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Article *in* Augmentative and alternative communication (Baltimore, Md.: 1985) · June 2015

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Augmentative and Alternative Communication, 2015; Early Online: 1–14

ISSN 0743-4618 print/ISSN 1477-3848 online
DOI: 10.3109/07434618.2015.1052153

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RESEARCH ARTICLE

Effects of Communication Partner Instruction on the Communication of Individuals using AAC: A Meta-Analysis

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Abstract

The purpose of this study was to conduct a systematic review and meta-analysis of the augmentative and alternative communication (AAC) partner instruction intervention literature to determine (a) the overall effects of partner interventions on the communication of individuals using AAC, and (b) any possible moderating variables relating to participant, intervention, or outcome characteristics. Seventeen single-case experimental design studies (53 participants) 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, communication partner interventions were found to be highly effective across a range of participants using AAC, intervention approaches, and outcome measure characteristics, with more evidence available for participants less than 12 years of age, most of whom had a diagnosis of autism spectrum disorder or intellectual/developmental disability. Aided AAC modeling, expectant delay, and open-ended question asking were the most frequently targeted communication partner interaction skills. Providing a descriptive overview, instructor modeling, guided practice, and role plays were the most frequently incorporated communication partner intervention activities within the included studies.

Keywords: *Complex communication needs; Intervention; Systematic review; Meta-analysis*

Introduction

The importance of partner instruction has long been recognized in the field of augmentative and alternative communication (Cumley & Beukelman, 1992; Mirenda, Iacono, & Williams, 1990; Schepis & Reid, 2003). By its very nature, communication with individuals who use AAC frequently is a complex process; individuals influence each other when one person is using AAC (e.g., Soto, 1999), and active participation on the part of the communication partner is often required to achieve successful communication (Kent-Walsh & McNaughton, 2005).

Partner Instruction in AAC

For most people with complex communication needs, learning to use AAC is not an intuitive process; similarly, knowing how to facilitate interactions is not intuitive for most communication partners. For many individuals with complex communication needs, typical interaction patterns include taking relatively few turns, initiating and responding infrequently, asking few questions, and using restricted linguistic forms (Light, Collier, & Parnes, 1985; Simmons-Mackie, 2000). In turn, communication partners tend to provide few opportunities for communication, take the majority of turns, and ask a disproportionate number of yes/no questions (Light et al., 1985). Disturbingly, these patterns have not only been documented within live communication interactions but they (along with other communication partner-related factors) have also been cited as major reasons for aided AAC device abandonment (Johnson, Inglebret, Jones, & Ray, 2006). As such, it is no surprise that research findings consistently indicate that having access to appropriate AAC solutions is not enough to ensure successful communication. Intervention – which often includes instruction for communication partners – is required to create changes in communication outcomes (Binger, Kent-Walsh, Berens, Del Campo, & Rivera, 2008; Binger, Kent-Walsh, Ewing, & Taylor, 2010; Kent-Walsh, Binger, & Malani, 2010; Kent-Walsh & McNaughton, 2005).

Fortunately, many studies have reported success with communication partner instruction, with successful

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(Received 31 December 2014; revised 20 April 2015; accepted 25 April 2015)

interventions reported across the lifespan of individuals with complex communication needs who interact with a wide variety of communication partners, including peers (Carter & Maxwell, 1998; Garrison-Harrell, Kamps, & Kravits, 1997), family members (Kent-Walsh, Binger, & Hasham, 2010; Nunes, 2005), educators (Bingham, Spooner, & Browder, 2007; Westover, 2010), and other professionals (Dattilo & Light, 1993). These studies have focused on teaching a variety of skills to partners, such as learning how to set up contexts for communication, provide AAC models, and ask questions (Nunes & Hanline, 2007; Binger et al., 2010). Skills are typically taught in one of three ways: in isolation (Ben Chaabane, Alber-Morgan, & DeBar, 2009), as a group with no identified implementation sequence (e.g., Hunt, Alwell, & Goetz, 1991), or as a cohesive strategy with a specific implementation sequence (Kent-Walsh, 2003). The latter approach typically includes support for generalized use of the strategy in a wide variety of appropriate situations, as a way of supporting the development and use of targeted communication skills by individuals using AAC (Kent-Walsh & McNaughton, 2005). These skills and strategies have been used to facilitate a variety of communicative responses, including pragmatic skills such as turn-taking (Dattilo & Light, 1993), semantic skills such as single word expressive vocabulary (Romski, Sevcik, Adamson, Smith, & Barker, 2010), and grammatical skills such as building word combinations (Binger et al., 2008, 2010).

Synthesis Articles in AAC

Systematic reviews, including those containing meta-analyses, can be used to explore the efficacy of interventions across numerous studies and to synthesize findings, yielding valuable information regarding trends across studies (Schlosser & Sigafoos, 2009). Furthermore, such reviews can be used to investigate various factors that may be particularly efficacious, such as identifying interventions that lead to particularly positive outcomes (Cooper, Hedges, & Valentine, 2009). Given the ongoing growth of the AAC research base and the need for practitioners to access information regarding evidence-based practice, there is a pressing need for articles synthesizing the AAC literature (Schlosser & Sigafoos, 2009). An increasing number of systematic reviews have recently appeared in the AAC literature and include those focusing on such topics as reading instruction (Barker, Saunders, & Brady, 2012), peer interactions (Chung, Carter, & Sisco, 2012), autism (Ganz et al., 2012; Schlosser & Wendt, 2008), challenging behaviors (Walker & Snell, 2013), tangible symbol use (Roche et al., 2014), and facilitated communication (Schlosser et al, 2014). Given the presence of the growing body of evidence investigating the use of partner instruction in AAC, there is a need to summarize and synthesize this body of work as well, which is the focus of the present article.

