

Systematic Review of the Effects of Interventions to Promote Peer Interactions for Children who use Aided AAC

Michelle C.S. Therrien, Janice Light & Lauramarie Pope

To cite this article: Michelle C.S. Therrien, Janice Light & Lauramarie Pope (2016) Systematic Review of the Effects of Interventions to Promote Peer Interactions for Children who use Aided AAC, *Augmentative and Alternative Communication*, 32:2, 81-93, DOI: 10.3109/07434618.2016.1146331

To link to this article: <http://dx.doi.org/10.3109/07434618.2016.1146331>



Published online: 23 Feb 2016.



Submit your article to this journal [↗](#)



Article views: 426



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 1 View citing articles [↗](#)

RESEARCH ARTICLE

Systematic Review of the Effects of Interventions to Promote Peer Interactions for Children who use Aided AAC

Michelle C.S. Therrien, Janice Light and Lauramarie Pope

Department of Communication Sciences and Disorders, The Pennsylvania State University, University Park, PA, USA

ABSTRACT

The goals of this systematic review were to investigate studies that implemented interventions to increase or improve peer interaction for children who used aided AAC, to evaluate the strengths and limitations of those studies, and to discuss implications for practice and directions for future research. A systematic search resulted in the identification of 19 studies (56 participants). Studies were coded and summarized in terms of participants, independent and dependent variables, outcomes, and quality of evidence. All 19 studies reported positive effects on interactions with peers, though the results varied in degree. Although the quality of evidence varied, three studies met the standards of conclusive evidence, and an additional five presented preponderant evidence. The most frequently used intervention components were teaching children with complex communication needs how to use AAC within social interactions and teaching peers skills and strategies to promote interaction. While the body of research suggests that intervention can promote positive peer interactions for children with complex communication needs, the evidence for preschool-aged children and children with autism spectrum disorders is relatively sparse.

ARTICLE HISTORY

Received 8 May 2015
Revised 17 December 2015
Accepted 21 January 2016
Published online 22 February 2016

KEYWORDS

Peer interaction;
augmentative and
alternative communication;
systematic review; social
interaction

Introduction

Social relationships are a core dimension of quality of life for people with and without disabilities. Social relationships benefit many facets of life; they have been shown to improve mental and physical health and reduce mortality risk (Umberson & Montez, 2010) and to benefit cognitive and language development (Hartup, 1989). When parents and support staff for individuals with intellectual disabilities were asked about quality of life, 100% spontaneously mentioned social relationships as an important element (Petry, Maes, & Vlaskamp, 2005). Individuals with disabilities and especially individuals who use augmentative and alternative communication (AAC) are at risk for social isolation from peers (Clarke & Kirton, 2003; Cooper, Balandin, & Trembath, 2009). Therefore, it is imperative that researchers investigate ways to facilitate peer interaction for students who use AAC to support the development of social relationships.

Peer interactions, the back-and-forth exchanges between two individuals, contribute to the development of friendships that enhance quality of life (Bukowski, Motzoi, & Meyer, 2009). Just as the social interactionist perspective of language development suggests a transactional relationship in which children learn language through interactions with their communication partners, social psychological theories of friendship assert that children learn how to be friends from engaging in social interaction with peers. The reactions and responses of a peer partner play a role in shaping future interactions (Prizant & Wetherby, 1990). For children who use

AAC, however, communication with peers presents a significant challenge because they encounter the same attitude barriers as other children with disabilities while simultaneously struggling to communicate. The barriers multiply for those who are beginning communicators or who are adapting to newly implemented supports. Adult communication partners are more likely than peers to be responsive to communicative attempts, and to respond in predictable ways. Peers may be less predictable and may be less invested in the success of the child who communicates using AAC.

Clarke and Kirton (2003) observed interactions between children who used aided AAC and their peers to determine whether previous research results concluding that individuals who used AAC are more passive in conversations with adults also applied when children who used AAC communicated with peers. They found that, although the distribution of turns in peer interaction was more equal than in conversations with adults, children who used aided AAC still initiated less and responded more than their peers. Although the results of Clarke and Kirton showed a more balanced conversation with peers, the context for these peer conversations was relatively unnatural and contrived. This structure is useful for a study analyzing patterns of communication, but results from Chung, Carter, and Sisco (2012b) show that conversations like these rarely, if ever, take place in a less structured environment such as a classroom, lunchroom, or playground.

Chung et al. (2012b) observed students with developmental disabilities who used AAC in an inclusive classroom

environment. They found that 89% of social interactions took place only with adults and an additional 6% involved both adults and other students; in contrast, only 5% of interactions involved just peers. How can children who use AAC learn the skills necessary to develop friendships with peers when only 5–11% of their interactions are with their classmates?

Social communication is an important tool in developing friendships. Communication allows us to engage and interact with others. “Communication is about laughing and arguing, learning and wondering why, telling stories, complaining about what is or what isn’t, sharing dreams, celebrating victories” (Light, 1997, p. 61). Children who have difficulty communicating are at risk for social isolation because communication is so essential for creating bonds between friends through laughing, arguing, complaining and telling stories. The link between communication and relationships illustrates why interventions that promote peer interaction are important: the back-and-forth conversations with peers are a necessary step toward developing friendships.

In order to provide the best services for children who use AAC, clinicians and teachers must be able to identify intervention approaches to support peer interactions. Systematic reviews are an established method of collecting and synthesizing relevant research, thus establishing an evidence base for interventions directed at children with disabilities (Horner et al., 2005). An additional benefit of a systematic review is that it highlights gaps in the current knowledge base and suggests next steps for research.

Some earlier reviews have investigated interventions to support social and communicative behaviors for individuals who used AAC, but have not focused on school-aged children or on peer interaction specifically (e.g., Hart & Banda, 2010). Still others have focused on increasing or improving peer interaction for school-aged children with disabilities, but did not focus specifically on children who used AAC (e.g., Nijis & Maes, 2014). A recent review (Kent-Walsh, Murza, Malani, & Binger, 2015) focused on communication partner training, including some studies that involved peer training but did not examine the effects of other interventions to promote peer interaction. One previous systematic review looked at interventions to increase peer interactions for children who used AAC (Chung, Carter, & Sisco, 2012a). This review provided evidence that intervention has been successful in promoting social interaction for children who use AAC, but took a broad approach, and allowed for the inclusion of studies with one or more participants who used any form of AAC; research that focuses on participants who use aided AAC (e.g., picture symbols, communication boards, speech generating devices) is required to understand the potential differences in intervention supports unique to this context. Furthermore, the review by Chung et al. examined the body of evidence as a whole, but did not provide evaluations of the quality of evidence or effectiveness of the interventions presented in individual studies. This information is critical for clinicians looking for evidence-based strategies to increase or improve interactions for their clients. Future work is required to evaluate evidence as a foundation of evidence-based practice.

Given the importance of peer interactions and the lack of a thorough systematic review to date, the aim of this project was to analyze studies with children with disabilities who use aided AAC, as these children are doubly at risk of difficulty in developing friendships. The goals of this systematic review were (a) to review studies that implemented interventions to increase or improve peer interaction for children who used aided AAC, (b) to evaluate the strengths and limitations of the available evidence, and (c) to discuss implications for practice and directions for future research.

Method

Inclusion and Exclusion Criteria

For inclusion in this review, studies had to meet the following criteria: (a) all participants in the study were children with developmental disabilities who used aided AAC prior to study onset or who were provided with aided AAC as part of the intervention, (b) participants in the study were school-aged (3–21 years old), (c) the partners for social interaction were peers (this excluded academic tutors, teachers, parents, and school aides), (d) the studies measured the impact of intervention, (e) the study was published in a peer-reviewed journal before January 2015, and (f) the study was published or translated into English.

