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Effects of Joint Attention Mediated Learning for toddlers with autism spectrum disorders: An initial randomized controlled study

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ABSTRACT

The purpose of this study was to determine effects of the Joint Attention Mediated Learning (JAML) intervention on acquisition of joint attention and other early social communication competencies for toddlers with autism spectrum disorders (ASD). Twenty-three parents and their toddlers were randomly assigned to JAML or a control condition. Observational assessments were collected at pretest, posttest, and follow-up sessions, while standardized developmental measures were collected at pre- and posttest. Significant intervention-×-time interactions, favoring the intervention group, occurred for the observational measures Focusing on Faces and Responding to Joint Attention, with both having large effect sizes that maintained at follow-up. In addition, significant intervention-×-time effects, also favoring the JAML group were found for receptive language on the Mullen Scales of Early Learning and the Communication sub-domain of the Vineland Adaptive Behavior Scale. The observational measures Turn-Taking and Initiating Joint Attention and the Expressive Communication measure on the Mullen, while not showing significant differences between groups, revealed moderate effect sizes favoring the JAML group, suggesting that a study with more power could well detect significant differences on all of the measures. Findings support a focused, developmentally sequenced, systematic, and family aligned approach that targets preverbal social communication development within parent–child relationships.

1. Introduction

Successful efforts to identify children with autism spectrum disorders (ASD) at earlier ages have created urgency for intervention approaches that effectively address early challenges, that are developmentally appropriate for toddlers, and that support the parent–child relationship. Social communication is an ongoing challenge for children with ASD, an early marker for which is difficulty acquiring joint attention, or social sharing of attention with a partner about a focus of mutual interest (Mundy, 1995). Yet, to date, few interventions designed to promote joint attention for toddlers with ASD and their families have been examined in randomized studies. The purpose of this investigation was to conduct an initial efficacy study of the Joint Attention Mediated Learning (JAML) intervention for toddlers with ASD and their primary interaction partners.

The past decade ushered in a surge of interest in early intervention (EI) for toddlers with early signs of ASD. Early identification was advanced by reliable screening protocols (e.g., Robins, Fein, Barton, & Green, 2001), the American Academy of Pediatrics' call for universal toddler screening for ASD (Johnson & Myers, 2007), and adaptation of the Autism Diagnostic Observational Schedule for toddlers (Luyster et al., 2008). The resulting increase in identified toddler-aged children with ASD opened the door for exploratory toddler research (listed in Schertz, Baker, Hurwitz, & Benner, 2011) that examined a variety of intervention approaches.

More recently, larger multi-site studies have begun to emerge as private and public funders prioritized EI research (Autism Speaks, 2011; Interagency Autism Coordinating Committee, 2005). To date, two multi-site randomized controlled EI studies involving toddlers with ASD and their families have reported findings. Dawson et al. (2010) reported significant improvement on IQ, adaptive behavior, and diagnostic category for toddlers who received the Early Start Denver Model (ESDM; Dawson et al., 2010). The ESDM combined developmental and behavioral approaches with parent training. Importantly, this study showed that toddler intervention could produce effects on standardized measures. A second study, conducted by Carter and her colleagues (2011), explored the Hanen "More Than Words" program. Delivered as a low-intensity short-term parent-implemented intervention, Hanen produced no main effects, but resulted in communication gains

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for a subgroup of toddlers who had lower initial levels of object interest.

As toddler intervention approaches are investigated, a need remains for models that, while achieving important outcomes, are also consistent with Part C of the Individuals with Disabilities Education Act (IDEA, 2004) and compatible with community EI systems. Part C policy and professional practice recommendations call for EI to (a) be situated in the natural environment and integrated into everyday experiences; (b) support the parent–child relationship and enhance family capacity to promote child learning; (c) promote an active child role in learning; and (d) use approaches that are systematically delivered and individually, developmentally, and practically appropriate (Bruder, 2010; Schertz et al., 2011). Congruence with EI principles, which provide a backdrop for decisions about how to focus and deliver intervention for infants and toddlers, is essential if research-informed models are to be replicated in community practice.

2. Considerations for intervention focus and process

Verbal communication is often the intervention focus of choice for toddlers with ASD. However, because preverbal forms of social communication are developmentally closer to the child's current capabilities, are foundational for verbal language (Mundy, Sigman, & Kasari, 1990), and are uniquely troublesome in ASD (Bakeman & Adamson, 1984), they have potential as a more appropriate and fruitful initial intervention target. Joint attention, which emerges in typical development between 9 and 12 months (Carpenter, Nagell, & Tomasello, 1998), is viewed as a precursor for verbal language because of widely replicated findings that it predicts language competency (Adamson, Bakeman, Deckner, & Romski, 2009; Charman et al., 2003; Markus, Mundy, Morales, Delgado, & Yale, 2000; Mundy et al., 1990). Joint attention's generative role in language development is one important reason for targeting it as a central focus for early intervention. Engagement in joint attention also predicts later social responsiveness and adult outcomes (Clifford & Dissanayake, 2009; Gillespie-Lynch et al., 2012) and, if social communication can be effectively promoted before patterns of social avoidance have become entrenched (during the toddler period), the difficulty with social engagement that is pervasive in ASD may be eased.

Recognizing joint attention's importance, researchers have targeted it as a focus for intervention with young children with ASD. Joint attention-focused interventions were reported as effective for older preschoolers (National Autism Center, 2009) and research with toddlers produced improvements on a variety of observational measures (Gulsrud, Jahromi, & Kasari, 2010; Jones, Carr, & Feeley, 2006; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Landa, Holman, O'Neill, & Stuart, 2011; Rocha, Schreibman, & Stahmer, 2007; Schertz & Odom, 2007; Vismara & Lyons, 2007). However, a need remains for joint-attention-focused toddler intervention research that reports on standardized outcome measures in controlled studies.

While the joint attention literature informs the focus of EI for toddlers with ASD, transactional theories of learning offer a useful framework to guide the intervention process. Transactional theories are important in light of the core social challenges in ASD and the primacy of parent–toddler interaction as the central learning vehicle during the toddler period. Situational learning (Lave & Wenger, 1991), mutual parent–child regulation (Tronick, 2007), and mediated learning (Feuerstein, 1980) theories all emphasize a process by which both learners and learning facilitators are changed. Across these theories, learning is portrayed as relational and embedded in dynamic, interdependent, and socially situated interaction rather than as a process of one-way skill acquisition. Mediated learning theory builds on Vygotskian sociocultural premises (1986) by approaching learning as a process of scaffolding to broaden set patterns of thinking, counter resistance to change, and increase awareness of others' perspectives (Feuerstein, 1980) – aims that relate directly to core difficulties in ASD. In her work with parents, Klein (1996) adapted Feuerstein's (1980) model to engage parents in mediating infant learning through guided processes that are socially and culturally contextualized. Stable child cognitive gains and parents' continued use of these mediation practices were documented in 3-year follow-up studies (Klein, 1996).

Longitudinal research has tested theories of transactional influences in child and parent outcomes. For example, in a study of infants and toddlers with developmental disabilities mother–child interaction and child self-regulation (behavior and mastery motivation) separately predicted change in child developmental outcomes and parent-well-being (Hauser-Cram, Warfield, Shonkoff, & Krauss, 2001). In longitudinal research with toddlers with ASD, Siller and Sigman (2008) found that language outcomes were separately predicted by both toddlers' responsiveness to others' joint attention overtures and parents' responsiveness to their children. These findings document the importance of parent–child interaction as the primary vehicle for early intervention for toddlers with ASD.