Historically, many systematic reviews have focused on findings from group design research, with the "gold standard" of intervention research purported to be group designs consisting of randomized controlled trials (Shadish, Cook, & Campbell, 2002). However, these and other group designs seldom are used in AAC intervention research, with experimentally controlled single case designs (SCDs) being employed instead. Although SCDs are sometimes viewed as designs of lesser certainty, they offer many benefits that are relevant to AAC intervention research in particular and not enjoyed by group designs. For example, SCDs (a) allow for the inclusion of heterogeneous populations (Light, 1999), (b) enable examination of the process of skill acquisition, which can yield key information regarding individual learning patterns (Beeson & Robey, 2006; Robey, 2004), (c) provide design flexibility, allowing for refinements to the intervention if needed (Binger, Maguire-Marshall, & Kent-Walsh, 2011; Light, 1999), and (d) enable examination of factors that result in successful intervention, which can then lead to larger studies (Robey, 2004). Because of the utility of these designs, experimentally controlled SCDs and group designs were included in the search strategy for the current systematic review.

Purpose and Research Questions

The purpose of this study was to provide a systematic review and meta-analysis of the AAC partner instruction intervention literature. The following were the research questions:

What are the overall effects of partner instruction interventions on the communication of individuals using AAC?

Do effects differ by variables relating to participant, intervention, or outcome characteristics?

Methods

Protocol

In accordance with procedures indicated by the Cochrane Collaboration (http://www.cohcrane.org), a protocol was developed at the outset of the investigation. The protocol consisted of (a) purpose of the review and related research questions, (b) search strategy for identification of studies, (c) criteria for selecting studies, (d) data extraction procedures, including the code book, and (e) data analysis procedures. This protocol was used as a roadmap for all aspects of conducting the search. Further details are provided in the sections that follow.

Search Procedures

Electronic database searches were conducted as the first step in the search to identify studies to be included in the systematic review, with studies appearing in the literature through 2013 eligible for inclusion. The following databases were included: Proquest Dissertation and Theses, Education Full Text, Education Research Complete, ERIC, Linguistics and Language Behavior Abstracts (LLBA), PsycInfo, PubMed, and Web of

Science. The following search terms were used: (a) "intervention" (including "treat"*, "therapy", "intervene"*, "instruct", "train"*, "educat"*, or "coach"*), (b) AAC (including AAC, augmentative and alternative communication, augmentative communication, alternative communication, or complex communicat*; and (c) communication partner (including "partner", "parent"*, "peer", "teacher", "educator", "guardian", "paraeducator", "para-educator", "paraprofessional", "para-professional", "spouse", "facilitator", or "caregiver"). For all databases except Proquest Dissertations and Theses, and Web of Science, these terms were used as keyword terms, without specifying the limiter. However, in the case of Proquest Dissertations and Theses, not using limiting terms yielded over 10,000 citations. Therefore, the second set of terms (i.e., the AAC terms) was set as the subject term. Additionally, Web of Science requires the setting of topic limiters. Finally, the reference lists for identified studies were searched for possible identification of additional studies for inclusion in the review.

Criteria for Inclusion and Exclusion

Title and Abstract Stage. At the title and abstract stage of review, studies were examined to meet specified criteria in the following three areas: participant characteristics, intervention characteristics, and outcome measure characteristics. In order to be included in this review, intervention studies were required to meet the following criteria with regard to participant characteristics: (a) include individuals of any age using any form of aided communication (SGD or non-SGD), excluding tangible symbol (i.e., real object) systems, and (b) involve any type of communication partner(s) of individuals using aided AAC, as defined by Kent-Walsh and McNaughton (2005). To meet the intervention inclusion criteria, studies had to involve some form of AAC treatment, education, intervention, coaching, or training specifically focused on communication partners of individuals using aided AAC. Finally, in order to meet the outcome measure inclusion criteria at the title and abstract review stage, studies had to contain at least one primary outcome that measured an aspect of language or communication outcome, which included aided communication as an option, for the individual using AAC. Studies focusing on explicit literacy instruction in the form of reading or writing interventions were excluded because the unique aspects of these types of intervention programs were judged to be more appropriate for a separate review by the research team. 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.

Full Text Stage. Full texts of the studies meeting the criteria were reviewed to determine if they employed one of the following research designs: (a) randomized controlled trial, quasi-experimental design, or single case experimental design, as defined by the What Works Clearinghouse (Kratochwill et al., 2010), or (b) case studies and pre-experimental designs, such as AB designs or one group pretest-posttest designs were excluded. To reduce the possibility of bias (Egger & Davey Smith, 1998; Egger et al., 1997), studies could be conducted in any country, written in any language, and either published in a peer-reviewed journal or approved as a dissertation or thesis. Conference papers from proceedings did not qualify because these papers typically do not include sufficient detail for the necessary coding within a systematic review (Schlosser & Wendt, 2008).

Included SCDs were required to track experimental control via at least three data points in the baseline and treatment phases so that trends could be demonstrated within any of the experimental designs, as outlined by Kratochwill and colleagues (2010). Studies employing any group design described by Ventry and Schiavetti (1986) also were eligible for inclusion.

As depicted in Figure 1, 2215 citations were reviewed at the title/abstract level; of these, 2165 were excluded. The remaining 50 citations were subsequently reviewed at the full-text level; of these, 32 were excluded. The total number of identified studies that met the inclusion criteria at both levels was 18, including 17 single-case experimental design studies and one group design study. Because there are no currently accepted methodologies for integrating aggregated data from single-case and group design studies, and the identification of only one group design study precluded synthesis across group design studies, the 17 single-case experimental design studies were advanced to the full coding and analysis phase of the investigation.