By limiting this review to studies of children who used aided AAC, this review focused on interventions that specifically targeted the unique challenges these children face in interacting with their peers. For children who use aided AAC, communication requires an additional layer of cognitive effort because their attention is split three ways: toward the communication partner, developing their message internally, and toward an external object through which they convey their message (Beukelman & Mirenda, 2013). Likewise, the communication partner faces the additional challenge of attending to both the child who uses AAC and the AAC system (Loncke, 2014). Studies were only included if they presented data that measured the impact of such interventions on peer interaction. All of the studies in this review were published in peer-reviewed journals to present the best quality of evidence, despite the potential for publication bias, which results in more studies reporting positive or significant results being published (Petticrew & Roberts, 2008).

Search Strategy

Studies of social interaction between children who used AAC and their peers were identified through a multi-faceted search including electronic database searches, hand searches of reference lists and works of specific authors, and hand searches of key journals. Figure 1 illustrates the process of searching for articles to satisfy the inclusion criteria. The first step was a search of the online databases ERIC, ProQuest, PsycInfo, and PubMed. Many combinations of key words related to the inclusion and exclusion criteria were tested for breadth and depth of results. Search terms were refined based on analyzing the results for relevance. The final search terms used were (a) “interaction” (including “social

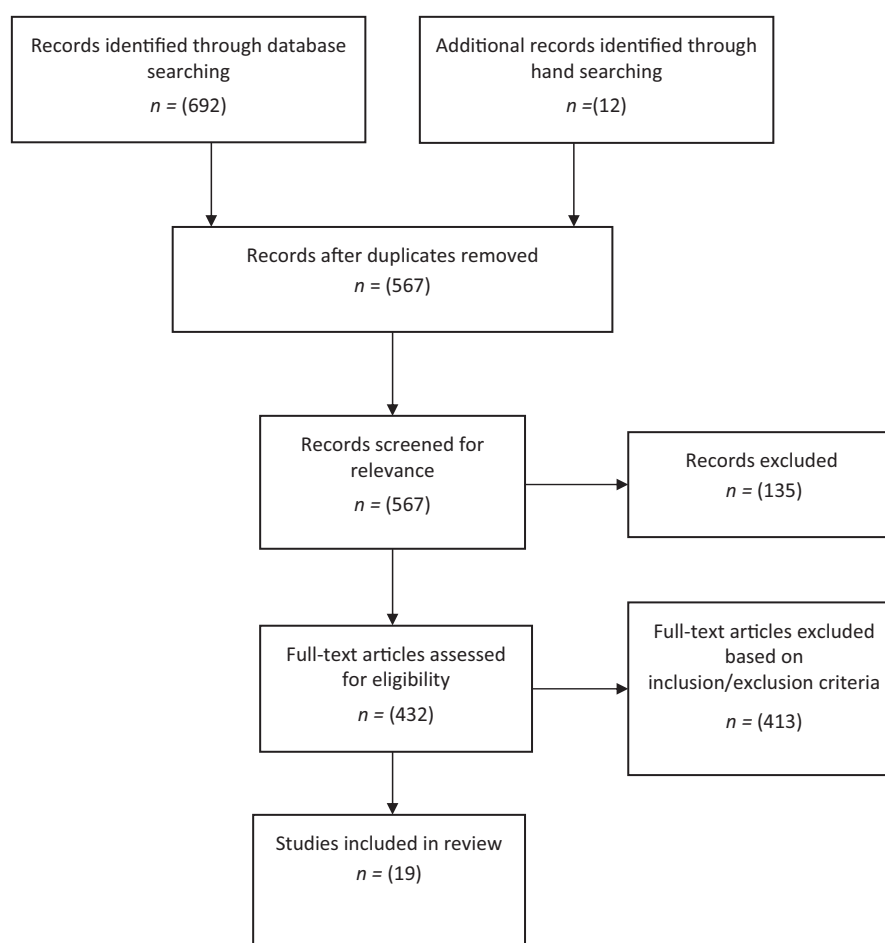


Figure 1. Flow diagram of study selection. Adapted from The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health-care interventions: explanations and elaboration by Liberati et al. (2009), *British Medical Journal*, 339, b2700.

communication”), (b) “augmentative and alternative communication” (including “communication aid,” “speech generating device,” “voice output,” “picture symbol,” and “picture exchange”), (c) “peer,” and (d) “child” (including “student”). The search string used a limiter to require that the words “interaction” or “social communication” be found in the abstract. In addition to database searches, a hand search of the reference list of the selected articles and of the following journals was completed: *Augmentative and Alternative Communication* (1985–2014), *Journal of Speech, Language and Hearing Research* (1997–2014), *Journal of Intellectual and Developmental Disability* (1996–2014), and the *International Journal of Language and Communication Disorders* (1980–2014). For each author of an included study, an additional search of publications by that author was completed to explore further relevant research. Finally, the reference list of a systematic review of a similar topic (Chung et al., 2012a) was reviewed. After eliminating duplicates, a total of 567 articles were found through the search. These records were initially screened for relevance to the topic. In this first pass, any articles relating to children with disabilities and communication were retained for further review, while articles on unrelated topics were excluded ($n = 135$). The remaining articles were examined more closely, at the abstract and full-text level. Nineteen studies were identified for inclusion in this review.

Coding Procedures

All studies that met the selection criteria were reviewed and coded. Definitions and examples from each coding category can be found in the Appendix. Each study was coded with respect to (a) study design, (b) participants (age, gender, and disability), (c) setting, (d) independent variables, (e) dependent variables, (f) outcomes, and (g) quality of evidence. As suggested by the Cochrane Collaboration (<http://www.cochrane.org>), the first author and a graduate student in communication sciences and disorders used the operational definitions found in the coding manual to independently code all of the included studies. Any disagreements were resolved through discussion and clarification of the operational definitions until consensus was reached and agreement on all codes was 100%. Had the two coders not been able to reach consensus, a third coder would have been consulted.

Based on the categories of social interaction interventions from Odom, McConnell, and Chandler (1993), the independent variable for each study was coded for type of intervention: child-specific, peer-mediated, environmental arrangement, or some combination of those three. Additionally, specific components related to each type of intervention were identified (see the Appendix). These components were given operational definitions and then each study was re-read to apply the coding scheme to the

Table 1. Summary of coded variables for included studies, including Quality of Evidence (QoE).

