setting up social groups to teach social and communication skills using games and activities. The session structure included didactic, practice with adult, peer prompting, teacher feedback and reinforcement. Five specific skills were targeted in the sessions: requests and shares, comment about ones play, comment about others play, niceties, play organizers.	6 months; 25–30min sessions; 3x/week
Kasari et al. (2012)	60	1–5 Age: $M=8.14$	3 typical peers from target child's classrooms. Peers were nominated by teachers based on	Peers were trained to engage children with social challenges on the playground.	Research Staff	Peers identified isolated children and used strategies to engage them; Direct instruction, modeling, role play, and rehearsal strategies were used to teach	6 weeks; 2x/week

Author	# Participants	Grade/Age	# Peers and Characteristics	Intervention Setting and Procedures	Trainer	Peer Training	Treatment Length and Dose
Roeyers (1996)	85	NA Ages: 5–13	appropriateness and peers' social network salience. 48 peers nominated by teachers and principals based on regular school attendance, appropriate peer interactions, compliant with adult instructions, and able to follow through with a task for an extended period of time.	Children with autism were brought into the room with their peers and instructed to do dyadic play.	School Staff	these skills to engage children with ASD. Peers were provided with techniques to react to aggressive behaviors, and how to get target child's attention. Three videotapes of children with ASD were shown to the peers, role play, and peer coaching were used to teach skills to engage children with ASD.	10 sessions; 30-minute sessions; 1–2×/week

Table 2

Study outcomes.

Author	Social Skills Measures	Social Outcomes	Generalization	Sustainment	Fidelity	Effect Size	Blind Observer	Inter-rater Reliability
Corbett et al. (2014)	Developmental Neuropsychological Assessment measures social perception Social Responsiveness Scale (SRS) measures social functioning including social awareness, communication, and cognition Companionship Scale measures verbal and nonverbal behaviors Peer Interaction Paradigm: 20-min playground interaction with two novel peers to measure social engagement	Significant increase in all social outcomes, except social communication on the SRS and social engagement on the Peer Interaction Paradigm.	20-minute playground interaction with two novel peers (ns)	NO	Research Staff Training Fidelity: pre and post training (89% and 91%, respectively) Peer Treatment Implementation Fidelity: Rated on a Likert scale of 1–5. Pre-intervention range: 2.6–3.67. Post intervention range: 3.67–4.2	Range: $d=0.23-0.74$	NO	NO
Kalyva and Avramidis (2005)	1-h circle time observation to measure social initiations and responses were coded.	Significant increase in social responses, but not social initiations	NO	2 month follow up: significant increase in social responses but not initiations	NO	N/A	NO	93.4%
Kamps et al. (2014)	10-min free play observation to measure total communicative acts	Both groups increased in total communicative acts (No significant difference between groups)	Two 10-min free play generalization probes with trained and untrained peers in Fall, Winter, and Spring. Both groups increased in initiations, responses, and total communication (No significant difference between groups)	Improvements maintained for total communicative acts from beginning of the year to mid-year, but did not increase in the spring	School Staff Implementation Fidelity: 3 h in-service training including, role play, rehearsal, and, model direct instruction; 15–100% (average: 86%)	N/A	NO	Non-treatment social probe: 33–100%; Generalization probe: 40–100% Intervention session: 84–89%
Kasari et al. (2012)	Playground Observation of Peer Engagement (POPE) measures solitary and joint engagement Social Network Salience (SNS) measures child's prominence within his/her classroom social network	Significance increase in SNS and TPSS	Significant increase in TPSS	12-week follow up: significant increase on the POPE and SNS, but not TPSS	Research Staff Implementation Fidelity: 94%	$d = 0.69$	YES	100%

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Author	Social Skills Measures	Social Outcomes	Generalization	Sustainment	Fidelity	Effect Size	Blind Observer	Inter-rater Reliability
Roeyers (1996)	Teacher Perception of Social Skills (TPSS) measures teacher's perception of children's social skills 10min videotaped sessions to measure duration of social interaction, social initiations and social responses	Significant increase in all social outcomes.	Social Behavior Rating Scale completed by school staff	NO	NO	N/A	YES	96%

Table 3

Quality rating of studies.

Author	Primary Quality Indicators						Use of statistical tests		
	Participant Characteristic	Independent Variable	Comparison Condition	Dependent Variable	Link between research question and data analysis				
Corbett et al. (2014)	x	x		x	x				
Kalyva and Avramidis (2005)		x		x	x				
Kamps et al. (2014)	x	x	x	x	x				x
Kasari et al. (2012)	x	x	x	x	x				x
Roeyers (1996)	x	x	x	x	x				x

Author	Secondary Indicators						Social Validity		
	Random Assignment	Interobserver Agreement	Blind raters	Fidelity	Attrition	Generalization/Maintenance	Effect Size		
Corbett et al. (2014)				x	x	x	x		x
Kalyva and Avramidis (2005)	x					x			
Kamps et al. (2014)	x			x	x	x			x
Kasari et al. (2012)	x		x	x	x	x	x		x
Roeyers (1996)	x		x		x	x			x

Author	Strength of Research Report
Corbett et al. (2014)	Adequate
Kalyva and Avramidis (2005)	Weak
Kamps et al. (2014)	Strong
Kasari et al. (2012)	Strong
Roeyers (1996)	Strong