Socio-cultural and mediated learning theories are complemented by conceptions of early intervention that informed Part C. Odom and Wolery (2003) describe a unified theory of EI practice in which intervention is oriented to important relationships, with learning opportunities embedded in natural experiences. EI theory is represented in calls for participatory caregiver roles to replace practices in which professionals directly intervene with children as caregivers look on and replicate activities between sessions (Bruder, 2010; Campbell & Sawyer, 2007; Hebbeler & Gerlach-Downie, 2002; Trivette & Dunst, 2005). These theory-aligned practices are bolstered by evidence of positive and significant associations between caregivers' facilitation of children's development and the family's sense of empowerment, with these associations predicting positive child outcomes (Dunst, Trivette, & Hamby, 2007). The JAML parent-mediated interaction-based approach, described following, is situated in early intervention theory as well as in the broader transactional theories described above.

3. Joint Attention Mediated Learning

The JAML intervention directly and exclusively addresses the social functions of preverbal communication, targeting engagement at progressively complex levels that begin just beyond the toddler's current capabilities. In the Focusing on Faces (FF) phase, the child is helped to look freely and often to the parent's face. In Turn-Taking (TT) the child engages with the parent in reciprocal repetitive play that acknowledges the other's shared interest by accommodating the parent's turn. Finally, triadic engagement is promoted using toys in the Joint Attention (JA) phase. In joint attention, the child both responds to the parent's bids for social attention and initiates social bids in reference to an object, indicated in each case by exchanging looks between the parent and toy. JAML emphasizes social rather than instrumental interaction in this phase through referential sharing of interest rather than requesting or responding to a partner's request.

The process through which this intervention focus is delivered is guided by five principles of mediated learning, with an aim of promoting active engagement in "learning how to learn" about social communication through the parent–child relationship. The principles, adapted from Klein (2003), apply to both toddler and parent learning. For toddlers, parents use the principles to help their children (1) sharpen their attention toward the competency addressed in the phase (focusing), (2) internalize a sense of self-regulation and order to communicate socially (organizing and

planning), (3) develop self-confidence related to the phase outcome (encouraging), (4) discern nuances of interaction that are socially important (giving meaning), and (5) interact more frequently in varied settings and with different people (expanding). Each principle is customized and operationalized for each intervention phase, as described below.

As parents apply mediation principles to promote their toddlers' learning, Intervention Coordinators (ICs) apply the same principles in their work with parents – to help them conceptualize the focus and process for the intervention phase as an alternative to training them in specific intervention activities. This approach is intended to support parents' internalization of JAML's aims and their competence, confidence, and freedom to orient parent–child interaction in ways that, while consistent with the intervention goals, are naturally aligned with child and family interests and priorities across the full range of daily activities. Thus, parent-led daily activities vary, but the focus and processes on which they are based are firm.

The JAML intervention has evolved through previous single case design (SCD) studies. An initial study with three parent–toddler dyads (Schertz & Odom, 2007) compared engagement in FF, TT, Responding to Joint Attention (RJA), and Initiating Joint Attention (IJA) during baseline and intervention conditions as successive intervention phases were introduced. Two of three toddlers acquired joint attention in parent–child interaction and the third achieved FF and TT. A complementary qualitative analysis traced the evolution of parents' self-efficacy and positive beliefs about their children's potential over the course of the intervention. A second set of SCD studies explored JAML's effects on child joint attention with 17 parent–toddler dyads (Odom, Schertz, & Baggett, 2011). For seven dyads, a multiple-baseline design across four phase-linked targeted outcomes (FF, TT, RJA, and IJA) showed generally consistent responses to JAML's original four phases. For the remaining 10 dyads, the same design was applied in three phases (FF, TT, and JA) instead of four, and also demonstrated experimental control for most participants (Odom et al., 2011). A common pattern that emerged was that TT initially increased when the intervention focus was directed to TT but decreased as increases in joint attention emerged in subsequent phases. Individual analyses guided refinement of the JAML intervention, resulting in enhancements that were applied in the present study.

The purpose of the current research was to examine the efficacy of JAML for promoting joint attention and other forms of early communication for toddlers with ASD. The specific research questions were:

1. After participating in the intervention, do toddlers in the JAML group engage more frequently in joint attention and other preverbal interactions than do children in the control group?
2. Do intervention effects for joint attention maintain across time?
3. Does participation in the JAML intervention have effects on children's language and communication relative to children in the control group?
4. Do parents report that JAML's goals, outcomes, and processes are acceptable?

4. Method

4.1. Participants

Toddlers under age 30 months were recruited in metropolitan and rural areas in Indiana, Kansas/Missouri, and North Carolina. Recruitment efforts focused on Part C providers, physicians, diagnostic centers, speech/language clinics, a university research database, and autism publications targeted to families. Eligibility was established if children met each of the following inclusion criteria: scores above the designated cut-off levels on the Autism Diagnostic Observation Scale (ADOS; Lord, Rutter, DiLavore, & Risi, 1999), absence of joint attention during interaction with parents based on direct observation, and chronological age below 30 months at the onset of intervention. Children who presented with a confounding diagnosis were excluded from the study (e.g., failure to thrive, premature birth >6 weeks, or other developmental disabilities such as Down syndrome). Participating families provided prior informed consent in accord with the human subjects protection procedures of each recruitment site's Institutional Review Board. Families who completed the study received a stipend of $100 to compensate for time contributed to assessment activities.

As participants were determined eligible, they were randomly assigned in pairs within sites to intervention or control conditions with matched duration between pre- and post-intervention assessments for members of the pair. Participant descriptions are summarized in Table 1. The mean age of child participants at enrollment was 24.6 and 27.5 for intervention and control groups, respectively, with similar scores between groups on the ADOS at entry. Parents were primarily Caucasian and most had some education beyond high school. The mean amount of time pairs spent in intervention or control conditions was 7 months (range = 4–12 months). There were no significant differences between groups on pretest measures or on the amount of time between pretest and posttest, all $p > .05$.

4.2. Design

The study employed a randomized controlled trial design with intervention and control groups. As noted, children and their families were first paired based on the order they qualified for participation and then randomly assigned to the JAML intervention or control group.

4.2.1. Intervention group

Intervention Coordinators (ICs) conducted weekly home-based intervention sessions with parents in their homes. All sessions were audio recorded. The ICs – two with master's degrees in early childhood education and one with an Ed.S. degree in counseling – coordinated recruitment, assessment, and intervention activities under the supervision of the first three authors. All received prior training and had experience implementing the JAML intervention. Separate manuals guided parent and IC activities. Referral to needed services such as professional counseling or parent-to-parent networking was deferred to Part C service coordinators, with whom families were encouraged to connect.

The first intervention session introduced JAML's phases and principles, parent and IC roles, and a basic overview of toddler learning. In each of at least 15 subsequent home visits, parents reviewed notes from daily activity logs and interacted with their toddlers for 10 min. The IC video-recorded this interaction and facilitated a guided reflection on the recording in reference to the targeted outcome for the current phase (FF, TT, or JA) and the mediated learning principles (focusing, organizing/planning, encouraging, giving meaning, and expanding) that had been introduced for the phase to date. Next, one of 15 units introduced a new intervention phase, if applicable, and the next mediated learning principle in the sequence, tailored to the current phase. A verbal review of the accompanying print materials (described following) was supplemented by a video example of a toddler with ASD engaging in the targeted phase outcome if a new phase was being introduced, and another of a parent applying the principle to the outcome. If the child had not made sufficient progress in a phase after all five mediated learning principles had been introduced, additional sessions were spent reviewing selected principles. To plan for the coming week, parents were guided to identify ways that

Table 1
Demographic characteristics at baseline: Intervention and control groups.