Study authors and design	IV	DV	Location	Participants ID/age/gender/disability	Peers #/age or grade/disability	Outcomes		QoE
						PND (%)	Gain scores	
Carter et al. (1998): Multiple baseline/probe	PM	% intervals of communicative peer interaction	School: general education classroom	Jason: 5;11/M/CP	10–12/K/none	67	21%	Sugg.
				Jared: 5;9/M/CP	10–12/K/none	90	27%	
				Craig: 5;9/M/CP	10–12/K/none	10	21%	
				Kylie: 9;8/F/CP	8–10/GR5/none	50	24%	
Chung & Carter (2013): Multiple baseline/probe	PM	% intervals of communicative peer interaction; % intervals of initiations; other (% intervals of reciprocal interaction)	School: gen. ed. classroom	Brian: 12/M/ID	3/GR6/none	15–100	–1–26% ^a	Prep.
						17–83	1–9% ^a	
						8–83	1–17% ^a	
				Laura: 11/F/ID	4/GR5/none	90–100	48–80% ^a	
						70–100	15–34% ^a	
				90–100	27–64% ^a			
Cosbey & Johnston (2006): Multiple baseline/probe	CSPM	Frequency of initiations	School: gen. ed. classroom	Sonja: 6;6/F/CP	22/K/other (2 classmates with disabilities)	100	4.2 ^b	Conc.
				Jessica: 3;6/F/CP	25/PreK/other (3 classmates with disabilities)	100	4.4 ^b	
				Brianna: 4;7/F/CP	11/PreK/other (2 classmates with disabilities)	100	3.5 ^b	
Garrison-Harrell et al. (1997): Multiple baseline/probe	CS, PM, EA	Frequency of communicative peer interaction; other (duration of interaction)	School: gen. ed. classroom; special education classroom; lunch; recess	Alice: 6;7/F/ASD	5/GR1/none	0–67	0.3–.09/min ^a	Sugg.
				Jerry: 7;2/M/ASD	5/GR1/none	67–90	171–237 s ^a	
						20–100	0.2–0.5/min ^a	
				Lee: 7/M/ASD	5/GR1/none	93–100	208–293 s ^a	
Hughes et al. (2000): Multiple baseline/probe	PM, EA	Frequency of initiations	School: gen. ed. classroom; lunch	Justin: 17/M/ID	4/17–18/none	100	5.3/min ^a	Concl.
				Jack: 16/M/ID	4/17–18/none	92	3.4/min ^a	
				Jerome: 16/M/ID	4/17–18/none	92	3.2/min ^a	
				Sarah: 16/F/ID	7/17–18/none	100	4.8/min ^a	
				Thomas: 18/M/ID	10/17–18/none	100	3.5/min ^a	
				Connor: 17/M/DS	16/unknown/none	100	97–100% ^a	
Hughes et al. (2011): Multiple baseline/probe	CS, PM, EA	% intervals of communicative peer interaction; % intervals of initiating; other (% intervals responding)	School: gen. ed. classroom; lunch			100	69–88% ^a	Concl.
						100	62–72% ^a	
				Joseph: 20/M/ASD	13/unknown/none	100	96–99% ^a	
						100	79–88% ^a	
						100	53–59% ^a	
				Gabby: 16/F/ASD	15/unknown/none	100	94–98% ^a	
						100	59–85% ^a	
						100	32–64% ^a	
				Akia: 21/F/ASD	11/unknown/none	100	97–98% ^a	
						100	68–88% ^a	
						100	66–77% ^a	
						100	99% ^a	
		100	65–86% ^a					
		100	84–95% ^a					
Hunt et al. (1996): Multiple baseline/probe	PM, EA	% intervals of communicative peer interaction; % intervals of initiations	School: general ed. classroom	Isaac: 12/M/other (SPID)	8–9/GR4/none	89	22%	Prep.
				Todd: 7/M/other (SPID)	10–20/GR1/none	56	9%	
						78	15%	
				Daniel: 7/M/CP	10–20/GR1/none	65	13%	
Hunt et al. (1988): Multiple baseline/probe	CS	Frequency of communicative acts	School: gen. ed. classroom; lunch. Community: work	Mary: 14/F/other	6/high school & university/none	73	21%	Sugg.
				Paula: 16/F/other	6/high school & university/none	84	7%	
				Peter: 16/M/other	6/high school & university/none	91	1.5/min ^a	
Hunt et al. (1991a): Multiple baseline/probe	CS, PM, EA	Frequency of communicative acts	School: gen. ed. classroom, lunch. Community: work	Christie: 15/F/ID	15/high school/none	73	1.1/min ^a	Prep.
				Judd: 17/M/ID	16/high school/none	100	1.5/min ^a	
				Cleo: 15/F/CP	19/high school/none	100	1.9/min	
Hunt et al. (1991b): Multiple baseline/probe	CS, PM	Frequency of communicative acts	School: general ed. classroom; lunch; recess	Arnie: 6;6/M/DS	12/GR 2/none	100	1.7/min	Prep.
				Joe: 10;4/M/ID	12/GR4/none	89	1.3/min ^a	
				Liza: 10;7/F/ID	12/GR4/none	100	1.8/min ^a	
						100	1.4/min ^a	

(continued)

Table 1. Continued

Study authors and design	IV	DV	Location	Participants ID/age/gender/disability	Peers #/age or grade/disability	Outcomes			
						PND (%)	Gain scores	QoE	
Hunt et al. (1990): Multiple baseline/probe	CS, PM	Frequency of communicative acts	School: general ed. classroom; lunch. Community: work	Matt: 18/M/DS	18/high school/none	100	1.2/min	Prep.	
				Katie: 18/F/DS	18/high school/none	100	2.3/min		
				Ty: 17/F/ID	18/high school/none	100	2.0/min		
Hunt et al. (1997): Multiple baseline/probe	CS PM, EA	% intervals of initiations; % intervals of communicative peer interaction; other (% intervals of commenting)	School: gen. ed. classroom; lunch; recess	Alex: 5/M/ASD	Unknown/K/other (all classmates)	50	12%	Incon.	
						90	28%		
						50	12%		
				Hong: 10/M/DS	Unknown/GR4/other (all classmates)	100	18%		
						100	44%		
Hunt et al. (2002): Multiple baseline/probe	CS, PM, EA	% intervals of communicative peer interaction (single peer and groups)	School: general ed. classroom	Paolo: 1/M/CP	Unknown/GR1/other (all classmates)	S: 77 G: 100	S: 13% G: 28%	Sugg.	
				Minh: 5/M/CP	Unknown/GR5/other (all classmates)	S: 75 G: 100	S: 7% G: 24%		
				Khamla: K/M/CP	Unknown/K/other (all classmates)	S: 88 G: 88	S: 18% G: 31%		
Johnston et al. (2003): Multiple baseline/probe	CS, PM	Frequency of initiations	School: special ed. classroom	Brad: 4;3/M/ASD	12/PreK/ASD	72	43% ^a	Incon.	
				Billy: 5;1/M/ASD	12/PreK/ASD	75	39% ^a		
				Alex: 5;3/M/ASD	12/PreK/ASD	88	51% ^a		
Jolly et al. (1993): Multiple baseline/probe	CS, EA	Frequency of initiations	School: special ed. classroom	Billy: 10/M/CP	3/G4/none	68 ^c	1.8/15 min ^c	Incon.	
				Rodney: 2/M/CP	3/G4/none	50 ^c	0.8/15 min ^c		
Kennedy et al. (1997): Multiple baseline/probe	PM, EA	Frequency of communicative peer interactions ^{d, e} other (number of peers per contact)	School: general ed. classroom	Max: 18/M/ID	Unknown/high school/none	82–85 ^e	0.8/class ^a	Sugg.	
				Paul: 11/M/CP	Unknown/middle school/none	82–93 ^e 67–100 ^e 67–100 ^e	1.2/class ^a 0.7–1/class ^a 1–1.9/class ^a		
Kravits et al. (2002): Multiple baseline/probe	CS, PM	Frequency of initiations ^f ; other (duration of interaction)	School: general ed. classroom	Molly: 6/F/ASD	Unknown/K/none	– –	– 16–120 s.	Incon.	
Trembath et al. (2009): Other (alt. treatment within multiple baseline/probe)	PM, EA	Frequency of communicative acts ^g (NT and SGD)	School: general ed. classroom	Jeremy: 4/M/ASD	2/PreK/none	69	1.0/min	Sugg.	
							40		1.1/min
				Shane: 3/M/ASD	2/PreK/none	50	0.8/min		
						100	0.5/min		
				Aaron: 5/M/ASD	2/PreK/none	0	0/min		
						63	0.9/min		
Trottier et al. (2011): Multiple baseline/probe	PM	Frequency of communicative acts	School: other (activity room)	Max/11;1/M/ASD	3/G6/none	92	0.6/min	Sugg.	
				Ian/11;4/M/ASD	3/G6&7/none	81	0.2/min		

CS, child-specific; PM, peer-mediated; EA, environmental arrangement; K, kindergarten; PreK, Preschool; CP, cerebral palsy; ID, intellectual disability; ASD, autism spectrum disorder; DS, Down syndrome; SPID, severe physical and intellectual disability; S, single; G, group; NT, naturalistic teaching; SGD, speech-generating device; Sugg., suggestive; Prep., preponderant; Incon., inconclusive; Concl., conclusive

^aApproximate values calculated from graph.

