Joint Attention Interventions for Young Children with Autism Spectrum Disorders: Caregiver and Child Actions and Transactions

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Joint Attention Interventions for Young Children with Autism Spectrum Disorders: Caregiver and Child Actions and Transactions

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education at Virginia Commonwealth University.

by

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Abstract

JOINT ATTENTION INTERVENTIONS FOR YOUNG CHILDREN WITH AUTISM SPECTRUM DISORDERS: CAREGIVER AND CHILD ACTIONS AND TRANSACTIONS

By Abigail K. Vo, Ph.D.

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Education at Virginia Commonwealth University.

Virginia Commonwealth University, 2011

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Early intervention is a critical component of efforts to optimize outcomes for children with autism spectrum disorders (ASD) and their families. One promising target for early intervention is joint attention, an early developing social-cognitive competency that is foundational to many other social, communicative, and cognitive skills; and a core deficit in children with ASD. While joint attention interventions are gaining interest among researchers, many are limited by their failure to situate joint attention development within the caregiver-child relationship and to adequately examine child and caregiver outcomes and transactional processes. The purpose of this study was to examine changes in child and caregiver joint attention actions and transactions across the course of a parent-mediated joint attention intervention. The Child-Caregiver Joint Attention coding system was developed and applied to videotaped caregiver-child interaction sessions from all phases of the Joint Attention Mediated Learning intervention. Participants included five mothers and their toddler aged sons. Joint
attention actions examined included gaze alternations, pointing, showing, joint attention responding, and joint attention initiating for both children and caregivers. Four of five children demonstrated increases in gaze alternations, joint attention responding, and joint attention initiating by the end of the intervention. Three caregivers demonstrated increases in gaze alternations and joint attention responding, and four displayed increases in joint attention initiating. There was no clear pattern of change across children or caregivers in pointing or showing. All participants, with the exception of one caregiver, responded to a higher percentage of opportunities for joint attention in the final intervention phase than in Baseline, suggesting that most participants became more responsive to their social partners by the end of the intervention. The findings of this study suggest that parent-mediated joint attention interventions have the potential to promote changes in both child and caregiver joint attention actions and transactional relationships. Future research should continue to examine outcomes for both children and primary caregivers and changes in child-caregiver transactions over the course of different types of joint attention interventions in order to inform intervention development and selection, and explore mechanisms for change.
Chapter 1: Introduction

The purpose of this chapter is to provide a rationale and framework for the present study as well as a brief overview of the chapters that are to follow. First, a statement of the problem will be presented, followed by a rationale for the study of the problem, and the purpose of the present study. Next, the literature serving as the foundation for the study will be introduced, followed by the specific research questions. The chapter will conclude with an overview of the methodology followed by a brief summary.

Statement of the Problem

Autism spectrum disorders (ASD) are a class of early-onset neurodevelopmental disorders that have a substantial and pervasive affect on multiple areas of functioning (American Psychological Association, 2000). Individuals with ASD experience significant qualitative impairments in reciprocal social interaction and communication skills. These disorders are also characterized by the presence of stereotyped, repetitive, or restricted patterns of activities, behaviors, or interests. Disorders encompassed in the category of ASD include Autistic Disorder (autism), Rett’s Disorder, Childhood Disintegrative Disorder, Asperger’s Disorder, and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS; APA, 2000).

While there is significant variation across individuals and within individuals over time with regard to characteristics such as the age of onset, presence of specific symptoms and associated features, and severity of functional impairment (National Research Council, 2001), ASD represents a significant concern for many families and professionals. Recent parent-
reported prevalence estimates indicate that as many as 110 in 10,000 children between the ages of three and 17 have received an ASD diagnosis (Kogan et al., 2009). The growing number of children with ASD and the potential challenges associated with educating and caring for them highlight the need for effective early interventions that can maximize adaptive development in specific areas of impairment and build the capacity of those responsible for supporting individuals with ASD. Without such interventions, the impairments associated with ASD can cause significant challenges for individuals and their families and caregivers in areas including communication, social interaction, education, medical care, and daily functioning (APA, 2000; Kogan et al., 2008).

Rationale for Study of the Problem

While much about ASD remains unknown, recent research makes it clear that effective early interventions can significantly improve outcomes (APA, 2000; Chawarska, Klin, & Volkmar, 2008). Early interventions targeted at ameliorating core deficits may be particularly effective at helping children with ASD and their families achieve meaningful functional outcomes (Kasari et al., 2005). Interventions that target the core deficit in joint attention have gained increasing interest among researchers. Joint attention is an early developing social-cognitive competency that is foundational to many other social, communicative, and cognitive competencies (Bakeman & Adamson, 1984; Charman, 2003). Notably, joint attention may function as a pivotal skill, meaning that gains in this area of development may be accompanied by collateral gains in other untrained social-cognitive skills and abilities (Mundy & Crowson, 1997).

Researchers have recently begun to investigate interventions designed to promote joint attention development in young children with ASD. Existing interventions (e.g., Kasari,
Freeman, Paparella, & Jahromi, 2008; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Schertz & Odom, 2007; Whalen, Schreibman, & Ingersoll, 2006) appear to have the potential to increase children’s joint attention competence and enhance functioning in associated social-cognitive skills. While such interventions show promise, as a group, they exhibit two major limitations.

First, many interventions fail to situate joint attention within the context in which it naturally develops. Early relationships between infants and young children and their primary caregivers serve as the context for the development of this and other social-cognitive competencies (Bruinsma, Koegel, & Koegel, 2004; Sandall, Hemmeter, Smith, & McLean, 2005). Failure to position joint attention interventions within this context may be problematic because it is inconsistent with the natural development of joint attention, which in turn may ultimately influence maintenance and generalization. Additionally, it disregards legal requirements, recommended practices, and theoretical perspectives guiding research and practice in the field of early intervention.