Participant characteristics	Intervention group (11 participants)	Control group (12 participants)
Child age (months: *M*/*SD*)	24.6/4.0	27.5/3.4
Parent[b] education (years: *M*/*SD*)	14.4/2.3	15.8/2.3
Parent[b] employed (full-time/part-time/none)	4/1/6	3/4/5
ADOS: Communication (*M*/*SD*)[a]	6.4/1.1	6.0/1.8
Social	11.0/2.6	10.8/1.8
Play	3.7/.8	2.8/1.5
Stereotopy	1.0/1.1	1.7/1.8
MSEL: Receptive language (*M*/*SD*)	21.0/2.0	25.9/9.1
Expressive language	24.6/6.7	24.8/6.9
VABS: Communication (*M*/*SD*)	63.7/9.4	69.6/10.7

[a] Descriptive scores are missing for one KS control group participant.
[b] Participating parent.

planned and routines-embedded parent–child interaction might incorporate the phase-linked principle in a manner consistent with family and child priorities, interests, and typical activities.

For each unit, the print materials described (a) what the child was expected to learn, (b) how the parent could apply the featured principle to promote the current phase outcome, (c) a brief vignette illustrating its application in parent–child interaction, and (d) "Ideas Other Parents Have Used" (see Table 2 for examples). Rather than prescribing or modeling specific activities, to promote self-efficacy, these materials and accompanying video examples used parent-generated examples that highlighted other parents' expertise and unique knowledge of the child.

Parents agreed to spend approximately 30 min daily dedicated to planned face-to-face interaction and additional time integrating phase-linked interaction into incidental daily activities. For research purposes, parents maintained a simple log to note daily activities, describe child engagement, and report approximate time spent. Intervention was discontinued when three or more instances of IJA were observed across multiple sessions. This criterion was based on findings from the single case design research (Odom et al., 2011), indicating that this level of IJA was a natural, if minimal, magnitude of the target criterion for a 10-min parent–child interaction session.

4.2.2. Control group

Children and parents in the control group participated in all assessment activities but no JAML intervention during the study, instead receiving services commonly available in their communities as described below. Funding did not permit full implementation of JAML with control group families; however, following data collection, ICs gave family members the same materials used for the intervention group and conducted three home visits (one for each phase) in which they explained how caregivers could use the material independently. Participants had access to general early intervention services and some families sought out specialized ASD-related interventions such as intensive applied behavior analysis.

4.3. Dependent variables

Observational and standardized assessments served as the dependent variables in this study. The observational measure assessed child performance in targeted preverbal social communication outcomes and the standardized measures assessed broad communication and social outcomes.

4.3.1. Observational assessment

The Precursors of Joint Attention Measure (PJAM), used to code video-recorded parent–child interaction, is a continuous, partial-interval observational coding system (Yoder & Symons, 2010) that assesses the occurrence of four targeted outcomes (Focusing on Faces, FF; Turn-Taking, TT; Responding to Joint Attention, RJA; Initiating Joint Attention, IJA). Using this system, observers who were blind to group assignment and working as data were generated, recorded whether the targeted outcome occurred in each 10-s interval. FF was coded if the child looked once or more at any part of the parent's face during the interval. A coding of TT required that the child perform one of at least two related actions in concert with a parent action within no more than two consecutive intervals. RJA was credited if the child responded to the parent's attempt to draw his or her attention to an object by alternating looks between the parent's face and the object for the apparent purpose of sharing interest. IJA was coded if the child alternated looks between the parent's face and an object for the apparent purpose of drawing the parent's attention to the object (i.e., "showing"). Previous research has shown adequate inter-observer agreement and sensitivity to intervention effects for the PJAM (Odom et al., 2011; Schertz & Odom, 2007).

4.3.2. Standardized assessment

Standardized assessments included the Mullen Scales of Early Learning (MSEL; Mullen, 1995) and the Vineland Adaptive Behavior Scales (VABS; Sparrow, Cicchetti, & Ball, 2005). The MSEL assesses the cognitive functioning of young children from birth to 68 months and is based on the child's responses to activities prepared by the examiner. It measures five skill domains, including receptive and expressive language, areas of interest for the current investigation. Receptive language items are primarily comprised of tasks that require children to point or to follow instructions of the examiner to manipulate toys and materials. Expressive language items are comprised of tasks that require children to use words to label, request, and make comments. Prompts are used to solicit child responses such as combining words creatively to refer to objects and communicating in multi-word phrases and sentences. Test–retest reliability for the Mullen is adequate ($M = .90$; $R = .71–.96$) and inter-scorer reliability is strong ($R = .91–.99$; Mullen, 1995). The VABS is a measure of adaptive behavior from birth to adulthood. It is based on parent interview and provides domain scores that include Communication and Socialization. Reliability and validity for the VABS are established as adequate (Sparrow et al., 2005). Test–retest reliability as well as inter-rater reliability for each subscale is .85 or higher.

4.4. Assessment procedures and measures

All families participated in assessment events at five time points: (1) initial eligibility screening, (2) pre-intervention, (3) intervention process, (4) post-intervention, and (5) follow-up. All assessment activities were conducted in family homes by research assistants who were trained on assessment procedures prior to enrolling families in the study. Separate research assistants, who

Table 2
Operationalized mediated learning principles for JAML intervention.

Mediated learning principles	Phases of intervention linked to mediated learning principles: guidance examples		
	Focusing on Faces	Turn-Taking	Joint Attention
Focusing	Promote face-looking with peek-a-boo variations. Make your face hard to avoid without being intrusive. Minimize distractions such as objects or verbal instructions.	Focus attention on the back-and-forth element of repetitive reciprocal actions. Imitate child's action and wait pointedly for a response in kind.	Help child focus on *both* an object of mutual interest and your face, emphasizing the social and reciprocal nature of "showing" interesting things to each other.
Organizing and planning	Structure time and space so child anticipates Focusing on Faces as natural, important, and expected during planned play sessions. Mark beginning and end of sessions with face-looking rituals such as peek-a-boo.	Establish predictable rhythms to foster a sense of order and reciprocity in play with a partner. Model Turn-Taking routine with your actions (Wait for partner > Perform same or related action > Repeat).	Build on the orderly rhythm of object-based Turn-Taking play by supplementing it with looks to each other's faces. Establish a pattern of looking at the toy, then to the partner's face with each turn.
Encouraging	Encourage feelings of success by responding with affection to face-looking. Encourage initiative rather than verbally or physically manipulating child to look at you. Take baby steps to make success achievable.	Early on, keep Turn-Taking simple, without props, and very repetitive to bolster feelings of success. Ease off if frustration appears. Build reciprocity into what child already does well (e.g., solitary play).	Show pleasure when child looks for your reaction as you show a novel toy. Emphasize the social looking-at-your-face part of joint attention over the toy-looking part. Demonstrate that social sharing is fun.
Giving meaning	To highlight what is most important to learn, show more excitement when child looks at you than when s/he looks at objects. Always respond when child looks at your face.	Calibrate your reaction to child's actions. Reserve excitement for the part of the Turn-Taking routine that is important, such as waiting for partner's turn.	Show excitement to give meaning to the *social* aspect of joint attention. Mute excitement when child engages for the purpose of *requesting* rather than for social sharing.
Expanding	As child becomes more comfortable, encourage more frequent and sustained looks. Introduce new face-looking games. Encourage family members to greet child and to wait expectantly for a look.	As Turn-Taking becomes reliable, introduce toys, focusing more on the back-and-forth rhythm than on the toy itself. Extend duration. Turn everyday routines into reciprocal games.	Promote joint attention across more times and places and with new partners. Use words to label objects around which attention is shared. Encourage verbalization as joint attention becomes established.

were trained to criterion in advance and who were blind to group assignment, completed observational coding.