^bNumber of initiations out of five opportunities.

^cValues calculated from bar graph, where no bar was assumed to be a value of zero.

^dStudy only measured interactions longer than 15 minutes.

^eStudy only reported weekly means of data collected daily.

^fData includes both adult and peer communication partners.

^gStudy only measured communicative acts that received a response.

interventions. To discuss and compare the outcomes of the selected studies, both percent of non-overlapping data (PND) and gain scores were computed for each participant in included studies (see Table 1). Gain scores were calculated as the difference between average performance during intervention and average performance in baseline.

Although single-subject research often relies on visual inspections of graphs, including looking for trends and variability, these techniques are considered unreliable when comparing multiple studies and do not provide a measure of effect size (Scruggs, Mastropieri, & Casto, 1987). Scruggs et al.

(1987) recommended using PND for comparison because it is easily computed across a wide variety of studies and provides a meaningful outcome. A benefit of PND is that it can be calculated from graphed displays and does not require access to the raw data. For PND, interventions with scores of 90% or above are considered highly effective, between 70 and 90% are fairly effective, between 50 and 70% are questionable, and below 50% are termed unreliable (Scruggs, Mastropieri, Cook, & Escobar, 1986). Improvement rate difference (IRD), another method of calculating effect size for single subject research, was not chosen because of a lack of a standard

scale for interpreting the scores (Parker, Vannest, & Brown, 2009).

A limitation of PND is that it does not provide information on the magnitude of effects, such that two interventions with 100% non-overlapping data may seem equally effective, even if one study reports treatment data minimally exceeding baseline and the second has a large improvement between baseline and intervention (Wendt, 2009). Therefore, gain scores were also calculated to examine the effectiveness of the interventions. The mean performance for each participant during baseline was subtracted from the mean performance during intervention (see Table 1). If mean data were not provided, approximate gain scores were calculated based on published graphs.

The certainty of the evidence presented in each study was investigated using the quality markers from Horner et al. (2005). They note that single-subject research is experimental, with the purpose of documenting causal relationships between independent and dependent variables. In doing so, however, certain features of the design, or quality markers, are critical. Each study was therefore analyzed regarding its adequacy in (a) describing participant and setting, (b) operationally defining and repeatedly measuring the dependent variable, (c) recording reliability of measurement of dependent variable, (d) choosing dependent variables and an intervention with social validity, (e) describing the intervention well enough to replicate, (f) reporting intervention fidelity, (g) documenting a predictable pattern in baseline, and (h) establishing experimental control.

Taking all of these factors into consideration, each study was given a quality of evidence rating of inconclusive, suggestive, preponderant, or conclusive using definitions similar to those in Kent-Walsh et al. (2015) and Schlosser and Wendt (2008). These definitions can be found in the Appendix.

Results

A total of 19 studies met the criteria for this review. A summary of the coded variables for each study is presented in Table 1. Overall, 56 children who used aided AAC were represented in the included studies.

Participant Characteristics

Children who used AAC. The research for this review covered the entire age span of school-age children (3–21). Middle and high school ($n = 24$) and elementary students ($n = 24$) were the most represented in the included studies. Preschool children ($n = 8$) were only minimally represented. Participants in the included studies had a variety of developmental disabilities. Children with cerebral palsy (CP) ($n = 15$), autism spectrum disorders (ASD) ($n = 17$), and intellectual disability ($n = 13$) were relatively equally represented in the included studies. Smaller numbers of children with Down syndrome ($n = 5$) and other developmental disabilities ($n = 6$) also participated.

Peers. In 15 of the included studies, the participating peers were children without disabilities. Three studies involved

many or all of the child's classmates in general education classrooms, and therefore included children with and without disabilities. A single study (Johnston, Nelson, Evans, & Palazolo, 2003) investigated ways to increase peer interactions in a preschool for children with autism spectrum disorders, so the peers were also children with ASD. Studies with participants in preschool through middle school utilized same-age or same-grade peers, while studies with high school students typically included peers who were in the same school, but not necessarily in the same grade. In one study (Hunt, Alwell, & Goetz, 1988) university students were recruited as some of the peers for students in high school.

Setting

All 19 of the included settings measured peer interactions at school. Three studies for high school students also measured interactions during breaks at community job placements.

Locations within schools varied across the studies and some studies measured interactions in a variety of locations. A majority of studies measured interactions in general education classrooms ($n = 15$), one study measured in both general education and special education classrooms, and two studies measured interactions in special education classrooms, and one measured interactions in smaller activity rooms. Eight studies measured interactions during lunch and three measured them during recess in addition to classroom time.

Independent Variables and Intervention Characteristics

All of the types of intervention described in Odom et al. (1993) – child-specific, peer-mediated, and environmental arrangement – were represented in the included studies. Although a few studies focused on single-component interventions ($n = 4$), the majority of studies combined intervention types. Child-specific strategies were combined with peer-mediated ones in five studies, peer-mediated and environmental arrangement strategies were combined in three studies, and one study combined child-specific strategies with environmental arrangement. All three types of intervention were combined (child-specific, peer-mediated, and environmental arrangement) in the remaining six studies. Table 2 presents the interventions broken down into their components. This breakdown illustrates the various combinations used in the reviewed research.

Dependent Variables

All of the studies included in this review looked at communication outcomes for the participants who used AAC, and many chose to measure several variables. Seven studies in this review measured communicative peer interactions, and six measured communicative acts by the child who used AAC. Although these variables are related, they provide different information. Studies counting communicative acts by the child who used AAC measure the number of times the child who used AAC took a single communicative turn; within one peer interaction, a large number of communicative acts

Table 2. Specific intervention components of included studies grouped by intervention type.

Study ID	Child-specific		Peer-mediated				Environmental arrangement		
	AAC use	Social skills	AAC info	Model AAC	Prompt AAC	Social skills	AAC	Peer groups	Motivating activities
Hunt et al. (1988)	X	X							
Carter and Maxwell (1998)			X			X			
Trottier et al. (2011)			X	X	X				
Hunt et al. (1990)	X	X				X			
Hunt et al. (1991b)	X	X				X			
Jolly et al. (1993)	X						X		
Kennedy et al. (1997)						X		X	X
Trembath et al. (2009)			X	X		X	X		
Chung and Carter (2013)			X	X	X	X			
Cosbey and Johnston (2006)	X					X			
Garrison-Harrell et al. (1997)	X		X			X		X	
Hughes et al. (2000)				X	X		X		
Hughes et al. (2011)	X	X			X	X	X		
Hunt et al. (1991a)	X	X				X	X		
Hunt et al. (1996)		X	X			X	X	X	X
Hunt et al. (1997)	X	X	X			X	X	X	X
Hunt et al. (2002)	X			X ^a		X	X	X	
Johnston et al. (2003)	X		X	X					
Kravits et al. (2002)	X		X			X			
Total	12	7	9	6	4	14	8	5	3

Components were identified only if they represented a change between baseline and intervention.

^aIndicates that this study may have used this component as part of the intervention. Hunt et al. (2002) presented on Unified Plans of Support, and each participant received an individualized intervention package, which may or may not have included peers modeling AAC use.

potentially could be measured. Additionally, 10 studies measured either frequency or percent intervals of initiations (separate from other communicative acts). A variety of other social variables were measured in one or two of the included studies. For example, two studies measured the duration of interaction with peers (Kravits, Kamps, Kemmerer, & Potucek, 2002; Garrison-Harrell, Kamps, & Kravits, 1997), and one study measured the number of peers per contact (Kennedy, Cushing, & Itkonen, 1997).

