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Systematic Review**

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Effects of Peer Support Interventions on the Communication of Preschoolers with Autism Spectrum Disorder: A Systematic Review

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ABSTRACT

Many young children with autism spectrum disorders (ASDs) experience difficulty in the development of communication skills. Teaching peers to make use of communication support behaviors has been investigated as a strategy to increase communication for young children with ASD in early childhood settings. The purpose of this systematic review was to examine (1) the overall effects of peer support interventions on the communication of young children with ASD and (2) any possible moderating variables related to participant and intervention characteristics. The social support model was used as a framework for the study of intervention components. Eighteen single-case experimental design studies (48 children with ASD) met the inclusion criteria and were advanced to the full coding and analysis phase of the investigation. Descriptive analyses and effect size estimations using the improvement rate difference (IRD) metric were conducted. Overall, peer support interventions were found to be effective across a range of young children with ASD and intervention approaches. Evidence was also identified for the use of the social support model as a framework to guide the development of peer interventions in early childhood settings. The use of friendship groups, the selection of play materials based on the interests of the child with ASD, and the provision of augmentative and alternative communication appeared to be associated with positive communication outcomes.

Communication goals for a preschool-age child (3–5 years of age) include the ability to use appropriate and effective strategies to interact with same-age peers; key communication behaviors at this stage of development include initiation of interactions, provision of appropriate responses to others, use of conflict resolution strategies, and sustained engagement in social play or group activities.^{1–3} These peer interactions increase opportunities for children to develop both important communication behaviors and social skills.

For many children, speech is an effective tool for communication.⁴ For children with autism spectrum disorder (ASD), communication is often a more challenging process.⁵ By age nine, 48% of children with ASD either have no or few spoken words, or speak using words but not sentences.⁶ Children with ASD typically do not respond to or initiate social interaction at the same rate as their typically developing peers^{7,8} and are at a higher risk for social isolation.⁵

Communication partners have been found to be effective in supporting the communication skill development of children with ASD.^{9–11} Successful support for the communication of children with ASD, however, typically requires the acquisition and use of new skills by the communication partner.^{12,13} With older age groups, peers are sometimes taught to act as instructors for the child with ASD, providing organized activities to teach new skills.⁵ In early childhood (EC) settings, current approaches emphasize that the peers of the child with ASD should act as natural communication supports,^{3,11} providing opportunities to practice and develop social communication behaviors within interactive play and small group activities.¹⁴

Because of the significant and often persistent communication impairments present in young children with ASD, providing appropriate supports for interaction and communication with peer partners should be a priority at an

early age.^{11,15} However, interventions to promote appropriate social communication interaction in young children with ASD are complex and pose challenges even for skilled adults.¹³ Given the importance of peer relationships, along with the increased percentage of time many children with ASD spend with typically developing peers, effective intervention strategies to teach peers to engage in positive age-appropriate interactions with children with ASD in EC settings are needed.¹⁶

One approach to this challenge is the use of a systematic review of the available research literature, and the examination of this research within an existing framework to investigate key intervention components. Of special interest is the social support model proposed by Hunt and colleagues¹ that includes general guidelines to increase positive social interactions between peers and individuals with complex communication needs, including children with ASD. Based on a review of the research and clinical experience, Hunt and colleagues¹ proposed three building blocks for designing and implementing social supports for children with complex communication needs: providing information to peers that will assist them in developing positive social relationships with the child with complex communication needs; identifying and using interactive media (including communication supports such as augmentative and alternative communication (AAC) devices, as well as play materials) as the basis for reciprocal social interactions; and arranging interactive activities and facilitating positive social interactions.

The social support model¹ has been investigated in school settings, with increases reported in both the communication behaviors of and the interactions between elementary-age children with severe disabilities and their typically developing peers.¹⁷ The social support model also appears to provide both a flexible and comprehensive guide to the creation of supports for an EC setting.

PURPOSE AND RESEARCH QUESTIONS

The purpose of this study is to provide a systematic review and meta-analysis of the preschool peer support and intervention literature for young children with ASD and their classmates, using the support model of Hunt et al¹ as a framework for the examination of the intervention components. The following research questions are addressed:

1. What are the overall effects of peer support interventions on the communication of young children with ASD?
2. What is the relationship between observed effects and variables relating to participant and intervention characteristics, including the social support model components identified by Hunt et al¹?
3. What is the strength of the evidence for peer support interventions as assessed using the Scientific Merit Rating Scale (SMRS)?¹⁸

METHODS

Search Procedures

The first step of the search procedures was a review of electronic databases for studies appearing in the literature from 1986 to 2015. This timeframe was chosen to include all studies published after the instatement of Part C of IDEA.¹⁹ The following databases were included: ProQuest Dissertation and Theses, PsycInfo, ProQuest Education Journals, and Education Resource Information Center (ERIC). The following search terms were used: ab(peer^m) AND ab((autism^m OR asd)) AND ab(((young child^m OR preschool^m OR early childhood))). For all databases, this set of terms was searched in the title and abstract fields. The search was restricted to English- language peer-reviewed studies.