Joint attention is a complex relationship-based interactional competency that develops over time during daily experiences shared by young children and their caregivers (Carpenter, Nagell, & Tomasello, 1998). While children with ASD may require intervention to facilitate the development of this competency, daily interactions and pre-existing relationships still serve as its context and foundation. Part C of the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA, 2004) indicates that service systems should increase the capacity of families to meet the needs of their young children with disabilities, and that services should be provided in natural environments to the extent possible. Similarly, recommended practices for practitioners and theoretical perspectives expressed by scholars in the field of early intervention support the argument that interventions for young children with disabilities should account for contextual
factors, involve caregivers in central roles, promote the capacity of families, and take place during typical daily activities in natural environments (Sandall et al., 2005).

The second major limitation of the existing joint attention intervention research is the absence of measurement systems that capture the complex reciprocal nature and are capable of representing the changes that occur as a result of intervention. While most joint attention intervention studies assess changes in child joint attention actions, they fail to measure caregiver joint attention actions, and the measurement tools used vary significantly in terms of level of precision and detail. Many such tools are administered by researchers in clinical settings using specific prompts to elicit joint attention, the results of which may or may not be representative of a child’s ability to respond to and initiate joint attention within natural contexts. It is argued that in order to accurately assess and understand the impact of joint attention interventions it is critical to measure both child and caregiver joint attention actions as they occur during typical caregiver-child interactions across the course of joint attention interventions. It is also suggested that an examination of changes occurring in temporally associated child and caregiver joint attention actions would contribute to a greater understanding of the affect of joint attention interventions on child-caregiver transactional patterns.

Observational measurement provides a means for examining caregiver and child contributions to changes in individual joint attention actions and transactional patterns as they occur in time at a high level of detail. Such measurement could illuminate the role that caregivers play in joint attention development for children who experience challenges in this area. They could also provide information on the changes experienced by both social partners to this critical relationship-based competency and highlight any patterns in the association between caregiver and child actions. This information, in turn, could aid in the assessment of intervention
effectiveness, and support or enhance intervention development or refinement efforts.

**Statement of Purpose**

The purpose of the present study was to examine changes in child and caregiver joint attention actions and transactions across the course of a parent-mediated joint attention intervention in order to address the aforementioned limitations in the existing literature on joint attention interventions. The first limitation was addressed by selecting a parent-mediated, relationship-based, developmental intervention model to examine. The selection of this intervention, the Joint Attention Mediated Learning model (Schertz, Odom, & Baggett, 2007), provided an opportunity to examine caregiver and child change within the natural context for joint attention development across the course of an intervention that was parent-mediated, non-prescriptive, and occurred in typical settings during daily activities. In order to address the measurement limitation, we developed, refined, and applied a novel observational coding system, the Child-Caregiver Joint Attention (CCJA) Coding System, to video-recorded interaction session between caregivers and children participating in the JAML study (Schertz, et al., 2007). By applying this novel coding scheme to data from an existing caregiver-implemented intervention we were able to closely and precisely examine changes in both child and caregiver actions across the course of a joint attention intervention, examine the data for patterns in child and caregiver change, and examine sequentially associated child and caregiver actions. Additionally, social validity was assessed by untrained observers to provide information on changes in the perceived quality of caregiver-child relationships.

**Literature/Research Background**

While descriptive research contributing to an understanding of joint attention development in typically developing children and children with ASD (e.g., Bakeman &
Joint attention is an early developing social-cognitive competency involving the sharing of attention and interest by a child and caregiver around an external object or event (Bakeman & Adamson, 1984; Schertz & Odom, 2004, 2007; Tomasello, 1995). It is currently the focus of a growing amount of intervention research for children with ASD due to its foundational nature (Mundy & Crowson, 1997). Interventions targeting the promotion of joint attention in infants and young children with ASD exhibit a high degree of variability in terms of intervention and study characteristics, including: participants, change agents, settings, philosophical orientation, study design, procedural approach, measurement systems, and level of primary caregiver involvement. Despite this variability, research on joint attention interventions is quite promising. Most studies report increases in joint attention for participating children, and some report improvements in collateral skills as well. However, as a group, these studies often lack an
emphasis on the caregiver-child relationship. The majority of such studies do not involve primary caregivers as change agents or measure caregiver change or caregiver-child interactions. These intervention studies were the subject of a systematic review, which will be presented in Chapter 2, following the research questions addressed by the present study and an overview of the research methodology.

**Research Questions**

The overall goals of the present study were to examine (a) the occurrence of child and caregiver joint attention actions, and (b) the sequential association between child and caregiver joint attention actions across the course of a parent-mediated joint attention intervention for young children with autism spectrum disorders. Specifically, the research questions addressed were:

1. What changes take place in the occurrence of joint attention responding and initiating actions in toddlers with early risk for autism spectrum disorders during the course of a parent-mediated joint attention intervention?

2. What changes take place in the occurrence of joint attention facilitating actions (responding and initiating) of caregivers of toddlers at early risk for autism spectrum disorders as they implement a parent-mediated joint attention intervention?

3. What changes occur in the sequential association between caregiver and child joint attention actions during the course of a parent-mediated intervention for young children at early risk for autism spectrum disorders?

**Methodology**

The present study employed a descriptive design to examine extant video data from an intervention study conducted by Schertz, Odom, and Baggett (2007). This involved the
refinement of a novel observational coding scheme, the Caregiver-Child Joint Attention Coding System, and its application to videotaped child-caregiver interactions recorded on five caregiver-child dyads across the course of their participation in the Joint Attention Mediated Learning model (JAML; Schertz, 2005a). An observational software system, Procoder for Digital Video (ProcoderDV; Tapp, 2003) was used to facilitate the observational coding of the videotaped interactions. Interobserver agreement was collected on 32% of videotaped interactions. Additionally, social validity was assessed by untrained observers who rated segments of video (baseline and final intervention phase) on items related to perceived quality of caregiver-child interactions. Analyses included descriptive statistics on caregiver and child actions, visual analyses of line graphs displaying session by session caregiver and child data, examination of the percentage of opportunities in which associated caregiver and child joint attention actions occurred, and a descriptive analysis of the social validity data.