Effects by Dependent Variables

All of the studies included in this review reported some positive gains in peer interaction as a result of intervention. Table 1 presents the percent non-overlapping data and gain scores for all participants in the included studies. For studies that measured the effect of intervention on frequency or percent intervals with peer interaction, the range of PND scores was 0–100. The greatest effects on this variable, 100% PND for all participants, were seen in Hughes et al. (2011). For studies that measured frequency or percent intervals of initiations, the range of PND scores was again 0–100%. For initiations, three studies had all PND scores in the highly effective range. In Cosbey and Johnston (2006) and Hughes et al. (2011), all participants had PND of 100%, and participants in Hughes, Rung, Wehmeyer, Agran, and Copeland (2000) had PND from 92–100. Finally, for the studies measuring frequency of communicative acts, PND ranged from 40–100%, although participants in five of the six studies had PND greater than 70%. Two studies measuring frequency of communicative acts, Hunt, Alwell, Goetz, and Sailor (1990) and Hunt, Alwell, and Goetz (1991a), had 100% PND for all participants.

Gain scores are a way of examining the extent of change in the dependent variable. Of the studies measuring communicative peer interactions, most measured percent of intervals. This method requires researchers to break measurement time

into small intervals (often 10–20 s) and count the number of intervals between the communicative peer interactions. The gains for this variable across all included studies ranged from no gain to an increase of 100% of intervals. Hughes et al. (2011), who measured highly social contexts such as lunch and the time before class began, had the highest gains, with individual participant gains ranging from 94–100% of intervals, meaning that average performance for each participant increased by 94–100%. Other studies measured during both academic and social time, and gain scores for many of these studies averaged around 23% of intervals. Six studies measured frequency of communicative acts. Of this group, gains ranged from 0–2.3 acts per minute. The group of studies by Hunt and colleagues (Hunt et al., 1988, 1990, 1991a, 1991b), all with similar interventions, showed comparable gains, with a range from 1.1–2.3 communicative acts per minute. Hunt et al. (1990) had the highest single gain score of the group (2.3 acts/min).

The group of studies measuring initiations had the most variability in how they measured success, so comparisons across studies are difficult. Of those who measured percentage of intervals ($n = 4$), Hughes et al. (2011) had the greatest gains (59–88% of intervals). Hughes et al. (2000) measured frequency of initiations and the gains ranged from 3.2–5.3 initiations per minute; these were the highest found in this review.

Effect by Intervention

Because the interventions and dependent variables in these studies varied considerably, it is challenging to say which specific components were the most successful at promoting or improving peer interaction. Studies that targeted only one intervention component, for example peer mediation alone, generally did not show as much of an effect in their respective dependent variables as interventions targeting multiple components. For example, Hughes et al. (2011) and Carter and Maxwell (1998) both targeted percent intervals of

communicative peer interaction. The intervention in Hughes et al. included child-specific, peer-mediated, and environmental arrangement components. Carter and Maxwell's, on the other hand, included only peer-mediated components. Percent non-overlapping data for the studies were 100% and 50–90% respectively. Gain scores also suggest that the intervention in Hughes et al. may be more successful (94–100% of intervals) than Carter and Maxwell (20–27% of intervals).

Effect by Participant Characteristics

Although looking at results by age group is complicated by the differences in both independent and dependent variables, one noticeable pattern in the data shows older children displaying greater gains than younger children. Participants over age 12 in the included studies had no PND lower than 77%. This may suggest that older participants are more likely to benefit from the types of social interaction interventions being investigated. Perhaps older participants bring more empathy, a greater awareness of others, and more developed social skills to the task, and so with some additional structure are more able to improve peer interaction. The uniform success with this age group, however, may also be attributed to intervention uniformity or disability uniformity. For this age group, five of the six interventions were very similar, introducing the same AAC system (communication books) and teaching the same conversational skills. Participants from this age group also were quite uniform in disability, as many had intellectual disabilities or Down syndrome. Only one participant in this older age group had a significant physical disability requiring alternative access. Participants in this age group displayed the largest gains in percent intervals of peer communicative interactions, frequency of initiations, and frequency of communicative acts.

The elementary school-aged participants had the most variability in PND, ranging from 0–100%. The interventions for this group were also the most varied, although a notable similarity is that all but one study included a peer-mediated component. The four studies with the highest PND for this age group measured either peer communicative interactions or communicative acts. The two measuring peer interactions (Hunt, Farron-Davis, Wrenn, Hirose-Hatae, & Goetz, 1997; Hunt, Soto, Maier, Müller, & Goetz, 2002) each had PND greater than 88% and gain scores ranging from 24–39% of intervals. The two measuring communicative acts (Hunt et al., 1991b; Trottier, Kamp, & Mirenda, 2011) each had PND greater than 80%, but the gain scores in these two studies were quite different. Participants in Hunt et al. (1991b) had an average of 1.3–1.8 more communicative acts per minute, while participants in Trottier et al. (2011) increased 0.2–0.5 acts per minute.

Only three studies in this review focused on preschool-age participants (3–5 years old). The results were varied, with PNDs ranging from 50–100%, although one study (Cosbey & Johnston, 2006) had 100% PND for all participants. In this study, participants were taught to use a single-switch with voice output to request entrance to a play activity and initiations increased by 3.5–4.4 within five opportunities.

Participant disability may also contribute to some of the patterns in the data. Of the studies measuring communicative acts, Trembath, Balandin, Togher, and Stancliffe (2009) and Trottier et al. (2011) had lower gain scores, which may be a result of participant disability, as both included only participants with autism spectrum disorders, for whom social deficits are part of the diagnostic criteria. This hypothesis, however, is not supported by the results of other studies. Two studies included children with autism as well as children with other disabilities. Hunt et al. (1997) and Hughes et al. (2011) were each replications of previous work (Hunt, Alwell, Farron-Davis, and Goetz, 1996; Hughes et al., 2000), but had similar or even better results in the replications that included children with ASD.

The degree of physical disability may also be an important factor in considering the impact of social interaction intervention. Although Hunt et al. (1997) was a replication of Hunt et al. (1996), the results were better, with a range of PND scores from 50–100% for initiations as compared to 0–65% in 1996. This may be attributable to differences in the participants. In the 1996 study, participants each had physical disabilities making it challenging for them to explore their environment and likely challenging for them to approach peers and groups without assistance. The participants from Hunt et al. (1997) were children with autism spectrum disorders and Down syndrome who were independently mobile, making it physically easier for them to approach other students.

Quality of Evidence

The measure of quality of evidence is a way of representing the certainty that the intervention as described in the published study caused the change in the dependent variable. Three studies in this review met the highest standards and were rated conclusive, while an additional five studies presented preponderant evidence. The remaining 11 studies may have presented effective interventions, but some design flaws preclude making that determination, and more research is required to determine their effectiveness.

In four studies rated as presenting inconclusive evidence that the outcomes of the study were a result of intervention, experimental control was a concern. To be rated inconclusive, design flaws such as a missing or rising baseline, or concerns about the systematic application of the independent variable, made it unclear whether the intervention or some extraneous variable brought about the change in the dependent variable (Kazdin, 2011). Of the seven included studies rated as suggestive, many included two instead of three demonstrations of effect and lacked either a measure of reliability for the dependent variable, or a report of procedural integrity. Five studies in this review presented preponderant evidence. Although each had minor design flaws, such as reporting reliability on less than 20% of their data, intervention likely produced the documented outcomes. Finally, three studies in this review presented conclusive evidence. Cosbey and Johnston (2006), along with Hughes et al. (2000, 2011) presented studies with strong experimental control and clear

demonstrations of effect. For these three studies, the evidence is strong that the intervention as described was the cause of the change in the dependent variable.