Data Extraction & Coding Procedures

The coding form and manual that were developed were adapted from the work of Schlosser and Wendt (2008). The form contained the following categories: (a) study

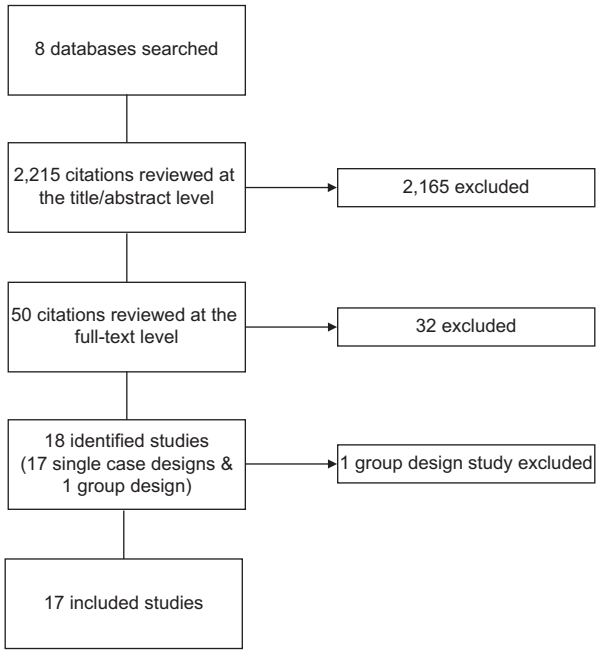

Figure 1. Search flow chart.

identification, (b) intervention design, (c) participant demographics and results, (d) partner demographics and results, (e) independent variable (i.e., intervention) details, (f) dependent variable details, including inter-observer agreement and treatment integrity details, and (g) certainty of evidence ratings based on design/internal validity, reliability of the dependent variable, and procedural integrity (Schlosser & Wendt, 2008). Before comparing the results, the second and third authors used the coding manual, which contained operational definitions for each of the above coding elements, to independently code all articles. Disagreements were resolved through discussion and consensus building until 100% coding agreement was reached for all coding elements to ensure inter-rater reliability. As per the Campbell Collaboration systematic review standards, a third coder would have been consulted had there been any difficulty in reaching consensus. The reader is directed to resources available at http://aac-ucf.unm.edu/research/publications.html via the coding form and manual in their entireties.

In light of recent discussions appearing in the literature regarding how to best measure effect sizes for SCD studies (e.g., Reynhout & Carter, 2011; Parker & Hagan-Burke, 2007; Parker, Vannest, & Davis, 2011; Parker, Vannest, & Brown, 2009), serious consideration was given to the effect size measure to select for the meta-analytic procedures. Probably the most common SCD effect size measure is percentage of non-overlapping data (PND), a simple measure calculated by determining the percentage of data points in each post-baseline phase that do not overlap with the highest baseline measure (Scruggs, Mastropieri & Casto, 1987). However, multiple authors have raised concerns with using PND, including failure to account for baselines that trend in the direction of the expected intervention effect (Scruggs), overemphasis on the most extreme point in baseline (Parker & Hagan-Burke, 2007; Parker et al., 2009), an inability to calculate confidence intervals because the sampling distribution is unknown (Parker et al., 2011), and insensitivity to powerful treatment effects (White, Rusch, Kazdin, & Hartmann, 1989). To help alleviate these issues, various alternate measures have been proposed, such as the percentage of all non-overlapping data (PAND; Parker & Hagan-Burke, 2007) and improvement rate differences (IRD; Parker et al., 2009). The latter approach is particularly promising, as it permits calculation of sampling distributions while also examining all baseline data points, not just the most extreme points (as with PND), and has been used in several recent SCDs (Binger et al., 2010; Kent-Walsh, Binger, & Hasham, 2010) and systematic reviews (Ganz et al., 2012). Accordingly, IRD was used in the current investigation as the effect size measure to afford comparison and aggregation of data across studies.

IRD is generally defined as the improvement rate of the treatment phase(s) minus the improvement rate of the baseline phase(s) (Parker et al., 2009). Calculating IRD involves initial elimination of overlap between baseline and intervention data by removing the fewest data points necessary. In some instances, two solutions are possible in eliminating overlap (e.g., Reynhout & Carter, 2011). For the purposes of maintaining consistency and inter-related reliability, the free online calculator developed by Vannest, Parker, and Gonen (2011) was used by the first author to calculate IRD for the communication outcome measures for the children with complex communication needs in each study to afford effect size comparisons; the child outcome measures were examined because these variables described the main desired outcomes of the examined communication partner instruction intervention studies. IRD scores can range from 0 to 1.0, with scores less than .50 indicating very small or questionable effects, scores between .51 and .70 indicating moderate effects, scores between .71 and .75 indicating large effects, and scores greater than .75 indicating large or very large effects (Parker et al., 2009).

With regard to inter-rater reliability for the effect size calculations, an online random number-generator tool was used to select a minimum 20% of dependent variable values for each investigation to be used by the fourth author to independently calculate IRD scores. Reliability calculations were completed for 46 of the 158 measures (29% of the data) and yielded 93% agreement; IRD scores within .05 points were considered to agree. The few slight discrepancies that existed were rooted in variability in reading values depicted on graphs within individual studies; these discrepancies were reconciled by the first and fourth author prior to completing the final analyses.

Results

Seventeen single-case design studies, comprising a total of 53 individuals with complex communication needs who completed at least the baseline and instructional phases of the investigations, met the inclusion criteria. Table I contains an overview of the included studies.

Descriptive Analyses

Participant Characteristics: Individuals using AAC. The 17 studies included between two and six participants with complex communication needs. The mean participant age in years was 7;6 (years;months) (range: 2;5–26;0). A total of 38 participants were male (72%) and 15 were female (28%), which is in keeping with other sex prevalence data for individuals who require AAC (e.g., Binger & Light, 2006). The majority of participants fell into the two youngest age groups, while relatively few participants were adolescents or adults: (a) 28% preschool-age (< 5 years), (b) 66% elementary school age (age 5–12 years), (c) 2% adolescent (12–17 years), (d) 4% adult (> 18 years). The individuals with complex communication needs were reported to use a variety of high tech, low-tech, and no-tech aided communication systems with and without voice output. With regard to primary

Table I. Included Single-Case Experimental Design Studies Examining the Effects of Communication Partner Instruction.