4.4.1. Eligibility determination

Eligibility determination was conducted across three visits using parent interview and three measures for establishing criteria for inclusion. These measures were the Modified Checklist for Autism in Toddlers (M-CHAT; Robins et al., 2001), the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999), and the (PJAM; Schertz, 2005).

During the first two home visits, a designation of high risk for Autism Spectrum Disorder was established via a two-stage administration of the M-CHAT. High risk was defined as failure on both the questionnaire and the follow-up interview (D. Robins, personal communication, June 5, 2007). The M-CHAT is a validated autism screening tool for toddlers with a sensitivity rating greater than .80 and specificity greater than .90 for subsequent diagnosis of ASD when both the questionnaire and interview formats are used (Wiggins, Piazza, & Robins, 2010).

For children who showed high risk on the M-CHAT, the ADOS was administered at the third home visit. The ADOS has demonstrated high inter-rater reliability, test–retest reliability, and internal validity (Lord et al., 1999). A condition for inclusion in the study was that participants met the cut-off for ASD. ADOS scores for all participants met the strict cut-off for an autism diagnosis on the Communication section of Module 1 (i.e., cut-off = 4). On the Social section one intervention group participant met the cut-off for ASD (4) and the others met the stricter cut-off for autism (7).

Finally, 10-min observations of parent–child interaction were video recorded during each of the three home visits to establish the absence of responding to or Initiating Joint Attention. Parents were asked to engage their child in interactive play during the 10-min sessions, which took place in the living area or child's room, in the way that they believed could best promote their children's interaction. Consistent with JAML's intervention process, this parent-guided activity did not follow a structured or prescribed protocol, but relied on parents' knowledge of their children's preferences to elicit interaction. Parents in both groups received the same instructions, which matched those provided at posttest. The ICs video recorded these sessions. Independent coders were masters- and doctoral-level students in fields related to education or psychology and a doctoral student in Educational Psychology coordinated independent coding activities. All coders participated in training until reaching at least a .80 kappa level of agreement compared to a master coder.

The PJAM was used not only for eligibility determination but also as a primary outcome measure. The eligibility coders, naïve to group assignment, also coded the observational assessment data. Continuous monitoring of agreement on the PJAM was achieved by having two independent research assistants code an overlap of 25% of videos throughout the study such that accuracy of coding was maintained for all targeted outcomes. When all data were collected, overall reliability was calculated. Inter-observer agreement calculations for the current study included mean Kappa scores of .75 (range = .38–1.00) for Focusing on Faces; .76 (range = –.02–1.00) for Turn-Taking; 71 (range = –.02–1.00) for Responding to Joint Attention; .89 (range = .44–1.00) for Initiating Joint Attention.

4.4.2. Pre-intervention assessment

All pre-intervention activities were conducted during three visits that included the 10-min video-recording of parent–child interaction for later coding with the PJAM (see description of

observation and coding procedures above). In addition, standardized developmental assessments were administered across the three pre-intervention visits, including the MSEL (Mullen, 1995) and the VABS (Sparrow et al., 2005). Pre-assessment scores provide an indication of the communication functioning of the sample immediately following enrollment. Mullen Expressive and Receptive Standard Scores are far below the standard mean (see Table 1).

4.4.3. Assessment of implementation

Two assessments of implementation were collected in this study. First, each IC's fidelity to JAML's protocol for implementing the intervention with parents was collected weekly. Second, parents reported to ICs, via a home activity log, their implementation of the JAML strategies during the week. Immediately following each intervention session, ICs completed the Parent Implementation Fidelity Checklist. This checklist is a 13-item rating scale with each item rated on a 3-point scale, ranging from "not observed," "observed partially," to "observed fully." One-eighth (12.5%) were randomly selected and reviewed by an independent rater, a trained research assistant, showing a mean fidelity rate across the study of 90%. Inter-rater agreement was calculated for the dually rated audio sessions. Agreement was computed as the number of checklist items on which raters agreed divided by the number of items × 100. The current study yielded a mean percent agreement score of 93% (range = 40–100%).

Fidelity of intervention implementation by ICs was assessed via the Intervention Coordinator Implementation Fidelity Checklist. Immediately following each intervention session, the IC completed an 11-item IC Implementation Fidelity Checklist, rated on a 3-point scale identical to that described above for the Parent Implementation Fidelity Checklist. Twenty-five percent of audio-recorded sessions were randomly selected and independently rated by a research assistant, and showed a mean fidelity rating of 89%. Descriptive statistics for the IC Implementation Fidelity Checklist were reported based on the 25% of independently rated IC checklists. Inter-rater agreement was computed using the formula described previously, yielding a mean percent agreement score of 92% (range = 40–100%).

Families in the JAML group were not prohibited from receiving other services alongside the JAML intervention, and reports from monthly interviews conducted by the IC with each family documented other community services received for both groups. The Monthly Services Record reported the number of hours per week children received services. Including JAML sessions, reported weekly hours for intervention and control group participants, respectively, were 7.41 (SD = 4.67) and 12.82 (SD = 14.06) for Indiana, 17.88 (SD = 9.06) and 21.35 (SD = 11.51) for Kansas, and 2.98 (SD = 1.25) and 6.25 (SD = 6.49) for North Carolina.

4.4.4. Post-intervention assessment

Within 2 weeks of completing intervention, each intervention group family and the paired family assigned to the control group participated in post-intervention assessment activities. Measures included three 10-min video-recorded parent–child interaction sessions later coded with the PJAM as well as the VABS, the MSEL, and a parent questionnaire on the acceptability of the goals, outcomes, and processes of the intervention.

4.4.5. Follow-up assessment

To assess whether post-intervention outcomes were maintained, two additional visits were conducted with participants from both groups to video-record 10-min parent–child interaction for PJAM coding. These data were gathered in two follow up visits 4 and 8 weeks after the intervention had ended.

5. Results

The primary question addressed by this study was whether JAML had a significant effect on children's joint attention and language development relative to children in the control group. These outcomes were measured with observational and standardized assessments.

5.1. Observational assessments

As noted, the study was designed as a two-group randomized controlled trial with intervention and control groups measured at pretest, posttest, and follow-up for the observational variables. These results are displayed in Fig. 1 and Table 3. The data were analyzed for a series of four outcomes Focusing on Faces (FF), Turn-Taking (TT), Responding to Joint Attention (RJA), and Initiating Joint Attention (IJA), in a repeated-measures model.