Summary

Many children with ASD experience specific deficits in the critical early developing social-cognitive competency of joint attention. These deficits have significant negative implications for children’s development and functioning in multiple domains. Fortunately, research on interventions to promote the development of joint attention in this population indicates that targeted early interventions can lead to positive outcomes in joint attention development and collateral gains in associated social-cognitive skills. However, the existing literature is limited by conceptual and methodological flaws including a lack of emphasis on primary caregiver involvement and the failure to use measurement systems capable of reflecting changes in child and caregiver actions and transactions. The present study attempted to add to the existing literature by addressing these limitations.
Chapter 2: Review of the Literature

The purpose of this chapter is to provide an overview of the literature that served as the foundation for the present study by presenting a systematic review of the literature on joint attention interventions for young children with autism spectrum disorders (ASD), with an emphasis on primary caregiver involvement. First, brief overviews of relevant topics are provided, including caregiver-child relationships, joint attention, joint attention and autism spectrum disorders, and joint attention interventions. Next, the procedures used in conducting the systematic review are described, followed by a presentation of the review. The review is organized on the basis of type of primary caregiver involvement in intervention procedures and presents information on other relevant methodological and conceptual characteristics. Finally, the limitations of the existing literature are discussed.

Overview of Related Areas

This section provides a brief introduction to four areas of research with relevance to the present study. These areas include early caregiver-child relationships, joint attention, joint attention and ASD, and joint attention interventions. These areas of research provide a context for the systematic review of literature that was conducted and are foundational to the present study.

**Early caregiver-child relationships.** Relationships between primary caregivers and their young children are often transactional in nature, with each social partner influencing and being influenced by the other (Bronfenbrenner, 2004; Sameroff, 1995). Primary caregivers play
a critical role in early child development, assisting their children in interpreting their surroundings, mediating learning, and providing experiences and opportunities that challenge their children to achieve higher levels of development (Feuerstein, 1980; Vygotsky, 1978). One key quality exhibited by caregivers who are particularly adept at supporting their children is parental (primary caregiver) responsiveness, which is characterized by reactions that are appropriate, prompt, contingent, and positive in affect (Ainsworth, Bell, & Stayton, 1974; Bornstein, Tamis-LeMonda, Hahn, & Haynes, 2008; Landry, Smith, Swank, & Guttentag, 2008). High levels of parental responsiveness are associated with positive child outcomes in the areas of social, communication, and cognitive development (Ayoun, 1998; Bornstein, 2008; Landry, Smith & Swank, 2006; Paavola, Kunnari, & Moilanen, 2005). There is also evidence that interventions targeted at enhancing responsiveness may positively influence the trajectory of the transactional caregiver-child relationship (Bakermans-Kranenburg, van IJzendoorn, & Juffer, 2003; Landry et al., 2006). It has been suggested that responsive caregiving may be particularly relevant to caregiver-child dyads in which biological risk is a factor, such as those in which children have ASD (Ruble et al., 2008; Siller & Sigman, 2008).

Infants and young children also make independent contributions to caregiver-child relationships. Children’s characteristics and behaviors influence the behavior of caregivers and contribute to the developing relationship (Bronfenbrenner, 2004; Sameroff, 1995; Van Egeren, Barratt & Roach, 2001). In particular, children with ASD may exert a unique influence on their caregivers, with characteristics of the disorder challenging the security of the attachment relationship, and influencing caregiver feelings and responses (Hoppes & Harris, 1990; Rutgers et al., 2007). On the other hand, caregivers of children with ASD may become proficient at adapting their actions to their children’s unique needs (Doussard-Roosevelt, Joe, Bazhenova, &
In summary, the actions of primary caregivers and children influence one another, with both social partners contributing to the developing relationship and shaping one another’s social environments and future behavior and development. Children’s social-cognitive skills, such as joint attention, develop within the context of these early transactional relationships (Bruinsma, Koegel, & Koegel, 2004). As such, primary caregivers have a unique opportunity to participate in and enhance the development of their children over time.

**Joint attention.** Joint attention, the coordination of attention between two individuals to an external object or event in order to share interest and social engagement, is a critical early developing social-cognitive competency (Bakeman & Adamson, 1984; Schertz & Odom, 2004, 2007; Tomasello, 1995). It is a fundamentally relationship-based competency, with each social partner relying on the other for the initiation of or response to attention-directing bids. The development of joint attention is a central accomplishment in infancy due to its foundational role in the development of a number of other essential skill sets and developmental processes (Bakeman & Adamson, 1984; Charman, 2003; Mundy & Crowson, 1997; Mundy & Newell, 2007; Mundy, Sigman, & Kasari, 1990). It has been linked theoretically and empirically to language acquisition, affective sharing, social cognition, cultural learning, and the development of theory of mind (Adamson & McArthur, 1995; Baron-Cohen, Tager-Flusberg, Cohen, 1993; Carpenter et al., 1998; Kasari, Sigman, Mundy, & Yirmiya, 1990; Tomasello, 1995).