In this review, seven studies included participants with autism spectrum disorders. Children with autism spectrum disorders, who are often identified because of difficulties with social interaction, made up 29% of the participants in the included studies. The quality of evidence seen in the studies with participants with ASD, however, was low. Three of the seven studies were rated inconclusive, and three were suggestive, with only one study (Hughes et al., 2011) presenting conclusive evidence. More research is needed to establish interventions for evidence-based practice. For preschoolers, the evidence in this review was also sparse. Only three studies dealt exclusively with children in this age group, with some 5-year-old participants included in studies with elementary school-age participants. One study in this group was inconclusive, and one was suggestive. The final study in the group (Cosbey & Johnston, 2006) was conclusive, presenting the best evidence of effect for young participants.

Discussion

The positive results reported by all of the researchers in this collection of studies showed that with support, children who use AAC and their peers could interact more frequently during the school day. If educators and clinicians provide intervention to support peer interaction for their students with complex communication needs, they may find that the percentage of time interacting with peers increases, and the percentage of time interacting with adults decreases.

The finding that multicomponent interventions generally saw better results than single component interventions affirms previous theories that intervention to improve communication outcomes for individuals with complex communication needs must consider the individual, the communication partner and the context in which the communication takes place (Light, 1997; Light & McNaughton, 2014). Each of these components contributes to the success of a communicative interaction. In targeting all three components, interventions increase the likelihood of having a positive impact on the communicative competence of the individual who uses AAC.

Clinical Implications

Although no one study presented the perfect intervention to improve social interaction for all children who use aided AAC, this body of research does have implications for speech-language pathologists and educators who are interested in promoting peer interaction for their students. The first important implication is that intervention can make a difference. All of the studies included in this review include participants who made positive gains in the area of peer interaction. Clinicians are encouraged to create goals about interaction with peers, and to support interaction between children who use aided AAC and their classmates.

The literature in this review may not provide a direct link between a specific client and an ideal intervention to

promote social interaction, yet the sum of the literature in this review suggests that approaching social interaction by working with the child who uses AAC, the peer communication partner and the environment is an evidence- and theory-based approach.

Clinicians seeking the interventions with the highest quality of evidence and best outcomes are directed to Cosbey and Johnston (2006) and Hughes et al. (2000, 2011). All of these studies used peer-mediated components, which highlights the importance of providing training for peers when working to improve peer interaction for children who use aided AAC. More specifically, two of the three studies emphasized teaching peers social skills to improve peer interactions with children who use aided AAC. Two of the studies taught peers to prompt AAC use, and one taught peers to model AAC use. In addition to peer-mediated components, each of the three studies considered child-specific and environmental arrangement components. In Hughes et al. (2000) for example, although researchers and professionals did not directly work with children who used AAC, they taught peers to implement the AAC and social skills training with the students who used AAC. In Cosbey and Johnston (2006), although motivating activities were not a part of the intervention, the children were participating in interactive activities in both baseline and intervention. These studies provide compelling evidence for the effectiveness of their intervention in improving outcomes for the involved participants.

Limitations

The goals of this systematic review were to review and evaluate studies in which interventions to increase or improve peer interaction for children who used aided AAC were implemented in order to discuss implications for practice and directions for future research. This goal resulted in searching for studies that focused exclusively on participants who used aided AAC. Although using aided AAC presents additional challenges in peer interactions, it is possible that interventions aimed at improving peer interaction for individuals who use unaided AAC would also be effective with students who use aided AAC and their peers. Additionally, an attempt was made to find all published studies evaluating interventions to increase peer interaction for children who used aided AAC; however, it is possible that some have been left out. Finally, the review only included published, peer-reviewed studies. Studies that failed to meet that standard may have provided additional insight into interventions to increase peer interaction. Due to publication bias, it may be that unpublished studies could give more information about ineffective interventions to promote peer interaction for children who used AAC, and therefore guide future research efforts.

Future Research

Considering the research summarized and evaluated in this review in the greater context of improving quality of life for children who use AAC helps define three paths for future

research. The first path fills in gaps and extends the research into increasing and improving peer interactions for children who use aided AAC. The second path investigates the connection between increased peer interactions and friendship development. The third path asks what other variables contribute to friendship development for children who use AAC, and whether interventions targeting those variables can have a quantitative or qualitative impact on friendship for children who use AAC.

Although this research review identifies interventions that successfully increased and improved peer interactions for children who used aided AAC, it also identifies several important gaps in that literature. Research studies designed to investigate interventions to promote peer interaction for young children and for children with autism spectrum disorders of all ages are imperative. Another significant gap in the literature is in studies comparing the effects of two different interventions. So many of the interventions in this study are composed of many components, but the effect of each component is unknown. It is possible that some components of the intervention are superfluous, while others are essential. Comparative research may be able to identify the most efficient intervention package for maximizing the effect.

Additionally, although some studies in this review included adult prompting either for students who used aided AAC or their peers, training of paraprofessionals in facilitation of peer interaction was a component in only a few of the intervention studies (Chung & Carter, 2013; Hunt et al., 1996; Hunt et al., 1997). This is surprising, given findings from Chung et al. (2012b) that showed that the majority of communication directed to students who used AAC came from paraprofessionals and the majority of communicative acts of students who used AAC were directed toward paraprofessionals. Causton-Theoharis and Malmgren (2005) investigated the effects of paraprofessional training on the peer interactions for children with severe disabilities. Their short, 4-h training session with paraprofessionals resulted in an increase in facilitation of peer interaction by paraprofessionals and an increase in peer interactions for the target students. Future research should investigate whether a similar intervention would be successful with paraprofessionals of students who use aided AAC.

Finally, it is notable that no studies on peer social interaction looked at promoting interaction outside of school during community activities such as children's sports leagues or scouts. Because common interests often bring children together and form a basis for relationship development, researchers should investigate whether this context can support peer interaction for children who use aided AAC. A more robust peer interaction literature would pave the way for a second path for future research investigations into whether and to what extent peer interaction interventions play a role in facilitating friendship development. Although social competence and friendship are not equivalent, increases in social competence, of which social communication is one aspect, should have an impact on friendship development (Goldstein, Kaczmarek, & English, 2002).

A third research path looks to determine what variables are missing from our studies of peer interaction and

friendship development for children with complex communication needs. In research about friendships between children without disabilities, some variables that distinguish friendship from acquaintance have been identified. Bukowski et al. (2009) identified characteristics in preschool-age dyads, such as degree of engagement in interactions, complexity in play behavior, and level of interdependence that distinguish peer acquaintance from friendship and may provide examples of dependent variables for use in future studies of interventions to improve social interaction with peers. These variables, and others that may be discovered through both qualitative and quantitative research, may help researchers to create interventions with a clear impact on friendship development, which plays a major role in increasing quality of life for children with disabilities.

Finally, future research in all three domains should consider more aspects of social validity in their interventions. In this review, 11 of the 19 studies reported some social validation measures, ranging from short Likert-scale surveys to interviews. Only six studies consulted peers and only three (Chung & Carter, 2013; Hughes et al., 2011; Trottier et al., 2011) gathered social validity data from the children with complex communication needs themselves. Gathering information from the children, although challenging, should be of primary importance for social validity of interventions directed at peer interactions.

Conclusion

Improving peer interaction for children who use aided AAC has been a goal of research for over 25 years. This review analyzed the quality of the existing research, summarized clinical implications, and called for future research. This review builds upon the previous review by Chung et al. (2012a), by considering evidence from recent studies and providing clinicians and educators with certainty of evidence and effect sizes for individual studies to aid in clinical decision-making. The studies in this review provide evidence that speech-language pathologists, educators, and paraprofessionals can effect positive changes in peer interactions for children with complex communication needs, but more research is needed to create a strong evidence-base for clinicians and teachers to draw upon. Children who use AAC deserve the opportunity to create lasting friendships to decrease feelings of loneliness and isolation and increase overall quality of life.