Each outcome was estimated as a hierarchical linear model (HLM) with two levels: *time* at Level 1 nested within *child* at Level 2. Repeated-measures analysis enables researchers to look not only at differences between treatment and control groups, but also at how the individuals in those groups change over the period of study. However, this also introduces dependency within subjects over time; that is, participants' scores are related to their previous scores. In HLM, within-subject dependence in the data arises out of the repeated measurement of participants (Bryk & Raudenbush, 1992; Burchinal, Nelson, & Poe, 2006). This dependence is incorporated into the model through estimation of within-subject random effects. Random effects are estimates of the subject effects of the model. For example, a fixed effect for the intercept can be estimated, which represents the grand mean of the data. A random effect for the intercept represents how much each individual observation may vary from that fixed effect. In these models, we included tests of the random effects for only the intercepts, allowing for mean differences in the dependent variables between subjects. No covariates were included in the models.

Participants were measured at eight time points: three pretest, three posttest, and two follow-up sessions. All eight time points were entered into the model. Because time between assessments could vary, this was treated as a categorical variable. Post hoc comparisons combined the data for each time period. We estimated the pretest effect as a model-based composite of the three pretest observations, the posttest as the three posttest observations, and the follow-up as the two follow-up observations. Each of these is the mean of those observations. Finally, we computed Cohen's d for the pairwise comparisons between treatment and control groups at each time point.

Neither TT nor IJA were significantly predicted by group, time, or their interaction (all $p > .05$). However, there were significant interactions between intervention and time for both FF ($F = 3.05$, $p < .01$) and RJA ($F = 7.19$, $p < .001$), indicating that change over time differed between the experimental and control groups. Across both outcomes, children in the experimental group showed a significant increase from pretest to posttest (all $p < .001$) and remained steady from posttest to follow-up. Changes in the control group were not significant. Further, control and intervention groups were significantly different at posttest and follow-up (all $p < .001$), for both FF and RJA but not at pretest (all $p > .75$). At pretest, the differences between treatment and control were small ($d < .10$), but the differences at posttest (FF $d = 1.24$; RJA $d = 1.39$) and at follow-up (FF $d = .84$; RJA $d = 1.18$) were substantial.

Following model testing, effect sizes were computed for pairwise comparisons at each time point. The effect sizes for all of these comparisons at pretest were small, all $d < .10$, but the differences at posttest (FF $d = 1.24$; RJA $d = 1.39$) and at follow-up (FF $d = .84$; RJA

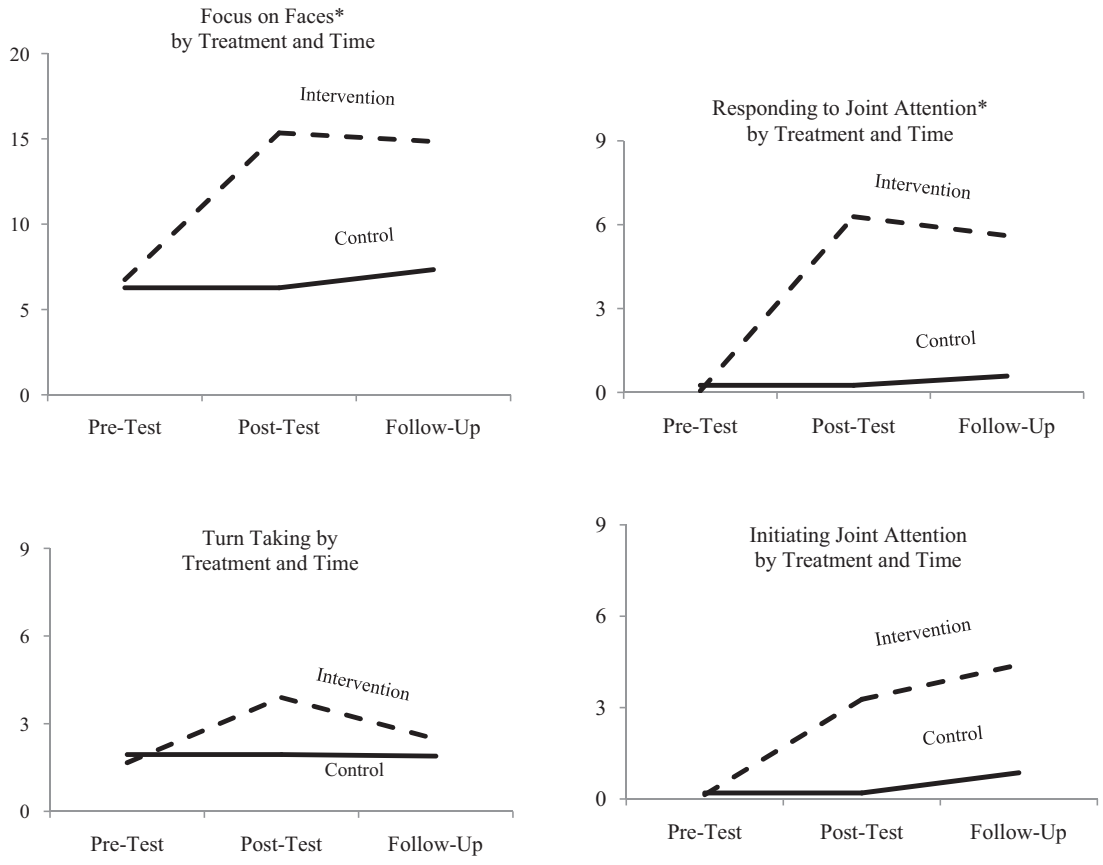

Fig. 1. Change over time: Observational measures.

$d = 1.18$) were substantial. Although changes in TT and IJA were not significant, their effect sizes from measures taken at these same time points were small to moderate (TT posttest $d = .55$; IJA posttest $d = .70$; TT follow-up $d = .10$ IJA posttest $d = .58$).

5.2. Developmental assessments

As with the video analysis, we tested outcomes from the standardized measures using HLM with time nested within child, but with just one pretest and one posttest assessment and no follow-up assessment. We conducted these analyses for the communication subdomains of the MSEL and the VABS. As in the observational measures, the effect sizes at pretest were all under .10. An initial analysis indicated no significant differences between groups at pretest. There was a significant main effect for increases over time on the MSEL expressive language measure ($B = 8.48$, $p < .0272$), indicating that both groups significantly improved their scores over time.

Table 3
Summary statistics.

	Observational assessment measures															
	Focusing on Faces				Turn-Taking				Responding to Joint Attention				Initiating Joint Attention			
	Control		Intervention		Control		Intervention		Control		Intervention		Control		Intervention	
Time	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Pretest composite	6.28	5.14	6.75	5.18	1.94	2.74	1.67	1.66	.25	.32	.06	.13	.19	.33	.14	.26
Posttest composite	4.31	2.64	15.35	7.79	1.89	2.06	3.90	3.19	.58	.68	6.29	5.53	.86	.77	3.27	3.17
Follow-up composite	7.33	6.81	14.85	8.99	2.85	3.06	2.47	2.17	.75	1.18	5.61	4.77	2.40	3.72	4.40	4.48

	Developmental assessment communication measures							
	Pretest				Posttest			
	Control		Intervention		Control		Intervention	
Assessment subscale	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
VABS: communication	69.55	10.73	63.73	9.42	68.08	19.77	75.90	13.51
MSEL: receptive language	25.91	9.07	21.00	1.95	25.33	8.52	28.27	11.35
MSEL: expressive language	24.75	6.89	24.58	6.71	27.17	11.21	33.27	15.79