Marked by the use of conventional gestures such as gaze alternation, pointing, and showing; triadic joint attention exchanges can be observed with increasing regularity among most primary caregiver-child dyads over the course of the first two years of life (Bakeman & Adamson, 1984; Carpenter et al., 1998; Jones & Carr, 2004; Mundy et al., 1990; Schertz &
Odom 2004, 2007). During this period, most children display the sequential development of joint attention and related social-cognitive actions (Carpenter et al., 1998). Joint attention, theoretically preceded by the development of precursor actions such as the ability to focus on faces and take turns, typically begins between six and nine months of age, becoming more complex and frequent between 15 and 18 months of age (Bakeman & Adamson, 1984; Carpenter et al., 1998). This includes both the ability to respond to (follow the attention of a social partner) and initiate (direct the attention of a social partner) extended episodes of joint attention (Bruinsma, et al., 2004; Carpenter et al., 1998; Charman, 1998).

In most infants, joint attention development unfolds naturally in the context of daily caregiver-child interactions. The infant’s growing ability to coordinate his attention with a caregiver to external objects and events provides the foundation for social, communicative, and cognitive competence (Carpenter et al., 1998; Tomasello, 1995).

**Joint attention and autism spectrum disorders.** The inadequate development of joint attention is unique to and characteristic of children with ASD (Loveland & Landry, 1986; Mundy & Crowson, 1997) and may have serious consequences for these children’s development (Carpenter & Tomasello, 2000). In fact, deficits in joint attention may serve as an important diagnostic indicator, particularly in very young children (Baron-Cohen, Allen, & Gillberg, 1992; Mundy & Sigman, 1989), and may be detectable prior to the appearance of other symptoms of the disorder (Lord & Risi, 2000). When joint attention actions are exhibited by children with ASD, they differ quantitatively and qualitatively from those of children without ASD (Warreyn, Roeyers, Van Wetswinkel, & De Groote, 2007).

Researchers suggest that joint attention constitutes a core deficit in children with ASD, distinguishing them from typically developing children and those with other developmental
delays (Mundy et al., 1990; Wetherby & Woods, 2008; Whalen, Schreibman, & Ingersoll, 2006). In a related perspective, joint attention is thought to serve as a pivotal skill (Charman, 2003; Jones & Carr, 2004; Mundy & Crowson, 1997), the development of which is likely to enable a number of collateral skills and abilities (Koegel & Frea, 1993). While the specific mechanisms by which joint attention enables other more complex social-cognitive competences continues to be debated, there appears to be consensus that the inadequate development of joint attention is highly problematic and warrants active early intervention targeted at ameliorating deficits (Jones & Carr, 2004; Mundy & Crowson, 1997; Schertz & Odom, 2004).

**Joint attention interventions.** While the fundamental nature of joint attention and the specific deficits observed in children with ASD suggest that joint attention should be a primary target for early intervention efforts, the active investigation of interventions specifically designed to promote joint attention is a relatively recent development (Jones & Carr, 2004; Kasari, Freeman, & Paparella, 2006; Whalen et al., 2006). Available interventions vary significantly in terms of a number of key characteristics including underlying philosophical perspectives, intervention procedures, settings, intervention agents, and specific joint attention actions targeted.

In general, joint attention intervention studies report promising results indicating that children with ASD can be taught joint attention actions, and sometimes experience collateral gains in associated social-cognitive skills (Kasari, et al., 2008; Whalen et al., 2006). However, there is not yet sufficient evidence to indicate the efficacy or superiority of any particular joint attention intervention for young children with ASD (Schertz & Odom, 2004; Yoder & McDuffie, 2006). In fact, it is likely that different interventions may be more or less beneficial for various subpopulations of children and families based on a variety of individual characteristics and
contextual factors (Sherer & Schreibman, 2005). Currently, there is a need to continue the investigation of existing interventions, with a focus on characteristics that will maximize efficacy and feasibility for young children with ASD and their families.

Method for Selecting Reviewed Studies

This section describes the procedures used for identifying the joint attention intervention studies reviewed below. First the author searched the following electronic databases: PsychINFO, ERIC, and PubMed/Medline. Searches included all articles published between January 1998 and December 2008 in English-language peer-reviewed journals, containing combinations of two or more of the terms “autism,” “joint attention,” and “intervention.” Inclusion of the term “intervention” was removed after it was determined that it resulted in either too wide (in combination with the term “autism” alone) or too narrow (in combination with the term “joint attention”) a range of studies. The initial search using the terms “autism” and “joint attention” generated 159 articles across the three databases.

These studies were then reviewed for inclusion based on the following criteria: primary data from an experimental intervention study, one or more participants between the ages of birth and five years, one or more participants with or at high risk for ASD, child joint attention actions as an intervention target and primary dependent variable. For studies including children not meeting age or diagnostic criteria, only those participants with or at high risk for ASD and meeting the age requirements were included in the review. Fifteen articles met these criteria, with one (Jones, Carr, & Feeley, 2006) containing two qualifying studies, for a total of 16 studies included in the review.

Systematic Review of Joint Attention Interventions

This section provides a systematic review of the 16 intervention studies identified that
targeted the promotion of joint attention development in young children with or at high risk for ASD. Studies were classified on the basis of type of primary caregiver involvement in intervention (no involvement, primary caregiver as consultant, primary caregiver as change agent). Other study characteristics described include participants, change agents, settings, philosophical and/or theoretical orientation (e.g., behavior analytic, developmental, mediated learning), study design, procedural approach (e.g., Pivotal Response Training, environmental arrangement, scripts, discrete trial training), measurement systems (e.g., behavioral observation, structured observation, behavioral ratings) and foci (e.g., specific joint attention behaviors targeted, social validity, generalization), and general outcomes. See Appendix A, Tables 2-1 through 2-3, for study characteristics.