	Partner characteristics	PWUAAC characteristics			Instructional outcomes and characteristics					Design type and quality appraisal	
Study	Type, CA, gender	Name, CA, gender	Primary Dx	Type of aided AAC used	Mean IRD*	Instructional approach and activities^	Instructional components+	DV domain(s)	Nature of DV(s)	Single-case design type	Appraisal and any areas of concern yielding rating lower than conclusive
Ben Chaabane, Alber-Morgan, & DeBar (2009)	Parent, 30;0, F	Myles, 6;0, M	ASD	Non-SGD (PECS)	0.61	Single skill	G, H	Semantic	Manding improvizations	MBD across behaviors	Suggestive
	Parent, 45;0, F	Cliff, 5;0, M	ASD	Non-SGD (PECS)	0.83	1, 2					
Binger, Kent-Walsh, Berens, Del Campo, & Rivera (2008)	Parent, 34;0, F	Antonio, 4;1, M	Other	SGD	1.00	Strategy instruction	A, B, C, I	Morpho-syntactic	Multi-symbol utterances	MPD across participants	Conclusive
	Parent, 44;0, F	Angela, 3;4, F	Other	Non-SGD	1.00	1, 2, 3, 4, 5					
	Parent, 26;0, F	Julia, 2;11, F	Other	SGD	1.00						
Binger, Kent-Walsh, Ewing, & Taylor (2010)	EA, NR; F	Oscar, 6;4, M	I/DD	SGD	1.00	Strategy instruction	A, B, C, I	Morpho-syntactic	Multi-symbol utterancesx	MPD across participants	Conclusive
	EA, NR; F	Adam, 4;6, M	I/DD	SGD and non-SGD SGD	1.00	1, 2, 3, 4, 5					
	EA, NR; F	Valerie, 5;8, F	CP		0.80						
Bingham, Spooner, & Browder (2007)	EA, 20; 0, F	Student 1, 16;0, F	I/DD	Non-SGD	0.00	Multi-skill	G,H	Pragmatic	Communicative turns	MBD across participants	Suggestive
	EA, 52;0, F	Student 2, 8;0, M	MD	Non-SGD	1.00	2,5					
	EA, 23;0, F	Student 3, 12;0, F	MD	SGD & Non-SGD	1.00						
Carter & Maxwell (1998)	Peer, NR; NR	Jared, 12;0, M	CP	Non-SGD	0.89	Multi-skill	B, C, D, H	Pragmatic	Communicative turns	MBD across participants	Suggestive
	Peer, NR; NR	Craig, 6;9, M	CP	Non-SGD	0.70	1, 2, 5					
	Peers, NR; NR	Jason, 6;11, M	CP	Non-SGD	0.75						
	Peer, NR; NR	Kylie, 9;8, F	CP	Non-SGD	0.78						
Chung & Carter (2013)	Peer,NR; NR	Brian, 12;0, M	I/DD	SGD and Non-SGD	0.59	Strategy instruction	A, B, C, D, G, H (Peers)	Pragmatic	Communicative turns	MBD across participants and settings	Preponderant
	EAs, NR; NR					1, 2 (Peers)	D, F, G				
	Teacher, NR; NR					1, 6	(EAs / teachers)				
	Peer, NR; NR	Laura	I/DD	SGD and Non-SGD	0.85	(EAs/teachers)					
	EA, 32.0, F										
	Teacher, NR; NR										
Datillo & Light (1993)	EA, 29;0, F	Barb, 18;0, F	MD	SGD	0.66	Multi-skill	B, E, H	Pragmatic	Communicative turns	MBD across participants	Suggestive
	Peer, 20;0, F										
	Caregiver, 25;0, F	Laura, 26;0, F	MD	SGD	1.00	1, 2, 4, 5					

Continued

Table I. Continued

	Partner characteristics	PWUAAC characteristics			Instructional outcomes and characteristics					Design type and quality appraisal	
Study	Type, CA, gender	Name, CA, gender	Primary Dx	Type of aided AAC used	Mean IRD*	Instructional approach and activities^	Instructional components+	DV domain(s)	Nature of DV(s)	Single-case design type	Appraisal and any areas of concern yielding rating lower than conclusive
Garrison-Harrell, Kamps, & Kravits (1997)	5 peers, NR; NR	Jerry, 7;2, M	ASD	Non-SGD	0.82	Multi-skill 1, 2, 4, 5	A, F	Pragmatic	Communicative turns	MBD across participants	Suggestive
	5 peers, NR; NR	Lee, 7;0, M	ASD	Non-SGD	0.74						
	5 peers, NR; NR	Alice, 6;7, F	ASD	Non-SGD	0.47						
Hunt, Alwell, & Goetz (1991)	Peer, NR; NR	Joe, 10;4, M	I/DD	Non-SGD	0.77	Multi-skill 1,2, 5	A, B, C	Pragmatic	Communicative turns	MBD across participants	Suggestive
	Peer, NR; NR	Lisa, 10;7, F	I/DD	Non-SGD	0.63						
	Peer, NR; NR	Arnie, 6;6, M	I/DD	Non-SGD	0.79						
Kent-Walsh (2003)	EA, 64;0, F	Adam, 4;3, M	CAS	Non-SGD	1.00	Strategy instruction 1, 2, 3, 4, 5	A, B, C, I	Pragmatic & semantic	Communicative turns and semantic concepts	MBD across participants	Conclusive
	EA, 40;0, F	Betty, 12;7, F	I/DD	Non-SGD	1.00						
	EA, 35;0, F	Caleb, 3;0, M	CAS	Non-SGD	1.00						
	EA, 59;0, F	Dave, 11;5, M	I/DD	SGD	1.00						
	EA, 4, 20;0, F	Emma, 9;0, F	I/DD	Non-SGD	1.00						
Kent-Walsh, Binger, & Hasham (2010)	Parent, 43;0, F	Abby, 8;0, F	CP	SGD and non-SGD	1.0	Strategy instruction 1, 2, 3, 4, 5	A, B, C, I	Pragmatic and semantic	Communicative turns and semantic concepts	MPD across participants	Conclusive
	Parent, 34;0, F	Brian, 5;4, M	I/DD		1.00						
	Parent, 29;0, F	Clea, 5;0, F	CP	SGD	1.00						
	Parent, 33;0, F	Dale, 8;3, M	CP	SGD	1.00						
	Parent, 45;0, F	Evan, 4;7, M	I/DD	SGD	1.00						
	Parent, 32;0, F	Freddy, 5;11, M	I/DD	Non-GD SGD	1.00						
Nunes & Hanline (2007)	Parent, 35;0, F	Barney, 8;11, M	ASD	Non-SGD	0.21	Multi-skill 1, 2, 4, 5	F	Pragmatic	Communicative turns	MBD across settings	Suggestive
	Parent, 31;0; F	Charlie, 5;8, M	ASD	Non-SGD	0.30						
	Parent, 30;0, F	Jason, 4;6, M	ASD	Non-SGD	0.43						
	Parent, 29;0, F	Kevin, 6;4, M	ASD	Non-SGD	0.41						
Park, Alber-Morgan, & Cannella-Malone (2010)	Parent, 35;0, F	Tad, 2;5, M	ASD	Non-SGD (PECS)	0.80	Multi-skill 1, 2, 5	A,C, D, H	Pragmatic	Picture exchanges	Changing criterion design	Suggestive
	Parent, 34;0, F	Eric, 2;7, M	ASD	Non-SGD (PECS)	1.00						
	Parent, 33;0, F	Bill, 2;6, M	ASD	Non-SGD (PECS)	1.00						
Rosa-Lugo & Kent-Walsh (2008)	Parent, 33;0, F	Alexis, 6;10, F	Other	SGD	1.00	Strategy instruction 1, 2, 3, 4, 5	A,C, D, H	Pragmatic and semantic	Communicative turns and semantic concepts	MBD across participants	Preponderant
	Parent, 45;0, F	Bernardo, 6;8, M	I/DD	SGD	1.00						