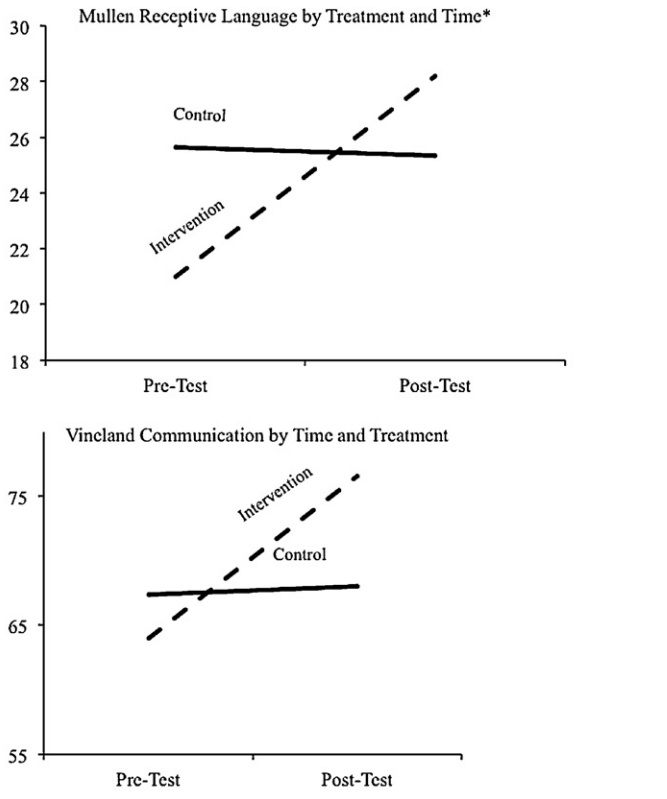

Fig. 2. Change over time: Developmental assessment measures.

Of greater consequence, there were significant time-×-treatment interaction effects for the two outcomes, MSEL Receptive Language Score and VABS Communication Scores (all $F > 4.6$, all $p < .05$) (see Fig. 2 and Table 3). The effect sizes for the posttest differences on the VABS Communication Scores and the MSEL Receptive Language Scores were moderate, $d = .59$ and $d = .34$, respectively. In all cases, the change in the JAML group was significant but the change in the control group was not. Additionally, there was some evidence of a similar pattern with the MSEL Expressive Language Scores although, as noted, this was not significant. As reflected in Table 3, scores for the control group increased only slightly, from 24.75 to 27.17 ($d = .22$), but more substantially for the intervention group, from 24.58 to 33.27,with a moderate effect size ($d = .78$).

5.3. Social validity

Measures of social validity were also reported. Parents assessed the acceptability of the intervention goals, outcomes achieved, and the intervention process, resulting in an overall mean rating of 4.80 from the 5-point 18-item Likert scale questionnaire. For each item, a majority of parents responded "strongly agree", indicating a high level of acceptance for all aspects of the intervention, including those related to JAML's outcomes, activities, and overall importance. In addition, responses showed that parents did not experience JAML as intrusive and reported that their hopefulness about their children's future and their confidence to support their children's development had increased as a result of the intervention.

6. Discussion

Intervention models that are both effective and appropriate for toddler-aged children with ASD and their families are a pressing need as children are identified at younger ages. This study showed positive effects from a parent-mediated approach to promote foundational preverbal social communication. The JAML intervention resulted in more frequent attention to parents' faces and responses to parents' joint attention overtures. Importantly, it also resulted in significant improvement on separate standardized communication measures even though language outcomes were not directly targeted in the intervention.

The findings of generalized effects for communication reported by two separate sources, Intervention Coordinators who were assessors for the MSEL and parents who were informants for the VABS, were encouraging. The MSEL expressive language, VABS communication, and MSEL Receptive Language Scores showed strong, moderate, and, modest effect sizes, respectively, with significant time-×-treatment effects for the latter two measures. In addition, large effect sizes were found with significant time-×-treatment effects for the observational measures Focusing on Faces (FF) and Responding to Joint Attention (RJA). Although time-×-treatment effects did not reach significance for Initiating Joint Attention (IJA), the trend across time was similar to FF and RJA and a moderate effect size was found at posttest and follow-up. The results for Turn-Taking (TT) were somewhat different, with the effect size moderate at posttest and very small at follow-up. This resembled a pattern detected in our previous single case design research using continuous measures (Odom et al., 2011), with Turn-Taking initially increasing and then declining after joint attention was introduced.

Taken together, the findings support an approach that guides learning from simpler to more complex forms of preverbal social communication for toddlers with ASD. It is well known that joint attention serves a pivotal function for language and social learning (e.g., Tomasello & Farrar, 1986; Van Hecke et al., 2007); however, the question of whether earlier developing competencies support joint attention development had not been studied previously in group comparison research. JAML is built on our theory that Focusing on Faces and Turn-Taking serve a foundational role for joint attention development. Regarding others' faces, a necessary component of joint attention, appears very early in typical infant development (Trevarthen & Hubley, 1978) but is compromised for infants with later diagnoses of ASD during their transition from infancy to toddlerhood (Osterling & Dawson, 1994). In the current study, increasing the frequency of looks to parent's faces may have facilitated acquisition of joint attention. Similarly, the reciprocity that characterizes simple Turn-Taking routines may increase toddlers' awareness of their partners' separate but related interest in the interaction, supporting the social basis for triadic joint attention.

These early communication outcomes were anticipated by Siller and Sigman's (2008) findings that language for toddlers with ASD was independently predicted by children's responding to parents' bids for joint attention and parents' responsiveness to the child. As predicted by that research, JAML's focus on mutual joint attention using parent mediation (which uses responsive strategies) resulted in improvement on communication measures. Because language has been identified as parents' area of greatest concern for toddlers with ASD (Coonrod & Stone, 2004) and is an entryway into the social world of the family (and later peers and others), this outcome has broad implications for child and family well-being.

In addition to JAML's targeted focus on foundational preverbal social communication competencies, the intervention's mediated learning framework may have influenced the results. In this approach, learning is viewed as a generative process

(Feuerstein, 1980; Klein, 2003) and is guided by principles that aim to help parents and toddlers focus purposefully on pertinent aspects of interaction, appreciate their own roles as interaction partners, and expand their capacity and motivation to learn on their own initiative. The mediated learning principles (focusing, organizing/planning, encouraging self-efficacy, giving meaning, and expanding) are designed to guide active learning, and roughly parallel the learning processes of acquisition, mapping, strengthening, refining, and execution that Siegler (1996) described. The mediated learning approach – and its primary focus on strengthening the learner's role in the learning process rather than using prescribed strategies to train distinct skills – is aimed at building on underlying competencies to promote broad-based learning. As such, it differs from the more commonly implemented approaches that may have a similar focus but that use more structured strategies based on principles of reinforcement. For both toddlers and parents, JAML's orientation to everyday experiences in natural environments and its emphasis on conceptual learning over prescribed intervention strategies may enhance independent use of strengthened learning processes to enhance social communication.

The intervention's alignment with the transactional orientations of socio-cultural and early intervention theories may further explain JAML's positive results (Beeghly & Tronick, 2011; Dunst, Bruder, Trivette, & Hamby, 2006; Lave & Wenger, 1991; Odom & Wolery, 2003). Professionally implemented, decontextualized, and more didactic intervention formats would appear to underutilize opportunities to embed toddlers' social learning through naturally occurring interactions with important communication partners, and thus miss opportunities to enhance the meaningfulness of socially based learning. The alternative of directly supporting caregivers to facilitate children's development was found in other research to impact family empowerment and to predict positive child outcomes, with children whose parents received focused support showing greater progress than those who received direct intervention from professionals (Dunst et al., 2006; Thompson & Lobb, 1997). The conclusion for this research is, of course, an empirical question that would be an important direction for future research.