Acknowledgements

This research is based on a candidacy project completed by the first author, under the direction of the second author, in partial fulfillment of the requirements of the degree of Doctor of Philosophy in Communication Sciences and Disorders, Pennsylvania State University. The authors wish to thank Dr Erinn Finke and Dr Carol Miller for their roles as committee members.

Disclosure statement

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

Funding information

This project was supported by funding from the Penn State AAC Leadership Project, a doctoral training grant funded by U.S. Department of Education grant H325D110008. Funding support for the AAC doctoral program at Penn State is also provided through the Hintz Family Endowed Chair in Children's Communicative Competence.

References

- Beukelman, D., & Mirenda, P. (2013). *Augmentative & alternative communication*. Baltimore, MD: Paul H. Brookes Publishing Co.
- Bukowski, W. M., Motzoi, C., & Meyer, F. (2009). Friendship as process, function, and outcome. In K. H. Rubin, W. M. Bukowski & B. Laursen (Eds.), *Handbook of peer interactions, relationships, and groups*. New York: Guilford Publications. Retrieved from <http://pensu.eblib.com/patron/FullRecord.aspx?p=406033>. pp 217–231.
- *Carter, M., & Maxwell, K. (1998). Promoting interaction with children using augmentative communication through a peer-directed intervention. *International Journal of Disability, Development and Education*, 45, 75–96. doi: 10.1080/1034912980450106.
- Causton-Theoharis, J. N., & Malmgren, K. W. (2005). Increasing peer interactions for students with severe disabilities via paraprofessional training. *Exceptional Children*, 71, 431–444.
- Chung, Y.-C., Carter, E., & Sisco, L. (2012a). A systematic review of interventions to increase peer interactions for students with complex communication challenges. *Research and Practice for Persons with Severe Disabilities*, 37, 271–287. doi: 10.2511/027494813805327304.
- Chung, Y.-C., Carter, E., & Sisco, L. (2012b). Social interactions of students with disabilities who use augmentative and alternative communication in inclusive classrooms. *American Journal on Intellectual and Developmental Disabilities*, 117, 349–367. doi: 10.1352/1944-7558-117.5.349.
- *Chung, Y.-C., & Carter, E. (2013). Promoting peer interactions in inclusive classrooms for students who use speech-generating devices. *Research and Practice for Persons with Severe Disabilities*, 38, 94–109. doi: 10.2511/027494813807714492.
- Clarke, M., & Kirton, A. (2003). Patterns of interaction between children with physical disabilities using augmentative and alternative communication systems and their peers. *Child Language Teaching and Therapy*, 19, 135–151. doi: 10.1191/0265659003ct2480a
- Cooper, L., Balandin, S., & Trembath, D. (2009). The loneliness experiences of young adults with cerebral palsy who use alternative and augmentative communication. *Augmentative and Alternative Communication*, 25, 154–164. doi: 10.1080/07434610903036785
- *Cosbey, J. E., & Johnston, S. (2006). Using a single-switch voice output communication aid to increase social access for children with severe disabilities in inclusive classrooms. *Research and Practice for Persons with Severe Disabilities*, 31, 144–156. doi: 10.1177/154079690603100207.
- *Garrison-Harrell, L., Kamps, D., & Kravits, T. (1997). The effects of peer networks on social-communicative behaviors for students with autism. *Focus on Autism and Other Developmental Disabilities*, 12, 241–256. doi: 10.1177/108835769701200406
- Goldstein, H., Kaczmarek, L. A., & English, K. M. (2002). *Promoting social communication: Children with developmental disabilities from birth to adolescence*: Paul H. Brookes Publishing Company.
- Hart, S. L., & Banda, D. R. (2010). Picture exchange communication system with individuals with developmental disabilities: A meta-analysis of single subject studies. *Remedial and Special Education*, 31, 476–488. doi: 10.1177/0741932509338354.
- Hartup, W. W. (1989). Social relationships and their developmental significance. *American Psychologist*, 44, 120–126. doi: 10.1037/0003-066X.44.2.120.
- Horner, R., Carr, E., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children*, 71, 165–179. doi: 10.1177/001440290507100203.
- *Hughes, C., Golas, M., Cosgriff, J., Brigham, N., Edwards, C., & Cashen, K. (2011). Effects of a social skills intervention among high school students with intellectual disabilities and autism and their general education peers. *Research and Practice for Persons with Severe Disabilities*, 36, 46–61. doi: 10.2511/rpsd.36.1-2.46.
- *Hughes, C., Rung, L. L., Wehmeyer, M. L., Agran, M., & Copeland, S. R. (2000). Self-prompted communication book use to increase social interaction among high school students. *Research and Practice for Persons with Severe Disabilities*, 25, 153–166. doi: 10.2511/rpsd.25.3.153.
- *Hunt, P., Alwell, M., Farron-Davis, F., & Goetz, L. (1996). Creating socially supportive environments for fully included students who experience multiple disabilities. *Journal of the Association for Persons with Severe Handicaps*, 21, 53–71.
- *Hunt, P., Alwell, M., & Goetz, L. (1988). Acquisition of conversation skills and the reduction of inappropriate social interaction behaviors. *Journal of the Association for Persons with Severe Handicaps*, 13, 20–27.
- *Hunt, P., Alwell, M., & Goetz, L. (1991a). Establishing conversational exchanges with family and friends: Moving from training to meaningful communication. *The Journal of Special Education*, 25, 305–319. doi: 10.1177/002246699102500304
- *Hunt, P., Alwell, M., & Goetz, L. (1991b). Interacting with peers through conversation turntaking with a communication book adaptation. *Augmentative and Alternative Communication*, 7, 117–126. doi: 10.1080/07434619112331275783.
- *Hunt, P., Alwell, M., Goetz, L., & Sailor, W. (1990). Generalized effects of conversation skill training. *Journal of the Association for Persons with Severe Handicaps*, 15, 250–260. doi: 10.1177/154079699001500404.
- *Hunt, P., Farron-Davis, F., Wrenn, M., Hirose-Hatae, A., & Goetz, L. (1997). Promoting interactive partnerships in inclusive educational settings. *Journal of the Association for Persons with Severe Handicaps*, 22, 127–137. doi: 10.1177/154079699702200301.
- *Hunt, P., Soto, G., Maier, J., Müller, E., & Goetz, L. (2002). Collaborative teaming to support students with augmentative and alternative communication needs in general education classrooms. *Augmentative and Alternative Communication*, 18, 20–35. doi: 10.1080/714868359
- *Johnston, S., Nelson, C., Evans, J., & Palazolo, K. (2003). The use of visual supports in teaching young children with autism spectrum disorder to initiate interactions. *Augmentative and Alternative Communication*, 19, 86–103. doi: 10.1080/0743461031000112016
- *Jolly, A. C., Test, D. W., & Spooner, F. (1993). Using badges to increase initiations of children with severe disabilities in a play setting. *Journal of the Association for Persons with Severe Handicaps*, 18, 46–51.
- Kazdin, A. E. (2011). *Single-case research designs: Methods for clinical and applied settings* (2nd ed.). Oxford: Oxford University Press.
- *Kennedy, C., Cushing, L., & Itkonen, T. (1997). General education participation improves the social contacts and friendship networks of students with severe disabilities. *Journal of Behavioral Education*, 7, 167–189. doi: 10.1023/a:1022888924438.
- Kent-Walsh, J., Murza, K. A., Malani, M. D., Binger, C. (2015). Effects of communication partner instruction on the communication of individuals using AAC: A meta-analysis. *Augmentative and Alternative Communication*, 31, 271–284. doi: 10.3109/07434618.2015.1052153.
- *Kravits, T. R., Kamps, D. M., Kemmerer, K., & Potucek, J. (2002). Brief report: Increasing communication skills for an elementary-aged student with autism using the picture exchange communication system. *Journal of Autism and Developmental Disorders*, 32, 225–230. doi: 10.1023/A:1015457931788
- Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P. A., ... & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health-care interventions: Explanation and elaboration. *British Medical Journal*, 339, b2700. doi: 10.1136/bmj.b2700
- Light, J. (1997). "Communication is the essence of human life": reflections on communicative competence. *Augmentative and Alternative Communication*, 13, 61–70. doi: 10.1080/07434619712331277848
- Light, J., & McNaughton, D. (2014). Communicative competence for individuals who require augmentative and alternative communication: A new definition for a new era of communication? *Augmentative and Alternative Communication*, 30, 1–18. doi:10.3109/07434618.2014.885080