Continued

Table I. Continued

	Partner characteristics	PWUAAC characteristics			Instructional outcomes and characteristics					Design type and quality appraisal	
Study	Type, CA, gender	Name, CA, gender	Primary Dx	Type of aided AAC used	Mean IRD*	Instructional approach and activities^	Instructional components+	DV domain(s)	Nature of DV(s)	Single-case design type	Appraisal and any areas of concern yielding rating lower than conclusive
Stiebel (1999)	Parent, NR; F	Steven, 4;2, M	ASD	Non-SGD	0.93	Strategy instruction	C, H	Pragmatic	Communicative turns	MBD across participants	Suggestive
	Parent, NR; M	Tommy, 6;8, M	ASD	Non-SGD	0.83	1, 6					
	Parent, NR; F	Jose, 4;6, M	ASD	Non-SGD	1.00						
	Parent, NR; F										
Trottier, Kamp, & Mirenda (2011)	3 peers, NR; NR	Ian, 11;4, M	ASD	SGD	0.83	Multi-skill 1, 2, 4	B, G	Pragmatic	Communicative turns	MBD across participants	Suggestive
	3 peers, NR; NR	Max, 11;1, M	ASD	SGD	0.90						
Westover (2010)	EA, 53;0, F	Alex, 8;0, M	CP	Non-SGD	0.97	Multi-skill	B, C, G	Pragmatic	Communicative turns	MBD across participants	Suggestive
	EA, 53;0, F	Brett, 9;0, M	I/DD	SGD and Non-SGD	1.00	1, 4					
	EA, 42;0, F	Carlos, 11;0, M	I/DD	SGD and Non-SGD	1.00						

Note. AAC, augmentative and alternative communication; ASD, autism spectrum disorder; CA, chronological age (denoted in years; months); CAS, childhood apraxia of speech; CP, cerebral palsy; DV, dependent variable; Dx, diagnosis; EA, educational assistant; F, female; I/DD, intellectual/developmental disability; IRD, improvement rate difference; M, male; MBD, multiple baseline design; MD, multiple disabilities; MPD, multiple probe design; NR, not reported; PWUAAC, person who uses augmentative and alternative communication.

*Aggregated across measures if applicable.

^Instructional activity legend: 1, descriptive overview; 2, modeling; 3, verbal practice; 4, guided practice; 5, role play; 6, written materials instruction (e.g., workbook);

+Targeted communication partner skills: A, aided AAC modeling; B, expectant delay; C, open-ended question asking; D, general environmental arrangement (including physical proximity of partners, making eye contact, and/or access/positioning of AAC device); E, generally described provision of communication opportunities; F, generally referenced partner interaction training; G, prompting (including, verbal, gestural and/or physical prompting); H, manding; I, contingent responding.

diagnosis, most of the participants with complex communication needs were reported to be diagnosed with autism spectrum disorder (32%) or intellectual/developmental disability (32%), with fewer participants reported to be diagnosed with cerebral palsy (17%), childhood apraxia of speech (4%), multiple disabilities (7.5%), or other (7.5%). Although participant receptive language data were not reported in all studies, the data available across studies was indicative of receptive language skills ranging from significantly delayed/disordered to within normal limits.

Participant Characteristics: Communication Partners. The communication partners who participated in the studies included caregivers, educational assistants, parents, peers, and teachers who ranged in age from 11;0 to 64;0; the average age for participating communication partners could not be calculated, as age data were not reported in all studies.

Intervention Characteristics. The communication partner interventions employed within the included studies fell into one of the following two general categories for how partners are taught: (a) strategy instruction, that is, a method in which the partners are taught to employ a series of communication skills in a specified multi-step, sequential manner as described by Kent-Walsh and McNaughton (2005), or (b) individual skill training, that is, partners are taught to employ specific communication skills individually or to employ a variety of separate skills within a less structured implementation sequence. As indicated in Table I, the instructional methods employed with the communication partners included various combinations of the following activities across studies: (a) providing a descriptive overview of skills or strategies, including the reasoning for the instructional content and the potential benefits of employing the skills and/or strategies, (b) providing instructor models (i.e., demonstrations) of how to implement the targeted communication skills and/or strategies, (c) including verbal rehearsal of sequential skills to be implemented, (d) including opportunities for the communication partners to practice the targeted skills or strategies in role plays with the instructor, (e) including guided practice opportunities (i.e., gradual fading of instructor cuing as communication partners progress toward independently demonstrating the targeted skills/strategies when interacting with the individuals using AAC), and/or (f) materials-focused instruction (e.g., following instructional workbook). Each study included either two, three, four, or five of these instructional components.