The JAML intervention is based on parents' dedication of approximately 30 min per day of planned parent–child interaction as well as their embedding of phase-linked interaction into everyday interactions. This half-hour was thought to approximate the time a working parent might typically spend with a toddler each day, and is in line with JAML's emphasis on a strong interactional focus rather than reliance on intensive time dedicated to prescribed activities.

This investigation had several strengths. It was conducted across geographically distinct sites in the United States with varied population characteristics, observational data were coded by blind coders, and multiple standardized outcome measures produced information about child performance from different sources. Additionally, both assessment and intervention activities were conducted in the family home, an authentic venue that is most likely to capture an accurate picture of toddler performance (Bagnato, Neisworth, & Pretti-Frontczak, 2010) and minimize the need for separate generalization training.

The study had limitations as well. As noted, this initial efficacy trial was modest in size and as a result underpowered, limiting our analysis in three ways. First, Initiating Joint Attention generated a modest effect size but did not reach statistical significance; a significant effect may have been detected in a larger study. Second, potential mediators and moderators such as parent responsiveness or self-efficacy could not be analyzed. Third, although our sample may have been typical of toddlers with ASD, parents were primarily Caucasian, most were from two-parent households, and most had some post-secondary education, limiting generalization across these dimensions.

Another limitation concerned the wording of questions on our social validity questionnaire, which contained positively stated items that may have predisposed respondents to validate the intervention. In addition, although funds supported blinded assessment for the observational measures, the same was not possible for the standardized measures. Finally, the standardized measures provided some evidence of JAML's effect on children's language, but they were subtests of general child development and adaptive behavior measures rather than language-specific assessments. Using a combination of recommended language measures (Tager-Flusberg et al., 2009) could describe communication gains more precisely and compare JAML's outcomes with those of other approaches. A larger efficacy trial is needed to address each of the limitations noted here.

In conclusion, the study suggests that JAML is a promising approach for promoting early social communication between toddlers with ASD and their parents. In addition to its positive effects, the intervention was feasible to deliver in a home-based setting and acceptable to parent participants. The next steps for this research will be to implement JAML with a larger population, to examine possible mediators and moderators of intervention outcomes, and to refine the processes by which outcomes are measured.

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References

Adamson, L. B., Bakeman, R., Deckner, D. F., & Romski, M. (2009). Joint engagement and the emergence of language in children with autism and Down syndrome. *Journal of Autism and Developmental Disorders*, *39*(1), 84–96.

Autism Speaks. (2011). *Autism Speaks Toddler Treatment Network*. Retrieved from http://www.autismspeaks.org/science/initiatives/toddler-treatment-network

Bagnato, S. J., Neisworth, J. T., & Pretti-Frontczak, K. (2010). *LINKing authentic assessment and early childhood intervention: Best measures for best practices*. Baltimore, MD: Brookes.

Bakeman, R., & Adamson, L. B. (1984). Coordinating attention to people and objects in mother–infant and peer–infant interaction. *Child Development*, *55*(4), 1278–1290.

Beeghly, M., & Tronick, E. (2011). Early resilience in the context of parent–infant relationships: A social developmental perspective. *Current Problems in Pediatric and Adolescent Health Care*, *41*(7), 197–201.

Bruder, M. B. (2010). Early childhood intervention: A promise to children and families for their future. *Exceptional Children*, *76*(3), 339–355.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models in social and behavioral research: Applications and data analysis methods* (1st ed.). Newbury Park, CA: Sage.

Burchinal, M., Nelson, L., & Poe, M. (2006). Growth curve analysis: An introduction to various methods for analyzing longitudinal data. In K. McCartney, M. Burchinal, & K. Bub (Eds.), *Monographs of the Society for Research in Child Development, vol. 71(3)* (pp. 65–87).

Campbell, P. H., & Sawyer, L. B. (2007). Supporting learning opportunities in natural settings through participation-based services. *Journal of Early Intervention*, *29*(4), 287–305.

Carpenter, M., Nagell, K., & Tomasello, M. (1998). Social cognition, joint attention, and communicative competence from 9 to 15 months of age. *Monographs of the Society for Research in Child Development*, *63*(4, Serial No. 255), 1–142.

Carter, A. S., Messinger, D. S., Stone, W. L., Celimli, S., Nahmias, A. S., & Yoder, P. (2011). A randomized controlled trial of Hanen's 'More Than Words' in toddlers with early autism symptoms. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *52*(7), 741–752. http://dx.doi.org/10.1111/j.1469-7610.2011.02395.x

Charman, T., Baron-Cohen, S., Swettenham, J., Baird, G., Drew, A., & Cox, A. (2003). Predicting language outcome in infants with autism and pervasive developmental disorder. *International Journal of Language and Communication Disorders*, *38*, 265–285.

Clifford, S., & Dissanayake, C. (2009). Dyadic and triadic behaviours in infancy as precursors to later social responsiveness in young children with autistic disorder. *Journal of Autism and Developmental Disorders*, *39*(10), 1369–1380.

Coonrod, E. E., & Stone, W. L. (2004). Early concerns of parents of children with autistic and nonautistic disorders. *Infants and Young Children: An Interdisciplinary Journal of Special Care Practices*, *17*(3), 258–268.

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., et al. (2010). Randomized, controlled trial of an intervention for toddlers with autism: The Early Start Denver Model. *Pediatrics*, *125*(1), e17–e23.

Dunst, C. J., Bruder, M. B., Trivette, C. M., & Hamby, D. (2006). Everyday activity settings, natural learning environments, and early intervention practice. *Journal of Policy and Practice in Intellectual Disabilities*, *3*(1), 3–10.

Dunst, C. J., Trivette, C. M., & Hamby, D. W. (2007). Meta-analysis of family-centered helpgiving practices research. *Mental Retardation and Developmental Disabilities Research Reviews*, *13*(4), 370–378.

Feuerstein, R. (1980). *Instrumental enrichment: An intervention program for cognitive modifiability*. Baltimore, MD: University Park Press.

Gillespie-Lynch, K., Sepeta, L., Wang, Y., Marshall, S., Gomez, L., Sigman, M., et al. (2012). Early Childhood Predictors of the Social Competence of Adults with Autism. *Journal of Autism and Developmental Disorders*, *42*(2), 161–174. http://dx.doi.org/10.1007/s10803-011-1222-0

Gulsrud, A. C., Jahromi, L. B., & Kasari, C. (2010). The co-regulation of emotions between mothers and their children with autism. *Journal of Autism and Developmental Disorders*, *40*(2), 227–237.

Hauser-Cram, P., Warfield, M. E., Shonkoff, J. P., & Krauss, M. W. (2001). Children with disabilities: A longitudinal study of child development and parent well-being. *Monographs of the Society for Research in Child Development*, *66*(3), 1–131.

Hebbeler, K. M., & Gerlach-Downie, S. G. (2002). Inside the black box of home visiting: A qualitative analysis of why intended outcomes were not achieved. *Early Childhood Research Quarterly*, *17*(1), 28–51. http://dx.doi.org/10.1016/s0885-2006(02)00128-x

Individuals with Disabilities Education Act, 20 U.S.C. § 1400 (2004).