Criteria for Inclusion and Exclusion

Title and abstract stage. At the title and abstract stage of review, studies were examined to meet specified criteria for participant characteristics, intervention characteristics, and outcome measure characteristics. To meet criteria

for participant characteristics, the study was required to include individuals between 3 and 5 years old, diagnosed with ASD, autism, Asperger's syndrome, or pervasive developmental disorder—not otherwise specified, and include individuals between 3 and 5 years old, who were peers of the children with ASD. To meet the intervention inclusion characteristics, studies were required to occur within an EC setting (i.e., child care, preschool, pre-k) and involve some form of training to the peer. Finally, to meet the outcome measure inclusion criteria, studies had to include one primary outcome that measured an aspect of language or communication outcome for the children with ASD.

For any abstracts that did not contain enough information to determine if the criteria were met, the full text was consulted to determine eligibility for inclusion. Similarly, if studies incorporated participants with other diagnoses, only the data for the children with ASD were considered and reported in this investigation. The first and third authors independently identified included articles to proceed to the full-text stage of the search procedures using the inclusionary criteria. Reliability calculations were completed for 20% of the 458 articles reviewed at the title–abstract phase, with 100% agreement (see Fig. 1).

Hand search. In addition, a hand search was conducted using the 1986–2015 issues of *Journal of Autism and Developmental Disorders*, *Topics in Early Childhood Special Education*, and *Research in Autism Spectrum Disorders*; these journals were identified using Web of Science as the three journals in which articles on this topic most frequently appeared. Two undergraduates trained in hand search procedures with the criteria for inclusion performed the hand searches. An additional 4,654 articles were reviewed during this stage of the review process (Fig. 1). With regard to inter-rater reliability for the hand search results, calculations were completed for 20% of the articles for each individual journal. The undergraduate students and the first author obtained 100% agreement on these articles.

Full-text stage. Studies meeting the title and abstract level criteria, or that were identified through the hand search, were reviewed at the

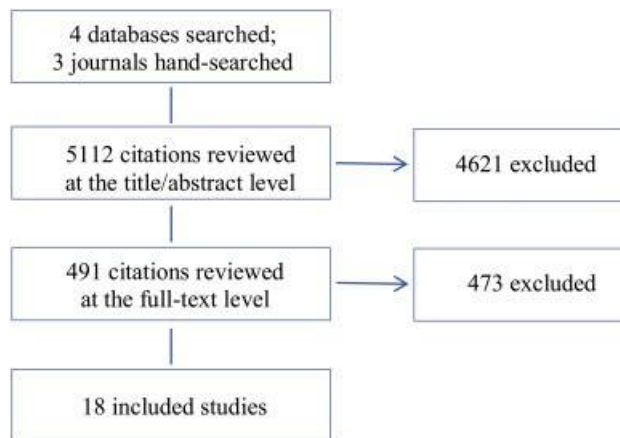


Figure 1 Search procedures.

full-text level to determine if they met the following additional criteria, which were needed for the analysis procedures used in this paper:

1. For the research design, the included study must have employed an experimental research design that allowed for direct visual analysis of the effect of the intervention on the individual participant's behavior, such as single-case experimental design.²⁰
2. For the intervention inclusion characteristics, the included studies were required to implement and describe an intervention that taught the peer to interact with the child with ASD.
3. For the outcome inclusion measure, at least one dependent variable needed to include a direct measure of a communicative interaction (i.e., involving an initiation and/or response) between the trained peer and the child with ASD.

Reliability calculations were completed for 100% ($n = 491$) of the previously identified studies using full-text inclusionary criteria, and yielded 99% agreement between the first and third authors. The one disagreement was for a study that met the age criteria for participants, but did not meet the setting criteria (i.e., took place within a kindergarten setting), and was ultimately excluded for that reason. The total number of identified studies that met the inclusion criteria at both levels was 18; thus,

18 single-case experimental design studies were advanced to the full coding and analysis phase of the investigation (Fig. 1).