With regard to research design, nearly all of the studies ($n = 16$) employed multiple baseline or multiple probe SCDs; of these, the majority ($n = 14$) employed multiple baseline/probe designs across participants, with one study employing multiple baseline/probe designs across behaviors or routines, and two studies using multiple baseline/probe designs across settings (one of these also employed multiple baseline across participants). The 17th study employed a changing criterion design.

Outcome Measure Characteristics. With regard to participant communication findings, data were extracted for the language domain and the nature of the dependent variables for participants with complex communication needs. All studies reported at least one dependent variable for participant communication that could be classified in the domain of pragmatics. Examples of these dependent variables included number of intervals being coded as including social interaction (Carter & Maxwell, 1998), proportion of communicative turns and initiations (Dattilo & Light, 1993), and frequency of communication acts (Trottier, Kamp, & Mirenda, 2011). Two studies reported dependent variables that fell within the morpho-syntactic domain through the tracking of multi-symbol messages (Binger et al., 2008, 2010). Finally, two studies reported dependent variables that fell within both the pragmatic and semantic domains because they tracked frequency of both multi-modal communicative turns and different semantic concepts. Most dependent variables encompassed multi-modal communicative measures that included aided and unaided communication, with several studies measuring aided AAC output specifically.

Effect Size Findings

Overall Effects. The mean effect size (IRD value) aggregated across studies and participants with complex communication needs was .83 ($SD = .23$; range: 0–1.0), which is indicative of a very large level of effect (Parker, Vannest & Brown, 2009.). Table I provides the mean IRD values, ranges, standard deviations, and levels of effect for the communication outcomes of individuals using AAC by study, in accordance with Parker, Vannest & Brown designations. Table II details the mean IRD values, ranges, and standard deviations by intervention characteristics; participant characteristics for individuals using AAC; and intervention outcome characteristics aggregated across studies when comparing baseline and intervention phases. When aggregated across studies and participants, almost all intervention characteristics, participant characteristics, and intervention outcome characteristics were found to have either moderate, large, or very large effects as indicated by IRD scores. It was not possible to calculate effect sizes for the communication partner-focused dependent variables, as not all studies included individual measures or graphed data for the communication partners; rather, in some cases overall pre/post averages and ranges were reported to illustrate the positive change in communication partner communication patterns. Similarly, it was not possible to calculate IRD values to compare baseline and maintenance or generalization phases across studies because many did not report maintenance and/or generalization data.

Intervention Characteristics. For intervention characteristics, the overall computed effect size for strategy instruction approaches to partner intervention, as defined by Kent-Walsh and McNaughton

Table II. Findings for Participants Using AAC by Intervention, Participant, and Intervention Outcome Characteristics.

Measure (*n*)	Number of cases*	IRD	Level of effect	*SD*
Intervention characteristics				
Instructional approach				
Strategy instruction	22	0.98	Very large	.06
Other skill-based instructional method	29	0.72	Large	.26
Instructional components+				
All five components	19	.99	Very large	.05
Four components	9	.56	Moderate	.26
Three components	12	.80	Very large	.10
Two components	13	.83	Very large	.28
Participant characteristics				
Aided AAC approach				
Speech generating device (SGD)	26	.95	Very large	.11
Non-SGD	27	.72	Large	.27
Age				
Preschool (≤ 59 mo)	15	.90	Very large	.18
Elementary (60−144 mo)	35	.83	Very large	.21
Adolescent (12−17 yrs)	1	.00	No effect	N/A
Adult (≥ 18 yrs)	2	.83	Very large	.24
Primary diagnosis				
Autism	17	.69	Moderate	.25
Intellectual/developmental disability	17	.86	Very large	.26
Cerebral palsy	9	.88	Very large	.12
Childhood apraxia of speech	2	1.0	Very large	.00
Multiple disabilities	4	.92	Very large	.17
Other	4	1.0	Very large	.00
Intervention outcome characteristics				
Nature of outcome measure				
Pragmatic	131	.66	Moderate	.37
Semantic	10	1.0	Very large	.00
Syntactic	6	.97	Very large	.08

Note. * The number of cases does not always equal the total number of participants across included studies due to variability across studies in (a) the way data were reported for individual subjects and dependent variables, and (b) the number of identified dependent variables.
+The five identified instructional components included descriptive overview, modeling, verbal rehearsal, guided practice, and role play.

(2005), indicated a very large overall level of effect (IRD = .98), in comparison to the large overall level of effect (IRD = .72) for other less structured skill-based approaches to partner instruction. IRD data also were disaggregated by the number of the following instructional activities, as detailed previously, conducted when working with the communication partners: descriptive overview, instructor models, verbal rehearsal, role plays, guided practice, and/or materials-focused instruction. Each study either included two, three, four, or five of these instructional components. Effect size measures for the combined use of these options yielded a very large IRD score with the exception of including four of the components, which yielded an overall moderate level of effect (IRD = .56).

Participant Characteristics: Individuals Using AAC. The following level-of-effect comparisons were noted with regard to participant characteristics for individuals using AAC:

- Speech-generating device (SGD) use yielded a very large overall effect size (IRD = .95) outcome compared to a large overall effect size (IRD = .72) for non-SGD device use.
- All identified age categories of individuals with complex communication needs yielded very large overall effect size values with the exception of adolescents, which yielded no effect (IRD = 0) in the case of the one study noted to include one participant with an age between 12 and 17 years of age.
- All identified primary diagnoses for individuals with complex communication needs yielded very large effect sizes, with the exception of autism spectrum disorder, which was indicated by a moderate level of effect (IRD = .69).

Again, it was not possible to complete effect size calculations for communication partner data because not all studies included specific participant characteristics for individual communication partners.

Intervention Outcome Characteristics. Although all studies included at least one outcome variable that was classified as a pragmatic outcome measure, overall IRD calculations yielded a moderate effect size rating (IRD = .66) for this characteristic. In contrast, very large effect sizes were yielded for semantic and morpho-syntactic measures (IRD = 1.0 & .97, respectively).

Discussion

The purposes of this meta-analysis were to determine the overall effects of communication partner interventions on the communication of individuals using AAC, and to determine if these effects might differ by participant, intervention, and/or outcome characteristics. In order to contextualize the findings of this investigation, a detailed summary of participant and intervention characteristics was included. Several findings with relevance to AAC interventions, policy, and future research are notable.