- Loncke, F. (2014). Augmentative and alternative communication: Models and applications for educators, speech-language pathologists, psychologists, caregivers and users. San Diego, CA: Plural Publishing.
- Nijs, S., & Maes, B. (2014). Social peer interactions in persons with profound intellectual and multiple disabilities: A literature review. *Education and Training in Autism and Developmental Disabilities*, 49, 153–165.
- Odom, S. L., McConnell, S. R., & Chandler, L. K. (1993). Acceptability and feasibility of classroom-based social interaction interventions for young children with disabilities. *Exceptional Children*, 60, 226–236.
- Parker, R. I., Vannest, K. J., & Brown, L. (2009). The improvement rate difference for single-case research. *Exceptional Children*, 75, 135–150.
- Petry, K., Maes, B., & Vlaskamp, C. (2005). Domains of quality of life of people with profound multiple disabilities: The perspective of parents and direct support staff. *Journal of Applied Research in Intellectual Disabilities*, 18, 35–46. doi: 10.1111/j.1468-3148.2004.00209.x
- Petticrew, M., & Roberts, H. (2008). *Systematic reviews in the social sciences: A practical guide*. Malden, MA: Blackwell Publishing Ltd.
- Prizant, B. M., & Wetherby, A. M. (1990). Toward an integrated view of early language and communication development and socioemotional development. *Topics in Language Disorders*, 10, 1–16. doi: 10.1097/00011363-199009000-00003.
- Schlösser, R. W., & Wendt, O. (2008). Effects of augmentative and alternative communication intervention on speech production in children with autism: A systematic review. *American Journal of Speech-Language Pathology*, 17, 212–230. doi: 10.1044/1058-0360(2008/021).
- Scruggs, T., Mastropieri, M., & Casto, G. (1987). The quantitative synthesis of single-subject research: Methodology and validation. *Remedial and Special Education*, 8(24), 24–33. doi: 10.1177/074193258700800206.
- Scruggs, T., Mastropieri, M., Cook, S., & Escobar, C. (1986). Early intervention for children with conduct disorders: A quantitative synthesis of single-subject research. *Behavioral Disorders*, 11, 260–271.
- *Trembath, D., Balandin, S., Togher, L., & Stancliffe, R. J. (2009). Peer-mediated teaching and augmentative and alternative communication for preschool-aged children with autism. *Journal of Intellectual & Developmental Disability*, 34, 173–186. doi: 10.1080/13668250902845210
- *Trottier, N., Kamp, L., & Mirenda, P. (2011). Effects of peer-mediated instruction to teach use of speech-generating devices to students with autism in social game routines. *Augmentative and Alternative Communication*, 27, 26–39. doi: 10.1044/1092-4388
- Umberson, D., & Montez, J. K. (2010). Social relationships and health: A flashpoint for health policy. *Journal of Health and Social Behavior*, 51, 554–66. doi: 10.2307/20798316
- Wendt, O. (2009). Calculating effect sizes for single-subject experimental designs: An overview and comparison. Paper presented at the The Ninth Annual Campbell Collaboration Colloquium Oslo, Norway.
- *Indicates studies included in the systematic review.

Appendix

Coding Definitions and Descriptions

Study ID	Author names and year of publication
Location	School: Intervention measured peer interactions at school. Specify whether intervention took place in general education classroom, special education classroom, lunch, recess, or other. Community: Intervention measured peer interactions at a community location. Specify whether intervention took place at work, recreation facility, church, or other. Home: Intervention measured peer interactions in a private residence.
Participant characteristics (ID, age, gender, disability)	Name or ID given to participant Reported age Reported gender Disability: CP (cerebral palsy), Down syndrome, ID (intellectual disability, mental retardation), ASD (autism spectrum disorder; includes PDD and Asperger's syndrome), or other (specify)
Peer characteristics (number, age, disability)	Number of peers associated with a given participant Reported age or grade level of peers Reported disability: None, CP (cerebral palsy), Down syndrome, ID (intellectual disability, mental retardation), ASD (autism spectrum disorder; includes PDD and Asperger's syndrome), or other (specify)
Study design	Alternating treatments, multiple baseline/multiple probe, withdrawal, group design, or other
Independent variable: Possible values from Odom, McConnell, and Chandler (1993)	Child-specific: Interventions focusing on the child who used AAC. Peer-mediated: Interventions focusing on the peers of the child who used AAC.
Independent variable components: Child-Specific	Environmental arrangement: Interventions that modified the environment to promote interaction. AAC use: researchers or professionals taught children how to use their AAC system
Independent variable components: Peer-mediated	Social skills: Researchers or professionals taught children skills to support interaction (e.g., how to ask and respond to questions) AAC info: Researchers or professionals provided peers with information about disability/AAC in general or specific information about their partner's disability or AAC Model AAC: Researchers or professionals taught peers to model use of AAC for children with complex communication needs Prompt AAC: Researchers or professionals taught peers skills for prompting the children with complex communication needs to use their AAC systems Social skills: Researchers or professionals taught children skills to support interaction (e.g., increase wait time, ask open-ended questions)
Independent variable components: Environmental-arrangement	AAC: Provision of AAC Peer groups: Establishing peer buddies or peer groups, or modifying existing groups Motivating activities: Setting up activities to promote interaction (e.g., games, small group discussions in class)
Dependent variable	Communicative peer interactions: Study measured number of times children who used AAC were engaged in a conversation with a classmate without disabilities Communicative acts by child who used AAC: Study measured number of turns or number of utterances produced by the participant who use AAC in interactions with peers. Initiations by child who used AAC: Study measured number of times the participant who used AAC began a new

(continued)

Continued

Study ID	Author names and year of publication
Certainty of evidence: Values are modified versions of those in Kent-Walsh et al. (2015)	<p>conversation with a peer.</p> <p>Other: Specify other social variables measured by included studies (e.g., duration of interaction, number of peers per interaction)</p> <p>Conclusive: Outcomes are undoubtedly due to intervention</p> <p>1. Strong design, strong reliability of dependent variable and procedural integrity</p> <p>Preponderant: outcomes are more likely to have occurred due to intervention than not</p> <p>1. Minor flaws in design, strong reliability of dependent variable and procedural integrity; OR</p> <p>2. Strong design, minor flaws in reliability of dependent variable and/or procedural integrity</p> <p>Suggestive: outcomes are plausible due to intervention</p> <p>1. Minor flaws in design, inadequate reliability of dependent variable and/or procedural integrity; OR</p> <p>2. Minor flaws in design, missing reliability of dependent variable or procedural integrity</p> <p>Inconclusive: flaws preclude any conclusions that outcomes are result of intervention</p> <p>1. Major flaws in design (instability in baseline, non-systematic application of the independent variable); OR</p> <p>2. Missing reliability of dependent variable and procedural integrity</p>