Data Extraction and Coding Procedures

Descriptive data. The coding form and manual for the review were adapted from Kent-Walsh et al.¹³ The form contained the following categories: (1) study identification, (2) intervention design, (3) participant (child with ASD) demographics and results, (4) partner (peer) demographics and results, (5) independent variable details including the Hunt et al's¹ support model components and classification of intervention, and (6) dependent variable details and classification. For the purposes of this investigation, the social support model components identified by Hunt and colleagues¹ were operationalized as five categories: (1) provision of information to peers, including the use of friendship training/ability awareness groups; (2) identification of interactive materials, including how materials and activities were chosen for use by the children; (3) provision of communication support, including the extent to which AAC supports were available to the children with ASD; (4) arrangement of interactive activities, including the types of activities used by the children; and (5) facilitation of positive social interactions, including the type of support behaviors provided by the adults. The coding manual contained operational definitions for each of the aforementioned coding

categories. The first and third authors used the coding manual to independently code 100% of included articles, with 100% agreement obtained between the two authors.

Improvement rate difference (IRD) data. IRD was used in this investigation as the effect size measure to afford comparison and aggregation of data across studies. At present, a variety of meta-analytic tools have been proposed for the aggregation of single-case research findings.^{20–22} IRD expresses the difference in successful performance between baseline and intervention phases and can be calculated from visual analysis of nonoverlapping data.²¹ While all the available tools have some identified limitations,²¹ the use of IRD has been the preferred metric in recent systematic reviews of communication partner training.^{10,13}

IRD scores can range from 0 to 1.0, with scores less than 0.50 indicating very small or questionable effects, scores between 0.51 and 0.70 indicating moderate effects, scores between 0.71 and 0.75 indicating large effects, and scores greater than 0.75 indicating very large effects.²¹ Inter-rater reliability for the scoring of IRD by the first and third authors was calculated for 95 of the 95 communication outcome measures (100% of the data) for both the children with ASD and peers. IRD scores within 0.05 points were considered to agree.¹³ Reliability calculations yielded 93% agreement between first and third authors' results. The disagreements that occurred were a result of difficulty in precisely identifying the relative position of the data points for some of the published graphs, and were reconciled by the first and third authors prior to completion of the first analysis.

Scientific Merit Rating Scale. The SMRS developed by the National Standards Project¹⁸ was used to evaluate the quality of science and intervention effects of the included studies. The SMRS measures five dimensions of experimental rigor for research studies involving individuals with ASD: (1) research design, (2) measurement of the dependent variable, (3) measurement of the independent variable or procedural fidelity, (4) participant ascertainment, and (4) generalization and maintenance. To determine the experimental rigor of each individual research study, the first and third

authors independently analyzed each study, using the criteria of the SMRS. The SMRS score is a composite score of the five dimensions, rounded to the nearest whole number. The SMRS score can range from 0 to 5, with scores of 5, 4, and 3 indicating sufficient scientific rigor has been applied, a score of 2 indicating initial evidence about intervention effects, and scores of 1 and 0 indicating insufficient scientific rigor has been applied. Inter-rater reliability for SMRS scoring for the 18 included studies yielded 96% agreement.

RESULTS

Eighteen single-case design studies met the inclusion criteria. The mean effect size (IRD value) aggregated across studies was 0.72 (standard deviation [SD] = 0.23; range: 0–1.0), indicative of a large level of effect.²¹

Descriptive Analyses

Participant characteristics for children with ASD. Table 1 contains an overview of the included studies and provides the mean IRD values for the communication outcomes of the children with ASD by study. A total of 48 children with ASD completed at least the baseline and intervention phases of the investigations as the recipient of the intervention. The mean age of participant in years was 4;3 (years; months) with a range of 3;0 to 5;11. A total of 42 participants were male (87%) and 6 were female (13%), closely representative of sex prevalence data for individuals with ASD.²³

Of the 48 children with ASD, 88% did not demonstrate age-appropriate language skills ($n = 42$)

The children with ASD were described as having a variety of communication skills, including no speech ($n = 5$), vocalizations and echolalia ($n = 14$), spontaneous single-word utterances ($n = 9$), and short phrases ($n = 8$). In four of the studies,^{24–27} AAC systems were provided for some of the children with ASD ($n = 8$, 17%). Information was not available for some participants ($n = 11$); when participants were described as making use of more than one speech behavior (e.g., single words and short phrases), the higher level skill (e.g., short phrases) was reported.

Table 1 Single-case Experimental Design Studies Examining the Effects of Positive Peer Supports