The central finding of this review is that a body of evidence consistently indicates that communication partner instruction has positive effects on communication performance of individuals using AAC. In other words, including communication partner instruction within AAC intervention plans will likely assist in yielding improvements in the communication skills of individuals with complex communication needs. Although effect sizes varied across participants, the average IRD score (IRD = .83) falls well within the very effective designation as suggested by Parker and Vannest (2009). This finding adds validity to earlier individual research reports and related discussions in the literature indicating that communication partner instruction can be an effective intervention component for individuals with complex communication needs (e.g., Cumley & Beukelman, 1992; Kent-Walsh & McNaughton, 2005).

This finding has important ramifications for clinical practice and related policy. Partner instruction should be viewed as an integral part of AAC assessment and intervention. Provision of instruction should be routinely provided unless there is clear evidence that typical partners in a full range of environments are regularly demonstrating the skills needed for a successful interaction. Unfortunately, the need for a communication partner is often unrecognized and/or unsupported. For example, reports indicate that clinicians often struggle to have assigned time to provide indirect interventions or to obtain reimbursement for time spent working with communication partners within educational, medical, and private sector service-delivery environments (e.g., Amundsen, 2014; Kent-Walsh, Stark & Binger, 2008). Therefore, significant advocacy efforts may be required on the part of individuals as well as accrediting and credentialing organization personnel to overcome both policy and procedures barriers that may prevent clinicians from implementing evidence-based communication partner interventions. Although identifying and widely disseminating evidence-based interventions is important, ensuring the feasibility of individuals with complex communication needs accessing such interventions also is crucial. Clearly, addressing communication partner interventions as a key component of intervention in relevant position papers and policies pertaining to professional practice and funding for service-delivery will assist with this. These issues also relate to the need for the integration of partner instruction within preservice personnel preparation programs to ensure that educators, speech-language pathologists, and related service providers are prepared to deliver these interventions when they enter the workforce. Use of innovative instructional approaches, such as web-based instruction and modules, may assist with ensuring adequate pre-service and in-service personnel preparation in this area.

Findings from this review also indicate that communication partner interventions can be effectively implemented across a range of communication partners, including caregivers, educational assistants, parents, peers, and teachers. Evidence indicates that these partners can be successful in modifying their communication patterns to better support functional communication with and the expressive language of clients with complex communication needs across age range and range of primary diagnoses. However, the moderate effect size (IRD = .69) identified for individuals with primary diagnosis of autism spectrum disorder is noteworthy, if not surprising, compared to the very large effect sizes noted for the other examined primary diagnoses (IRD Range: .86–1.0). Given that the entire premise of communication partner instruction is that individuals with complex communication needs will improve in expressive communication in response to changes in partner communication behavior, the social challenges often observed with individuals with autism spectrum disorder may mitigate the power of communication partner instruction. However, given that this study did suggest the possibility of obtaining positive client communication results via communication partner instruction, with a rather broad range of effect sizes noted for this population (IRD Range: .21–1.0), consideration of communication partner instruction as a possible intervention component for individuals with autism spectrum disorder certainly is warranted, and there is a clear need for future communication partner instruction research with this population.

Other effect size findings for participant characteristics falling below the large effect size designation (i.e., the age of participants) also warrant further scrutiny. The suggestion that there is no effect of partner training (IRD = 0) for adolescents who use AAC may be highly misleading; this effect size is based on one participant in one study. Similarly, the reported very large effect size (IRD = .83) for persons who use AAC above the age of 18 years was based on only two participants in one study. Clearly, additional research is warranted with these two age groups prior to drawing any further conclusions, particularly given the positive outcomes indicated for the younger participants included in this review.

With respect to the examined intervention characteristics, both strategy instruction approaches and other skill-based instructional methodologies yielded very large (IRD = .98) and large (IRD = .72) effect sizes, respectively. When examining these results, however, standard deviations and ranges also should be considered, that is, the standard deviation calculated for strategy instruction was .06 (range: .8–1.0) compared with the standard deviation of .26 (range: .21–1.0) calculated for other skill-based instructional methods. The discrepancy in the IRD calculations across these two approaches to partner instruction may suggest important differences in their comparative robustness. Increased consistency across studies in reporting maintenance and generalization data also might provide relevant comparative information. Additionally, further examination of the data in Table I suggests that the moderate level of effect identified for including four of the five examined instructional components (descriptive overview, modeling, verbal rehearsal, guided practice, and role play) may be a related finding because verbal rehearsal, a characteristic integral to strategy instruction, may be the key omission that results in decreased efficacy. This might explain why relatively good effects were observed for interventions that included only two or three of the instructional components – this small number of instructional components may be sufficient if instruction targets only two or three partner skills that do not need to be sequenced in a specific manner. Further comparative investigation of these characteristics and related issues of intervention dosage appears to be warranted. Data analysis options were limited, due to the lack of precise procedural information with regard to exactly how individual skills were targeted or instructional activities were implemented.

With regard to outcome characteristics, the focus on pragmatic skills across the included studies is understandable but also concerning. Clearly, individuals who

require AAC need to achieve competency in areas other than just pragmatics (Beukelman & Mirenda, 2013). Furthermore, pragmatic measures yielded the lowest effect size, with a moderate IRD of 0.66. The other two outcome categories that were examined were semantic and syntactic outcome measures, both of which yielded very large intervention effects. Notably, each of the cases indicated in Table II falling within these two categories employed strategy instruction. Again, further comparative investigations are warranted to examine these possible key moderator variables.

Limitations

There are several limitations in the present investigation that should be considered. First, the central goal was to evaluate the overall effects of partner instruction on the communication of individuals using AAC; this goal does not encompass detailed data reporting or meta-analysis of communication partner-related dependent variables. This is an important distinction, given that change in communication partner instruction research should be measured through at least a two-pronged process. Partner-focused dependent variables should be monitored for demonstration of change as a result of the partner intervention, as these are the driving force of the investigation; dependent variables associated with the behavior change of individuals using AAC (as a result of the partner changes) are also critical, and should be monitored second.