**No primary caregiver involvement.** Four joint attention intervention studies were characterized by a lack of primary caregiver involvement (beyond informed consent). Interventions not involving caregivers took place in school settings that served children with ASD and developmental disabilities. These included university-based early intervention and preschool programs (Hwang & Hughes, 2000; MacDuff, Ledo, McClannahan,& Krantz, 2006; Martins & Harris, 2006) and behaviorally based school programs (Taylor & Hoch, 2008). Eleven male children between the ages of three and five years (with the exception of one female participant not meeting the age criteria for this review) with confirmed diagnoses of autism participated in these studies. All four studies employed multiple-baseline or multiple-probe across participant designs (Kazdin, 1982). Intervention agents were researchers (Hwang & Hughes, 2000; MacDuff et al., 2006, Taylor & Hoch, 2008) and/or classroom staff (Martins & Harris, 2006).

These school-based interventions differed from one another in philosophical approach
and joint attention actions targeted. Using a behavior analytic procedure (most-to-least prompting), Taylor and Hoch (2008) promoted both responding to joint attention (RJA) and initiating joint attention (IJA) in two children (one additional child above five years of age also participated) already demonstrating some joint attention behaviors. Targeted RJA actions included looking at an item in response to a point, commenting appropriately on an item, and looking back at the researcher following a look and comment. Initiating a bid for joint attention was defined as pointing to an item, making a directive statement, and commenting on the item. Martins and Harris (2006) used structured behavior analytic techniques (discrete trial training [DTT], time delay) and more naturalistic procedures (child-selected materials, varied reinforcers, and behavioral momentum) to teach one discrete RJA action (following an adult’s eye gaze and head turn) to three children who failed to display RJA prior to intervention. MacDuff and colleagues (2006) taught three children lacking IJA skills to initiate bids for joint attention using scripts and script-fading procedures. The specific IJA actions targeted included verbal bids for joint attention, scripted bids for joint attention, unscripted bids for joint attention, and pointing. Finally, using a naturalistic approach, Hwang and Hughes (2000) adapted an existing social interactive training program (Klinger & Dawson, 1992) which included contingent imitation, naturally occurring reinforcement, environmental arrangement, and expectant look to target IJA (referential looking, pointing, and showing) and other social-communicative actions (eye contact and motor imitation) in three children with autism.

All four interventions resulted in increases in the targeted joint attention actions. Additionally, each study assessed generalization (to novel setting, stimuli, and/or people) with three of the four reporting moderate to high levels of target actions during generalization probes (MacDuff et al, 2006; Martins & Harris, 2006; Taylor & Hoch, 2008). However, generalization
was not assessed in settings or with individuals outside of the school environment. Additionally, it was unclear whether children experienced collateral increases in joint attention actions not directly targeted. For instance, Martins and Harris (2006) reported that training for RJA did not result in collateral increases in IJA. Social validity was assessed in just one of the four studies. Hwang and Hughes (2000) had unfamiliar viewers rate segments of baseline and training videotape on items associated with social-communication, including joint attention.

Observational coding was used to collect data on joint attention actions in each study. Three of the four (MacDuff et al., 2006; Martins & Harris, 2006; Taylor & Hoch, 2008) used event recording systems to record occurrences of targeted joint attention actions, while one (Hwang and Hughes, 2000) applied a more complex observational coding system supported by software.

In summary, interventions not involving primary caregivers occurred in school-based settings and employed single-case research designs with small numbers of child participants between the ages of three and five years, with confirmed diagnoses of autism. Philosophical underpinnings of the interventions varied from behavioral to naturalistic behavioral to developmental and targeted a variety of joint attention actions (i.e., RJA and IJA actions with a wide range of definitions). Intervention outcomes were assessed using observational coding systems of differing levels of complexity. Reported outcomes included increases in targeted child joint attention actions and generalization to novel settings, stimuli, and/or individuals within the school setting. Although these interventions resulted in joint attention gains for the participating young children with autism, they did not teach or assess joint attention within the natural context of development (i.e., caregiver-child relationships), nor did they examine effects on reciprocal caregiver-child transactions.
Primary caregiver as consultant. Six of the joint attention intervention studies meeting criteria involved primary caregivers indirectly. Caregivers participated in these studies in the role of consultant (e.g., providing information, assessing social validity), but did not serve as change agents. These studies displayed significant variation, evidenced by differences in underlying philosophical perspectives, research designs, settings, participant characteristics, type of joint attention actions targeted, types of caregiver involvement, measurement systems, and outcomes reported. These interventions took place in university-based laboratories (Baker, 2000; Naoi, Tsuchiya, Yamamoto, & Nakamura, 2008; Whalen & Schreibman, 2003), private clinics (Kim, Wigram, & Gold, 2008), early intervention programs (Kasari, Freeman, & Paparella, 2006), and behaviorally based preschool programs (Jones et al., 2006). Eighty-one children (68 males, 13 females) between the ages of two and five years with confirmed diagnoses of autistic disorder or another ASD (with the exception of one child with a probable diagnosis of ASD) participated in these studies. A number of experimental designs were used in the investigation of these interventions including multiple-baseline across participants (Baker, 2000; Naoi et al., 2008; Whalen & Schreibman, 2003), multiple-baseline probe across behaviors (Jones et al., 2006) repeated measures comparison (Kim et al., 2008), and randomized controlled intervention (Kasari, et al., 2006) designs. Trained interventionists (e.g., researchers, therapists, teachers, or graduate students) delivered the intervention in each study.

Like the interventions with no primary caregiver involvement, this group of studies exhibited variation in philosophical approach, intervention procedures, and joint attention actions targeted. From a behavioral perspective, Noai and colleagues (2008) manipulated antecedent events (the presentation of preferred materials and exaggerated responses) to teach IJA to one young child (two other children over five years of age also participated). The IJA actions
assessed included gaze shifting, pointing, physical direction of attention, and verbal responses.

In a combined approach, Kasari and colleagues (2006) compared the effects of a joint attention intervention and a symbolic play intervention on RJA and IJA, which included pointing, showing, giving, and coordinated joint looks. Fifty-eight children participated in this study (20 in the joint attention group, 21 in the symbolic play group, and 17 in the control group). The joint attention intervention included DTT and more naturalistic procedures (resembling milieu teaching; Warren, 1991).