Study	Gender, CA of child with ASD	Gender, CA of peer	Support behavior	Nature of DV	Mean IRD ^b	SMRS score
Ganz and Flores 2008	3 M, 4;5–4.7	3 F, 4–5 1 M, 4	I	Unscripted phrases, responses, total speech	0.58	3
Garfinkle and Schwartz 2002	4 M, 3;7–5;5	28 NR, ^a 3–5	Px	Social interactions, imitation	0.24	2
Goldstein et al 1992	3 M, 3;7–5;3	5 F, 3;3–5;4 5 M, 3;3–5;4	I, Pt, Px, R	Social behavior, linguistic, nonlinguistic	0.58	4
Hundert, Rowe, & Harrison, 2014	1 F, 5;10 1 M, 4;8	27 NR, 3–5	I, Pt, Px, R	Interactive play	1.0	4
Katz and Girolametto 2013	1 F, 4;8 2 M, 4;1–5;1	4 F, 4–4;11 2 M, 5;4–5;6	I, Pt, R	Extended interactions	0.97	3
Kohler et al 2007	1 F, 4;9	5 F, 4 1 M, 4	I, Pt, R	Social interactions	0.88	2
Lee and Lee 2015	1 F, 3;9 2 M, 3;10–4;2	9 NR, 3;8–4;3	I, Pt	Social interactions	1.0	2
Lorah et al 2014	3 M, 4–5	2 F, ^a 4–5 1 M, ^a 4	R	Independent mands	1.0	3
MacDonald et al 2009	1 M, 5	1 M, 5	Pt	Scripted verbalizations, scripted actions	0.95	2
McGee et al 1992	3 M, 3;7–5;11	3 F, 4;5–4;11	I, Pt, R	Reciprocal Interactions	0.94	2
Nelson et al 2007	4 M, 3;9–4;5	NR ^a	Pt, Px	Prompted, unprompted initiations	0.54	3
Odom and Watts 1991	3 M, 3;5–5	2 F, 5 2 M, 4–5	I, Pt, Px, R	Social interactions	0.30	2
Pellecchia and Hinline 2007	1 F, 4 2 M, 4–5	NR, ^a 3–5	R	Independent mands	1.0	2
Sainato et al 1992	3 M, 3;7–4;8	2 F, 3;11–4;2 1 M, 4;7	I, Pt, Px, R	Social behavior	0.57	4
Sawyer, Luiselli, Ricciardi, & Gower 2005	1 M, 4	3–5 NR, 3–12	I, Pt, R	Verbal sharing, physical sharing	0.83	1
Strain et al 1994	1 F, 3 2 M, 4–5	10 NR, 3–5	I, Pt, Px, R	Social interactions	0.66	2
Trembath et al 2009	3 M, 3–4	3 F, 3–5 3 M, 4–5	I, Pt, Px, R	Linguistic, nonlinguistic	0.62	2
Zanolli et al 1996	2 M, 4;2–4;10	6 F, ^a 4–6 4 M, ^a 4–5	R	Initiations, initiation topographies	0.81	3

Notes: CA, chronological age (denoted in years; months); DV, dependent variable; F, female; I, initiation; IRD, improvement rate difference; M, male; NAC, National Autism Center; NR, not reported; Pt, prompt; Px, proximity; R, reinforce; SMRS, Scientific Merit Rating Scale.

^aTypically developing and developmental delay

^bAcross participants.

Table 2 details the mean IRD values, ranges, and SDs by participant characteristics for the children with ASD and peers, as well as intervention characteristics. Effect size was large for the oldest children with ASD, 4- and 5-year-olds (IRD = 0.73 and IRD = 0.71), although a moderate effect size rating was observed with the youngest children, 3-year-olds (IRD = 0.65). Also, a very large effect size (IRD = 0.93) was indicated for girls as opposed to an overall moderate level of effect (IRD = 0.61) observed for boys. For participants who used AAC prior to intervention (but not necessarily within intervention activities), an overall moderate level of effect (IRD = 0.57) was reported.

Participant characteristics for peers supporting child with ASD. At least 138 peers served as the intervention agents within the included studies. The peers who participated in the studies ranged in age from 3;0 to 5;11. For the 11 studies that reported gender data, 21 of the peer participants were male (38%) and 35 were female (63%).

The majority of studies (72%) reported the peer participants to be typically developing, and a large (0.75) effect size was calculated for this population. Three studies^{24,28,29} trained children who were reported to be either typically developing or diagnosed with a developmental disability, to act as peers—a very small (0.47) effect size was calculated for these individuals.

Table 2 Findings for Peers Supporting the Communication of Children with ASD

Measure (<i>n</i>)	Number of cases	IRD	Level of effect	SD
Participant characteristics, child with ASD				
Age				
3.0–3.11	11	0.65	Moderate	0.29
4.0–4.11	26	0.72	Large	0.07
5.0–5.11	11	0.74	Large	0.30
Gender				
Male	42	0.66	Moderate	0.28
Female	6	0.95	Very large	0.09
AAC				
Prior to study	8	0.57	Moderate	0.39
Participant characteristics, peer				
ASD	6	1.0	Very large	0
TD and developmental delay	10	0.47	Very small	0.25
TD	32	0.75	Large	0.24
Intervention characteristics				
Training				
Peers only	22	0.75	Large	0.27
Both peers and child with ASD	26	0.71	Large	0.28
Peer support behavior				
Initiation	31	0.74	Large	0.24
Prompt	33	0.74	Large	0.24
Proximity	25	0.56	Moderate	0.25
Reinforce	33	0.78	Very large	0.24

Abbreviations: ASD, autism spectrum disorder; IRD, improvement rate difference; TD, typically developing.