Interagency Autism Coordinating Committee. (2005). *IACC autism spectrum disorder (ASD) services roadmap*. Retrieved from http://iacc.hhs.gov/publications/2005/services-subcommittee-report-may16.shtml

Johnson, C. P., & Myers, S. M. (2007). Identification and evaluation of children with autism spectrum disorders. *Pediatrics*, *120*(5), 1183–1215, doi:10.1542.

Jones, E. A., Carr, E. G., & Feeley, K. M. (2006). Multiple effects of joint attention intervention for children with autism. *Behavior Modification*, *30*(6), 782–834.

Kasari, C., Gulsrud, A. C., Wong, C., Kwon, S., & Locke, J. (2010). Randomized controlled caregiver mediated joint engagement intervention for toddlers with autism. *Journal of Autism and Developmental Disorders*, *40*(9), 1045–1056. http://dx.doi.org/10.1007/s10803-010-0955-5

Klein, P. S. (1996). *Early intervention: Cross-cultural experiences with a mediational approach*. New York, NY: Routledge.

Klein, P. S. (2003). A mediational approach to early intervention: Israel. In S. L. Odom, M. J. Hanson, J. A. Blackman, & S. Kaul (Eds.), *Early intervention practices around the world* (pp. 69–80). Baltimore, MD: Paul H. Brookes.

Landa, R. J., Holman, K. C., O'Neill, A. H., & Stuart, E. A. (2011). Intervention targeting development of socially synchronous engagement in toddlers with autism spectrum disorder: A randomized controlled trial. *Journal of Child Psychology and Psychiatry*, *52*(1), 13–21. http://dx.doi.org/10.1111/j.1469-7610.2010.02288.x

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, England: University of Cambridge Press.

Lord, C., Rutter, M., DiLavore, P. C., & Risi, S. (1999). *Autism Diagnostic Observation Schedule – WPS (ADOS-WPS)*. Los Angeles, CA: Western Psychological Services.

Luyster, R., Guthrie, W., Gotham, K., Risi, S., DiLavore, P., & Lord, C. (2008). *The Autism Diagnostic Observation Schedule – Toddler module: Preliminary findings using a modified version of the ADOS*. Paper presented at the International Meeting for Autism Research, London, England.

Markus, J., Mundy, P., Morales, M., Delgado, C. E. F., & Yale, M. (2000). Individual differences in infant skills as predictors of child–caregiver joint attention and language. *Social Development*, *9*(3), 302–315.

Mullen, E. M. (1995). *Mullen Scales of Early Learning* (AGS ed.). Circle Pines, MN: American Guidance Service.

Mundy, P. (1995). Joint attention and social–emotional approach behavior in children with autism. *Development and Psychopathology*, *7*, 63–82.

Mundy, P., Sigman, M., & Kasari, C. (1990). A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and Developmental Disorders*, *20*(1), 115–128.

National Autism Center. (2009). *The National Autism Center's National Standards Project: Findings and conclusions*. Randolph, MA: National Autism Center. Retrieved from http://www.nationalautismcenter.org/pdf/NAC%20Findings%20&%20Conclusions.pdf

Odom, S. L., & Wolery, M. (2003). A unified theory of practice in early intervention/early childhood special education: Evidence-based practices. *Journal of Special Education*, *37*(3), 164–173.

Odom, S. L., Schertz, H. H., & Baggett, K. B. (2011). Single case design and growth curve analysis of an intervention to promote joint attention for toddlers with autism spectrum disorders. In *Paper presented at the International Meeting of Autism Research*. San Diego, CA, http://imfar.confex.com/imfar/2011/webprogram/start.html#srch=words

Osterling, J. A., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of Autism and Developmental Disorders*, *24*(3), 247–257.

Robins, D. L., Fein, D., Barton, M. L., & Green, J. A. (2001). The Modified Checklist for Autism in Toddlers: An initial study investigating the early detection of autism and pervasive developmental disorders. *Journal of Autism and Developmental Disorders*, *31*(2), 131.

Rocha, M. L., Schreibman, L., & Stahmer, A. C. (2007). Effectiveness of training parents to teach joint attention in children with autism. *Journal of Early Intervention*, *29*(2), 154–173.

Schertz, H. H. (2005). *Precursors of joint attention video coding measures*. Bloomington, IN: Indiana University.

Schertz, H. H., & Odom, S. L. (2007). Promoting joint attention in toddlers with autism: A parent-mediated developmental model. *Journal of Autism and Developmental Disorders*, *37*(8), 1562–1575.

Schertz, H. H., Baker, C., Hurwitz, S., & Benner, L. (2011). Principles of early intervention reflected in toddler research in autism spectrum disorders. *Topics in Early Childhood Special Education*, *31*(1), 4–21. http://dx.doi.org/10.1177/0271121410382460

Siegler, R. S. (1996). *Emerging minds: The process of change in children's thinking*. New York: NY: Oxford University Press.

Siller, M., & Sigman, M. (2008). Modeling longitudinal change in the language abilities of children with autism: Parent behaviors and child characteristics as predictors of change. *Developmental Psychology*, *44*(6), 1691–1704, doi:10.1037/a0013771.

Sparrow, S. S., Cicchetti, D. V., & Balla, D. A. (2005). *Vineland Adaptive Behavior Scales* (2nd ed.). Circle Pines, MN: American Guidance Service.

Tager-Flusberg, H., Rogers, S., Cooper, J., Landa, R., Lord, C., Paul, R., et al. (2009). Defining spoken language benchmarks and selecting measures of expressive language development for young children with autism spectrum disorders. *Journal of Speech, Language and Hearing Research*, *52*(3), 643–652.

Thompson, L., & Lobb, C. (1997). Pathways to family empowerment: Effects of family-centered delivery of early. *Exceptional Children*, *64*(1), 99–113.

Tomasello, M., & Farrar, M. J. (1986). Joint attention and early language. *Child Development*, *57*(6), 1454.

Trevarthen, C., & Hubley, P. (1978). Secondary intersubjectivity: Confidence, confiding and acts of meaning in the first year. In A. Lock (Ed.), *Action, gesture and symbol* (pp. 183–299). London, England: Academic Press.

Trivette, C. M., & Dunst, C. J. (2005). Family-based practices. In S. R. Sandall, M. L. Hemmeter, B. J. Smith, & M. E. McLean (Eds.), *DEC recommended practices: A comprehensive guide for practical application in early intervention/early childhood special education* (pp. 107–127). Missoula, MT: Division for Early Childhood.

Tronick, E. (2007). *The neurobehavioral and social–emotional development of infants and children*. New York, NY: Norton.

Van Hecke, A. V., Mundy, P., Acra, C. F., Block, J. J., Delgado, C. E. F., Parlade, M. V., et al. (2007). Infant joint attention, temperament, and social competence in preschool children. *Child Development*, *78*(1), 53–69.

Vismara, L. A., & Lyons, G. L. (2007). Using perseverative interests to elicit joint attention behaviors in young children with autism: Theoretical and clinical implications for understanding motivation. *Journal of Positive Behavior Interventions*, *9*(4), 214–228.

Vygotsky, L. (1986). *Thought and language (A. Kozulin, Trans.)*. Cambridge, MA: MIT Press (Original work published 1934).

Wiggins, L. D., Piazza, V., & Robins, D. L. (2010). Paper presented at the International Meeting for Autism Research. *Comparison of a broad-based screen versus disorder-specific screen in detecting young children with an autism spectrum disorder*.

Yoder, P., & Symons, F. J. (2010). *Observational measurement of behavior*. New York, NY: Springer.