Whalen and Schreibman (2003) also implemented an intervention combining DTT and more naturalistic procedures (Pivotal Response Training [PRT]; Koegel, Koegel, & Schreibman, 1991) to teach RJA (responding to showing, pointing, gaze shifting) and IJA (coordinated gaze shift, pointing). Similarly, Jones and colleagues (2006) taught teachers to implement an intervention consisting of DTT and PRT techniques to teach RJA and IJA to five young children. RJA included gaze alternation following an adult’s bid for joint attention, while IJA included gaze alternation and pointing following the presentation of a target object or event.

Using an indirect approach to enhancing joint attention development, Kim et al. (2008) compared the effects of improvisational music therapy with play therapy on children in order to enhance precursor actions (eye contact, turn-taking), RJA (following a point), and IJA (gaze alternation, pointing, showing). In another indirect approach, Baker (2000) incorporated children’s thematic ritualistic interests into games in order to enhance joint attention (supported JA, coordinated JA) in play with siblings.

All six studies reported increases in targeted joint attention skills. Generalization (across settings, people, stimuli, and/or time) was assessed in four of the six studies. Additionally, Jones and colleagues (2006) incorporated training to novel stimuli into their intervention. Child
participants demonstrated varying levels of success in generalizing learned joint attention skills. Social validity was also assessed in four of the six studies using methods including sibling interviews (Baker, 2000) and pre- and post-intervention ratings of videotapes (Naoi et al., 2008; Whalen & Schreibman, 2003) and the PDDBI (Cohen, Schmidt-Lackner, Romanczyk, & Sudhalter, 2003; Kim et al., 2008).

Primary caregivers (all parents) were involved in a number of different aspects of these intervention studies. They provided demographic information (e.g., Kasari et al., 2006), were consulted regarding child preferences and reinforcers (e.g., Jones et al., 2006; Naoi et al., 2008), and participated in assessments of social validity (e.g., Kim et al., 2008) and generalization (e.g., Kasari et al., 2006; Whalen & Schreibman, 2003). Such participation took the form of surveys, interviews, and observations (of caregiver-child interactions and by caregivers of intervention sessions). However, primary caregivers had no direct involvement in determining, implementing, or guiding the intervention process.

Joint attention behaviors were assessed in these studies in two primary ways. Some form of observational coding was used in each of the six intervention studies. Additionally, structured measures, including adaptations of the ESCS (Mundy et al., 1996; Seibert et al., 1982) were employed in three of the six studies. Statistical analyses were also used to compare outcomes across groups in the two studies using group designs (Kasari et al., 2006; Kim et al., 2008). While Kasari and colleagues (2006) measured some caregiver-child interaction variables (amount of time caregiver and child were jointly engaged around objects, and who initiated joint engagement [caregiver or child]), specific caregiver joint attention actions were not independently measured in this or any of the other intervention studies in this category.

In summary, joint attention interventions with indirect primary caregiver involvement
varied greatly in terms of setting, design, philosophical framework, and form of caregiver involvement. Settings included both clinical and naturalistic environments (e.g., schools). Both single-case designs and group designs were employed. Philosophical approaches varied, however three of the six interventions used a combined (behavior analytic and naturalistic) approach. Caregiver involvement ranged from the provision of demographic information to involvement in caregiver-child interactions to assess generalization across individuals.

Measurement procedures reflected design differences and primarily included observational coding systems and variations on pre-existing structured assessments (i.e., ESCS), with three of the six studies using more than one form of measurement. All studies reported gains in targeted joint attention skills and the majority targeted or assessed generalization with positive results. While these studies make significant contributions to the literature and to an understanding of what types of interventions may promote joint attention actions in young children with ASD, they do not situate those gains within the natural context for joint attention development. Nor do such interventions promote primary caregiver competence in supporting young children with ASD, or take into account the transactional nature of caregiver-child interactions and early social-cognitive development.

**Primary caregiver as change agent.** Six joint attention interventions studies involved primary caregivers (all primary caregivers were parents) as change agents (i.e., participation in caregiver training, as co-therapists, or as primary interventionists). Sixty-four children participated in these intervention studies, with many commencing intervention prior to three years of age. Some of the intervention approaches promoted joint attention directly through instruction on specific child joint attention actions, while others utilized indirect methods for promoting joint attention (e.g., generalized communication interventions, mediated learning
Joint attention was assessed in these studies using structured methods (e.g., ESCS) and a variety of observational coding systems. All studies resulted in some degree of success in promoting targeted child joint attention actions.

**Primary caregiver training.** In a randomized group experiment Yoder and Stone (2006) compared the effects of Responsive Education and Prelinguistic Milieu Teaching (RPMT; Yoder & Warren, 2002) and the Picture Exchange Communication System (PECS; Bondy & Frost, 1994) on IJA and other early developing social-communicative skills (turn-taking and requesting) in 36 children with ASD between the ages of 1.8 and 4.5 years. Measures of pretreatment IJA were used as a predictor of differential response to intervention. RPMT is a method designed to facilitate intentional communication in prelinguistic children with developmental delays in combination with education to enhance parental (primary caregiver) responsiveness. PECS is a six-phase intervention for children with ASD, which teaches children to use picture symbols for communicative purposes. Both interventions included a child treatment component (three 20-minute therapy sessions per week for six months from trained therapists) and a parent education component (up to 15 hours of training). The RPMT parent training component focused on enhancing parental responsiveness, while the PECS parent training component emphasized how to promote PECS use outside of the therapy setting. Treatment sessions took place in a university clinic (Yoder & Stone, 2006).