Two studies reported on training peers who were also diagnosed with ASD to deliver the intervention,^{25,30} and a very large (1.0) effect size was observed for these studies.

Intervention characteristics. A wide variety of instructional strategies were employed in teaching peers to provide communication supports; because more than half of the studies ($n = 11$) used a combination of approaches, it is difficult to interpret effect size scores. Eleven studies used strategy instruction; for example, Nelson et al²⁸ taught peers to use the “Keys to Play” strategy to model and promote strategy use by the children with ASD. Four studies (22%) used a self-monitoring component. Lee and Lee³¹ used a “good friend board” to help peers keep track of the number of friendship behaviors in which they engaged with children with ASD. Video modeling was used in two studies (11%). MacDonald

et al³² showed peers a short video of adults acting out a play scenario using thematic play sets. Play scripts were used in three studies (17%); Ganz and Flores,³³ for example, taught peers and the children with ASD specific play-themed scripts to use during joint-play experiences.

The support behaviors targeted for use by the peers were coded using the four categories identified by Odom and Strain¹²: (1) initiate interaction with the child with ASD, (2) prompt target behavior from child with ASD, (3) engage in proximity with the child with ASD, or (4) reinforce the behavior of the child with ASD.

Intervention instruction was provided to the peers in one of two ways: either peers were taught exclusively (10 studies) or both the peer and the child with ASD participated in the intervention instruction (8 studies). The effect

size was large (IRD = 0.75, and 0.71, respectively) for both approaches.

IRD data were disaggregated by both the total number and type of peer support behaviors targeted during instruction. These results should be interpreted with caution as interventions included “bundles” of treatments, and it is not possible to identify the individual contributions of the components. It may be useful, however, to investigate the effect sizes associated with the different elements.

A very large effect size was observed for teaching peers to provide reinforcement (IRD = 0.78), a large effect size was seen for teaching

peers to initiate (IRD = 0.74) and/or to prompt behaviors (IRD = 0.74), and a moderate effect size was observed for teaching proximity-related behaviors (IRD = 0.56). When a combination of support behaviors was taught to peers, a very large overall effect size (IRD = 0.93) was observed.

Outcome measure characteristics. Data on outcome measures were extracted for both the peer (when reported) and the child with ASD. In keeping with the inclusion criteria, all studies reported at least one communication behavior of the child with ASD as a dependent variable. Examples of these dependent variables included numbers of intervals that included social interaction of the child with ASD with peers ($n = 9$), frequency of unprompted social initiations ($n = 2$), and communication behaviors ($n = 3$) as measured by percentage of intervals with any speech,³³ total communicative acts³⁴ and total communication behaviors per minute.²⁷

A small number of studies ($n = 5$) reported results for both the child with ASD and peer outcomes. Only two studies reported on individual peer outcomes,^{32,35} with measures of behavior including frequency of scripted verbalizations, and total number of strategies used with the child with ASD. The remaining three studies^{34,36,37} reported peer outcome data as overall peer group behavior. Because only a small number of studies included graphed data for the peers, it was not possible to calculate effect sizes relative to peer-focused dependent variables (i.e., peer’s use of targeted strategies).

Research design. With regard to research design (Appendix A), nearly all of the studies

($n = 15$) employed multiple baseline or multiple probe single-case designs; of these, the majority ($n = 7$) employed multiple baseline/multiple probe designs across participants, with one study employing multiple baseline across setting,²⁶ and four studies using multiple baseline/probe designs, with additional components (e.g., embedded, nonconcurrent). Because many studies did not report generalization and/or maintenance data to compare with baseline, it was not possible to calculate IRD values for these study features.

Hunt et al’s support model components. Hunt et al¹ recommended that peer interven-

tions to support inclusion develop positive social supports using components from five main categories: provide information to peers, identify interactive materials, provide communication support, arrange interactive activities, and facilitate positive social interactions. Table 3 details the use of these five categories of social supports for each of the 18 studies. All studies included at least one component of the Hunt et al’s¹ social support model. Table 4 lists the effect sizes associated with the use of each social support category. Observed effect sizes ranged from moderate to very large for the individual components.

Friendship groups. Of the 18 studies reviewed, 8 studies (44%) provided specific friendship and ability information about the child with ASD (including both strengths and challenges) to peers as part of the intervention procedure. Sainato et al,³⁵ for example, posted cartoon pictures of play strategies on the wall and used happy/sad, yes/no faces during intervention measures to provide visuals to peers regarding their use of targeted peer-mediated behaviors. Studies that included the use of friendship and ability awareness groups produced a very large overall level of effect (IRD = 0.79), while studies that did not had a moderate overall level of effect (IRD = 0.68).