The investigative team initially intended to structure the research questions for this systematic review and meta-analysis in the same way (i.e., by including research questions for both participants using AAC and communication partner participants). However, known variability in contemporary publication procedures in this area of research influenced the decision to not include a central research question related to the findings of communication partner behavior. An example of this variability can be illustrated through examination of data reporting within two studies published by the first and fourth authors. Binger et al. (2008) and Kent-Walsh, Binger, and Hasham (2010) employed the same two-pronged, or layered, design approach, with data for the main communication partner-dependent variable monitored for demonstration of change to guide implementation of the multiple baseline design; and data for the dependent variables relating to the participants using AAC (as a result of the partner behavior change) monitored secondarily. The manuscripts for these two studies were submitted as companion articles for potential publication in the same journal issue. Although both articles were accepted for publication and published in the same journal issue, the original manuscripts were evaluated by different reviewers, and as a result the published articles ended up looking remarkably different in their final published formats. Specifically, in the Binger and colleagues article, graphs for both communication partner data and data relating to the communication of the participating children using AAC appear in the article. In contrast, as a result of the review process, the graphs for the communication partner data were removed from the Kent-Walsh and colleagues article and replaced by a brief summary of communication partner findings in narrative format; this seemingly subtle change that transpired during the review process had notable implications for meta-analytic purposes alone.

Because a cursory review of other published articles in the area of communication partner instruction revealed similar variability in data reporting, and in light of a desire to capture as many published studies as possible within the planned review, the research questions for the current investigation were crafted to focus on the results for participating individuals using AAC, which capture the intended larger reason for implementing communication partner interventions in the first place. The main research questions also were supported by the inclusion criteria requiring that at least one comparative numerical value for communication partner data be provided to ensure that change in partner behavior did occur. Although the limited data available in some of the studies published to date influenced the specification of the research questions for the current investigation, future examinations of this area would be enhanced by the adoption of expanded reporting standards for communication partner instruction research. Specifically, editorial review boards are urged to uphold the two-pronged methodological standards for this type of research by allowing, and even requiring, authors to present complete findings for both participating individuals using AAC and communication partner participants.

A second limitation, as indicated within the method section, was that only one group- design study was identified through the search procedures. Since aggregation of data across studies is only possible when more than one study is identified and no accepted conventions exist to aggregate data across group designs and single-case designs, the current investigation does not include data from all identified studies originally meeting the inclusion criteria. However, the one identified study employing a group design (Romski et al., 2010) did report positive findings when employing communication partner instruction with preschoolers using AAC.

A third limitation relates to a gap in identified studies in the area of adult-acquired disorders such as aphasia. Implementation of partner instruction for those who support these individuals is common (e.g., Hopper, Holland, & Rewega, 2002; Simmons-Mackie, Raymer, Armstrong, Holland, & Cherney, 2010); therefore, we expected to identify and include studies targeting communication partners of both individuals with adult-acquired disorders and developmental disabilities. However, a post-hoc comparison of the terminology employed in our search strategy with terminology in the aphasia literature yielded some inconsistencies. It appears that alternate terminology may be used in aphasia literature in particular that does not necessarily clearly identify AAC interventions in the same manner

as literature targeting other populations. In light of this limitation, readers are referred to other related systematic reviews specifically focused on adults with acquired disorders (e.g., Simmons-Mackie et al., 2010).

Fourth, using the IRD metric, the authors limited the effect size calculations to communication and expressive language outcomes, by comparing baseline phase measurements to intervention phase measurements only. Therefore, it is not possible to evaluate or compare findings for other types of measures that were reported within some studies (e.g., challenging behavior variables). Similarly, it is not possible to gauge the effects of communication partner interventions within maintenance or generalization conditions, although some studies did report such data. It also may not be possible to compare the results of the current investigation to the results of other systematic reviews by virtue of the authors' selection of the IRD to report effect sizes; it is noteworthy that the quality of effect sizes used in this investigation were identified as preliminary by Parker, Vannest & Brown (2009), so it is possible that they may be positively or negatively skewed.

Finally, due to known variability in the literature for reporting dosage details, and identified coding challenges for dosage in other systematic reviews (e.g., Walker & Snell, 2013), the protocol for the present investigation did not include dosage parameters. As indicated by Walker and Snell in their review of challenging behavior interventions, future research in communication partner instruction must clearly specify the extent to which AAC interventions are implemented, in order to afford the establishment of connections between dosage and intervention effects.

In summary, the results of this meta-analysis indicate that there is a growing body of literature lending strong support for incorporating communication partner instruction within intervention programs for a broad range of individuals with complex communication needs. This point is particularly apparent when examining the publication years of the studies meeting the inclusions criteria for this investigation across the last several decades; there were 0 studies published in the 1980s, five studies published in the 1990s, six studies published between 2000 and 2009, and another six studies published in the 4 years between 2010 and 2013. Although this increased attention to communication partner intervention studies is encouraging, results of this investigation also highlight the need for methodological rigor and areas requiring attention in future research. In particular, including detailed participant and procedural information, along with reporting all data for dependent variables relevant to communication partners first and participating individuals using AAC second, will afford replication and selective application in clinical practice. Furthermore, publication standards for communication partner intervention studies should include reporting of complete data sets for communication partner variables, as well as variables based on participating individuals using AAC. Additionally, the results of this investigation indicate that there is a critical need to examine the effectiveness of working with a broader range of communication partners, including partners of adults who use AAC in community settings. Consideration of a wider variety of communication partners leads naturally to the need to consider a wider variety of communication contexts, such as academic, vocational, and social settings, which were not directly examined in the current review. Finally, addressing the quality indicators of single-case research, including maintenance, generalization, and fidelity of coding and implementation (Horner et al., 2005 & Kratochwill et al., 2010), will strengthen the basis of evidence and broaden clinical implementation of communication partner interventions.

Declaration of interest: The second and third authors report no conflicts of interest. Although some of the first and fourth authors' research is reviewed in the present article, procedural precautions were taken to minimize conflict of interest; all coding of articles was conducted by the second and third authors only.

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