The joint attention action targeted by these interventions was IJA, which was defined as an, “intentional communication act about an object that attempts to get the adult to comment, laugh, smile, show attention, or give a label” (Yoder & Stone, 2006, p 430). While parent actions were assessed, they were not joint attention actions, but rather measures of parental support (e.g., strategies to maintain engagement, optimal response to child communication).
Child actions were assessed using the abridged ESCS (Mundy et al., 1996) and observational coding supported by software. Using multiple regression procedures, Yoder and Stone (2006) found that children with higher initial levels of IJA benefited more from the RPMT intervention, while those with lower initial levels of IJA benefited more from the PECS intervention. Parent participants received an average of 9.25 hours of training; however, the extent to which they used this training in the home setting was not assessed. Generalization and social validity data were not collected.

Another joint attention intervention that incorporated a parent training component was the Scottish Centre for Autism (SCA) preschool treatment program (Salt et al., 2001; 2002). Using a social-developmental therapeutic approach, this intervention was developed to promote social-communicative skills including joint attention in pre-school aged children with autism (Salt et al, 2001; 2002) through individualized interventions based on each child’s profile of deficits and strengths in the areas of social, communication, play, and adaptive skills. Specific strategies used in this center-based approach included following the child’s lead, shaping the child’s interactions, introducing adult direction over time, using contingent language, and introducing flexibility, among others. The parent training component of the intervention included workshops related to the rationale and treatment approaches used, the impact of an autism diagnosis, behavior management strategies, and behavioral approaches to teaching. Parent participants observed and/or participated in weekly therapy sessions and were asked to use treatment approaches at home for one hour per day (Salt et al., 2001).

Using a two group (treatment and waiting list control) pre-test post-test design, Salt and colleagues (2002) assessed the effects of the SCA intervention on 17 children with autism and their families (12 in treatment group, 5 in control group). Joint attention was measured at pre-
test and post-test using the abridged ESCS (Mundy et al., 1996). A more specific behavioral definition of joint attention was not provided by the authors. Results of a repeated measures multivariate analysis of variance indicated that children in the treatment group experienced significant improvement in joint attention relative to those in the control group (Salt et al., 2002). Parental actions were not measured, although the Parenting Stress Index (Abidin, 1995) was used to assess change in parental stress level resulting from participation in the intervention. Generalization and social validity were not assessed.

These two studies provided important information regarding the ability of three different social or communication interventions to promote joint attention and other social-communicative actions in young children with ASD. Primary caregivers (parents) were involved as agents of change, receiving the parent education component of each intervention. However, therapists implemented the interventions with child participants and parental use of intervention strategies was not assessed outside of the clinic setting. As such, it is unclear if, and how, changes in parent actions contributed to changes in child joint attention competency, or how the interventions affected reciprocal caregiver-child transactions

*Primary caregiver as co-therapist.* In a single subject reversal design with alternating treatments, Vismara and Lyons (2007) examined the effects of using PRT and children’s perseverative interests to increase IJA in three young children (ages 34, 26, and 38 months) with confirmed diagnoses of autism. Intervention occurred either in a clinic setting or in the child’s home. During the 12-week intervention (weekly 2.5 hour sessions) primary caregivers (parents) were trained to use the motivational strategies of PRT. Intervention sessions began with modeling by the researcher and gradually involved caregivers as therapists. In addition to PRT, children’s perseverative interests were manipulated across conditions. This included a
perseverative interest (PI) stimuli condition, a nonperseverative (NP) interest stimuli condition, and an alternating treatments condition (PI and NP stimuli interspersed within intervention sessions).

Videotaped segments of parent-child interaction from baseline and treatment sessions were coded using observational software for IJA, which included gaze alternation, pointing, showing, giving, and commenting. Parent-child interactions were assessed using a global measure to determine if quality of interaction was affected by intervention condition, however, parent joint attention actions were not measured (Vismara & Lyons, 2007). Child IJA actions increased in all children during the PI condition as opposed to the NP condition, although increases varied in magnitude among participants. There was also some evidence for generalization across stimuli as IJA increased with NP stimuli during the alternating treatment condition. However, generalization to other social partners and settings was not assessed, nor were social validity data collected.

In an extension of their teacher-implemented intervention (conducted concurrently), Jones and colleagues (2006) taught two of the caregivers from their primary study to intervene with their children in order to extend joint attention to novel stimuli and routines in home and community settings. A multiple baseline probe design across behaviors (RJA and IJA) was used. Participants included two parents (one mother and one father) and their sons (ages two and three) with a diagnosis of autism or a diagnosis of probable ASD. Intervention occurred in at least two home or community settings for each dyad. In a combined approach, DTT with strategies from PRT (natural consequences and activity interspersal), was used by parents to teach their children to respond to bids for joint attention using originally introduced materials and routines, followed by an expansion to additional materials and routines. This same procedure was then used to
teach children to initiate joint attention (Jones et al., 2006).

Parent participants recorded the occurrence and type (independent or prompted) of targeted child joint attention skills per trial. RJA consisted of gaze alternation following an adult bid for joint attention, while IJA consisted of directing an adult’s attention using gaze alternation and pointing following the target presentation. Both children mastered the targeted joint attention skills and were able to expand these skills to additional materials and routines.

Generalization was assessed by coding videotaped segments of unstructured play interactions between child participants and their parents. The results of this assessment were mixed, with one of the two children demonstrating generalization. Two measures of social validity indicated that the child participants appeared more socially appropriate and somewhat more like an age-matched typically developing peer following intervention (Jones et al., 2006).

Both studies involving parents as co-therapists contributed to the joint attention literature by assessing the effects of the use of PRT strategies in combination with other intervention techniques (DTT, incorporating perseverative interests) to promote joint attention actions in young children with ASD. Parent participants were directly involved in intervention implementation, and parent-child interactions were examined. However, parent joint attention actions were not directly assessed, and analyses of interactions were not intended to produce results related to reciprocal primary caregiver-child processes.