Material selection. Interactive materials were selected in one of two different ways. Material selection was based most frequently on the basis of interest of the child with ASD ($n = 7$) or on the classroom routine ($n = 4$). McGee et al³⁸ used a reinforcement assessment procedure to identify preferred toys of the child

Table 3 Use of Social Support Model Components across Studies (Hunt et al¹)

	Friendship group	Material selection	AAC	Activities	Adult support
Ganz and Flores 2008	Friendship	Child with ASD	–	Thematic	M, P, F
Garfinkle and Schwartz 2002	–	CR	–	Art, manipulatives	M, P, F
Goldstein et al 1992	–	–	–	Dramatic, gross motor, manipulatives	M, P, C
Hundert et al 2014	Friendship	Child with ASD	–	Dramatic, manipulatives, thematic	M, P, F
Katz and Girolametto 2013	Friendship	CR	PECS	Art, manipulatives	M, P
Kohler et al 2007	Buddy skills	Child with ASD	–	Thematic	M, P, C
Lee and Lee 2015	Friendship	–	PECS	Snack	M, P, F
Lorah et al 2014	–	–	PECS	Manipulatives	P
MacDonald et al 2009	–	–	–	Thematic	P
McGee et al 1992	–	Child with ASD	–	Manipulatives	M, P, F
Nelson et al 2007	–	Child with ASD	–	Free play	M, P
Odom and Watts 1991	–	CR	–	–	M, P, C
Pellecchia and Himeline 2007	–	Child with ASD	–	Manipulatives	P
Sainato et al 1992	Friendship	–	–	Dramatic, thematic	M, P, C, F
Sawyer et al 2005	Friendship	–	–	Free play	M, P, C
Strain et al 1994	–	–	–	Manipulatives	M, P, C, F
Trembath et al 2009	Friendship	CR	SGD	Free play	M, P, C, F
Zanolli et al 1996	–	Child with ASD	–	Art, manipulatives	M, P, F

Abbreviations: AAC, augmentative and alternative communication; ASD, autism spectrum disorder; C, check; CR, classroom routine; F, fade; M, model; NR, not reported; P, prompt; PECS, picture exchange system; SGD, speech-generating device.

with ASD prior to intervention while Katz and Girolametto³⁹ used materials typically available and most often identified as favored play materials in child care centers. The overall computed effect size for using materials and activities that were highly preferred by the child with ASD yielded a large overall level of effect (IRD = 0.72) compared with the moderate overall effect size (IRD = 0.56) yielded by materials and activities that were selected based on classroom routine and availability.

AAC. As reported earlier, a total of eight children with ASD used AAC systems to communicate, but the application of AAC to support the communication of children with ASD within intervention procedures occurred for 25% of the children with ASD ($n = 12$). For example, Trembath et al²⁷ identified all three children with ASD as having very limited functional speech, with one participant already using AAC, but the interven-

tion introduced use of a speech-generating device to support the communication of all the children with ASD. Use of AAC throughout intervention yielded a very high level of overall effect (IRD = 0.90) while studies that did not report the use of AAC within intervention procedures yielded moderate levels of overall effect (IRD = 0.64).

Interactive activities. All of the 18 studies made use of interactive activities, typically combinations of activities and toys routinely found within EC centers. Activities were classified into the following categories: (1) art, (2) dramatic, (3) free play, (4) gross motor, (5) manipulatives, (6) snack, and/or (7) thematic playsets. The use of interactive activity categories produced either moderate, large, or very large overall effect sizes. Manipulatives and snack (IRD = 0.77 and 1.0, respectively) produced very large overall levels of effect while gross motor, art, free play, and dramatic play

Table 4 Effect Size Findings for Hunt et al's Social Support Model Components

Measure (<i>n</i>)	Number of cases	IRD	Level of effect	SD
Friendship group				
Yes	19	0.79	Very large	0.25
NR	29	0.68	Moderate	0.09
Material selection				
Child with ASD	18	0.72	Large	0.22
Classroom routine	13	0.56	Moderate	0.11
AAC				
Yes	12	0.90	Very large	0.22
NR	36	0.64	Moderate	0.28
Interactive activity				
Art	9	0.61	Moderate	0.37
Dramatic play	8	0.68	Moderate	0.26
Free play	8	0.61	Moderate	0.22
Manipulative	26	0.77	Very large	0.29
Gross motor	3	0.58	Moderate	0.25
Snack	3	1.0	Very large	0
Thematic play	10	0.73	Large	0.25
Adult support				
Model	41	0.68	Moderate	0.27
Prompt	48	0.72	Large	0.27
Check	17	0.62	Moderate	0.21
Fade	26	0.68	Moderate	0.29

Abbreviations: AAC, augmentative and alternative communication; ASD, autism spectrum disorder; IRD, improvement rate difference; NR, not reported.

activities yielded moderate overall effect sizes (IRD $\frac{1}{4}$ 0.58, 0.61, 0.61, and 0.68).

Adult support behaviors. The adult support provided to the peers during these activities was coded by the nature of instructional support provided^{3,40}: (1) model, (2) prompt, (3) check, and/or (4) fade. All studies (100%) reported the use of prompts by adults, and most studies ($n = 15$) reported the use of adult models for targeted intervention behavior. Fewer studies reported an adult performing a check to ensure mastery of newly taught skills ($n \frac{1}{4}$ 7) or the fading of adult support within the intervention conditions ($n \frac{3}{4}$ 9).

IRD data were also disaggregated for the reported use of adult support behaviors. The reported use of prompting yielded overall large effect sizes (IRD $\frac{1}{4}$ 0.72) compared with the moderate overall levels of effect yielded by reported adult support behaviors of modeling, checking, and fading (IRD $\frac{1}{4}$ 0.68, 0.62, and 0.68).

Scientific Merit Rating Scale

Overall scores. To determine the overall quality of science and intervention effects of all studies included within this investigation, the mean SMRS score was calculated. The mean SMRS score, aggregated across studies, was 2.51 (SD $\frac{1}{4}$ 0.79; range: 0–5.0). The score, rounded to 3, provides initial evidence of overall application of scientific rigor for the single-case design peer support interventions explored in this systematic review.

Composite scores. Table 1 provides the SMRS composite scores of each individual research study. As specified by the National Standards Project,¹⁸ the composite scores have been rounded to the nearest whole number to provide a general means of comparison across studies. A little less than half of the studies ($n = 8$) scored in the range of 3 to 4, indicative of sufficient use of scientific rigor within the intervention. The remaining 56% of studies scored in the range of 2 and 1. Studies with

composite scores of 2 ($n = 9$) suggest initial evidence of intervention effects, while one study scored 1, suggesting insufficient scientific rigor has been applied.

DISCUSSION

One promising approach to supporting the development of new communication skills by children with ASD is the use of peers as natural communication supports in preschool settings. This systematic review sought to answer three key questions: (1) What is the impact of teaching peers to support the communication of young children with ASD? (2) Does the impact differ by participant and intervention characteristics, including the social support model components identified by Hunt et al?¹ (3) What is the strength of evidence for peer support interventions?¹⁸

This review provides evidence that interventions focused on teaching peers to support the communication of young children with ASD can result in positive changes in the social communication behaviors of children with ASD. Although there was variability in effect sizes across participants, the average IRD score (IRD 0.72) falls within the large overall effect size designation.²¹ The findings also indicate that the proposed model of social supports by Hunt et al¹ (Tables 3 and 4) may provide a useful framework for the development and evaluation of peer interventions in the EC classroom and can be effectively implemented using a variety of materials, activities, and instructional supports typical of an EC classroom. Furthermore, overall strength of evidence based on SMRS ratings⁸ indicates an overall sufficient application of scientific rigor in the research reviewed here.

To support the adaptation and use of peer communication supports in EC classrooms, we discuss the results in more detail later, using the model of Hunt et al¹ as a framework.

Friendship Groups

During the preschool years, peer relationships become more important, particularly in the context of play.^{15,41} Young children with ASD, however, are at higher risk for peer

rejection compared with other children with disabilities.⁴² Past research provides evidence that explicit instruction in positive and supportive friendship skills, along with information regarding both the abilities and needs of their classmates with disabilities, can help peers implement effective social interventions.^{43,44} The findings from this review indicate that studies that incorporated friendship and ability awareness groups yielded a very large overall effect (IRD = 0.79) on the communication skills of the children with ASD, while studies that did not had a moderate overall effect (IRD = 0.68).

Material Selection

Play is a major learning tool for communication of young children^{45,46} and consideration of the child's preferences has been identified as a key component in successful play experiences.⁴⁷ Studies that selected intervention materials identified as high interest to the child with ASD yielded a large effect size (IRD = 0.72), as opposed to moderate overall effect size (IRD = 0.56) for studies using materials based on the classroom routine.

AAC

It is estimated that almost half of children with ASD will demonstrate no or limited speech,⁶ and the use of AAC is frequently recommended as a support to successful communication.^{5,13} At the same time, it is frequently reported that appropriate support for the use of AAC is not provided.^{14,48} In this review, those studies that did include AAC systems within instruction and intervention measures yielded a very high overall level of effect (IRD = 0.90) on the communication outcomes of the children with ASD.

Interactive Activities

Organizing activities to support interaction opportunities has been identified as a key component of successful communication interventions.¹⁵ The use of manipulatives, and of snack, yielded the largest effect sizes (IRD = 0.77 and 1.0, respectively) compared with

the other activities within the category (Table 4). These findings are congruent with findings by Thiemann-Bourque,¹¹ who reported snack time produced the highest levels of increased AAC communication within a preschool setting because food was considered a preferred item for all children in the classroom. It is important to note that manipulatives also yielded a very large effect size, providing evidence that play activities (e.g., play dough, building blocks, puzzles) can also serve as strong communication opportunities for children with ASD and their peers. As noted by Thiemann-Bourque,¹¹ manipulative activities also have the benefit of being provided within small social groups in which there is a shorter wait time between turns, and fewer social rules.

Support for Positive Social Interactions

A high overall level of effect (IRD $\frac{1}{4}$ 0.72) was observed when adults provided prompting support to peers during intervention measures. To promote positive peer supports, Hunt et al¹⁵ discussed the significance of the social communication facilitator's role, and the role of informed adults in building the bridge of communication between children with complex communication needs and their peers. For nonverbal, or minimally verbal, children with ASD who are beginning communicators, communication and social gains will largely depend on opportunities for communication with responsive, trained peers.¹¹ Responsive, trained peers are the result of knowledgeable adults who provide both modeling and prompting (faded over time) to teach peers how to engage and interact with the child with ASD.

LIMITATIONS

There are two main limitations to the present investigation. First, the main goal in this review was to evaluate the effects of teaching peers to support the communication of children with ASD. A detailed analysis of the impact of teaching on peer behavior was challenging, however, because only a small number of studies provided comprehensive information on peer characteristics or dependent variables. This

information is needed to support a better understanding of the relationship between the training components, the characteristics of the peers, and outcomes. Detailed peer characteristic and outcome data would also support a better understanding of the relationship between changes in peer behavior, and changes in the communication behavior of the child with ASD.¹³

The second limitation occurred in the interpretation of results of this investigation due to the frequent use of "bundled" treatments within individual research studies. Bundling of components presents challenges when identifying the individual contributions of specific intervention features. Though the overall strength of the literature gives confidence in the use of peers to provide communication support to children with ASD, the results should be interpreted with caution.

CONCLUSION

The results of this investigation contribute to the growing evidence that peers in EC can be effective communication partners for children with ASD. It is especially positive to note the gains for children with ASD during interactions in which the peers acted as natural play partners, rather than as instructors, during typical EC activities (e.g., manipulative play, dramatic play).^{49,50} In developing interventions focused on preschool-age participants, five supports identified by Hunt et al¹ appear to positively impact the communication outcomes of children with ASD: (1) providing friendship training and ability awareness to peers, (2) identifying interactive materials using the interests of the child with ASD, (3) supporting the use of AAC within preschool activities, (4) using interactive activities to facilitate social communication, and (5) utilizing adult support behaviors to model and promote communication and interaction for both the peer and the child with ASD. Continued research is needed to develop and refine developmentally appropriate partner-training techniques across a broad range of activities; however, the SMRS evidence score of 3 provides support for the use of this technique with children with ASD.

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Appendix A Design Specifics for included Studies

Study	Single-case design type	Design characteristics
Ganz and Flores 2008	Changing criterion design	Fidelity, generalization, social validity
Garfinkle and Schwartz 2002	MBD, across participants	Fidelity, generalization, maintenance, social validity
Goldstein et al 1992	Reversal design	NR
Hundert, Rowe, & Harrison, 2014	MBD, nonconcurrent	Fidelity, generalization
Katz and Girolametto 2013	MBD, across participants	Fidelity, maintenance, social validity
Kohler et al 2007	MBD, across participants	NR
Lee and Lee 2015	MBD, across participants	Fidelity, maintenance, social validity
Lorah et al 2014	MBD, across participants	Generalization, maintenance
MacDonald et al 2009	MPD	Maintenance
McGee et al 1992	MBD, across participants	Generalization, maintenance, social validity
Nelson et al 2007	MPD	Fidelity, maintenance, social validity
Odom and Watts 1991	MBD, embedded component	Social validity
Pellecchia and Hineline 2007	MBD	NR
Sainato et al 1992	MBD, across participants	Generalization
Sawyer, Luiselli, Ricciardi, & Gower 2005	Reversal design	Maintenance, social validity
Strain et al 1994	MBD, across settings	NR
Trembath et al 2009	MBD	Generalization
Zanolli et al 1996	MBD, embedded MPD	Fidelity, generalization

Abbreviations: MBD, multiple baseline design; MPD, multiple probe design; NR, none reported.