Primary caregiver as intervention agent. Rocha and colleagues (2007) used a multiple-baseline design across participant pairs to assess the effects of a combined behavior analytic and naturalistic intervention intended to promote RJA in three children (ages 26, 27, and 42 months) with autism. Participating primary caregivers included one father and two mothers. Two comparison groups (developmental and chronological) not receiving intervention were included
in the study to provide estimates of the levels of joint attention exhibited by typically developing children. Baseline and parent training occurred in university-based clinic playrooms, while generalization probes occurred in parents’ homes (Rocha et al., 2007).

Prior to training of specific phases of the intervention, parent participants were trained in basic techniques of both DTT and PRT. The intervention consisted of five phases across which parent-child dyads progressed as children met pre-established mastery criteria. The five phases were: 1) response to hand on object, 2) response to object tapping, 3) response to showing of object, 4) following a point, and 5) following a gaze. Target joint attention behaviors were scored from videotapes of 10-minute segments of each session using partial interval recording to determine the occurrence or nonoccurrence of each target action in each 30-second interval. Targeted child joint attention actions included coordinated joint attention (i.e., gaze alternation during active engagement) and joint attention responding (i.e., responding within three seconds of a bid for joint attention by engaging with the target object; Rocha et al., 2007).

In contrast with previous research, Rocha and colleagues (2007) also measured the caregiver action of joint attention initiation, which included caregiver initiations intended to communicate about an object using one of the trained strategies (i.e., placing child’s hand on object, tapping object, showing object, gaze shifting toward object with or without pointing). An additional assessment, the Unstructured Joint Attention Assessment (adapted from Loveland and Landry, 1986) was used as a pre-post measure of child joint attention responding (Rocha et al., 2007).

This intervention resulted in increases in parent bids for joint attention and associated child responses across all phases of the intervention and in generalization sessions. The proportion of bids to which children responded also increased. However, the extent of these
increases varied across participants, and the results of the intervention generally did not maintain at intervention levels at follow-up in child or parent participants, particularly in the generalization setting (home). Social validity was assessed using a two-item parent satisfaction questionnaire and by comparing the results of participants post-intervention Unstructured Joint Attention Assessment with the data for the chronological comparison group on this measure. Parents expressed satisfaction with the intervention, and comparisons with typically developing children indicated that children with autism were more like children without autism in joint attention responding following intervention (Rocha et al., 2007).

Schertz and Odom (2007) examined the effects of a parent-mediated developmental model for promoting joint attention using a mixed methods design (multiple-baseline across behaviors and qualitative). In this relationship-based model, the researcher supported parents in using principles of mediated learning and knowledge about joint attention development to promote precursor (focusing on faces and turn taking) and joint attention (RJA and IJA) actions in toddlers with strong early markers of autism. The researcher served as an educator and coach to parent participants, but did not work directly with child participants (Schertz & Odom, 2007).

Participants were three boys (ages 24, 33, and 22 months; all later received diagnoses of autism) and their mothers. Intervention sessions took place in families’ homes. In each phase of the intervention, parent participants were provided with information on the targeted competencies and strategies and examples for ways to promote them indirectly within natural parent-child interactions. They were asked to spend approximately one hour daily in intervention related interactions with their children. Parents met with the researcher approximately once weekly for a review of progress, the introduction of new learning material, collaborative planning, and the discussion of parental concerns (Schertz & Odom, 2007).
Child precursor and joint attention actions were coded from 10-minute segments of videotaped parent-child interactions recorded during each weekly researcher home visit. An observational coding system including precursor actions (focusing on faces, turn taking), RJA (responding to parent joint attention bid with gaze alternation), and IJA (using gaze alternation to direct parent’s attention) was used to code the occurrence of each targeted skills using interval recording (10-second intervals). Two of the three children demonstrated gains in all four targeted areas (focusing on faces, turn-taking, RJA, IJA), while the third child demonstrated gains in precursor actions, but had minimal success with joint attention. Additionally, notes maintained by parent participants as well as their weekly discussions with the researcher were used to perform a qualitative analysis of parental views of child progress, challenges, and indicators of resilience. Generalization across settings was assessed in alternative home and community settings, and maintenance was assessed at 5-week follow-up. Child participants demonstrated generalization and maintenance of acquired joint attention skills. Social validity was assessed using a parent questionnaire, the results of which indicated intervention acceptability and parental perceptions of improvements in child functioning (Schertz & Odom, 2007).

The two interventions in which caregivers served as the primary intervention agent represent two divergent approaches to promoting joint attention in young children with ASD. One directly targeted specific RJA actions (Rocha et al., 2007), while the other promoted precursor, RJA, and IJA actions by targeting the caregiver’s ability to mediate child learning (Schertz & Odom, 2007). However, both used observational coding schemes and interval recording to assess levels of targeted joint attention skills and resulted in gains in those skills. In a methodological advancement over the other studies reviewed, Rocha and colleagues (2007)
also assessed a caregiver joint attention action (IJA).

**Summary and Limitations of Existing Literature**

This section summarizes the findings of the above literature review and identifies conceptual and methodological limitations in the existing research on joint attention interventions for young children with or at high risk for ASD.

**Summary.** This review provided information on 16 intervention studies designed to promote joint attention behaviors in young children with or at high risk for ASD. Remarkably, 100% of the studies meeting criteria reported increases in joint attention actions resulting from intervention. This supports the conclusion that targeted early intervention has the potential to positively influence the course of the problematic deficits in joint attention commonly observed in children with ASD. However, the interventions investigated varied widely with regard to a number of other key study characteristics including participants, settings, change agent, roles of primary caregivers, study design, philosophical/theoretical orientation and procedural approach, and measurement systems and foci. These variations will be briefly described below.

Child participants ranged in age from 22 to 71 months of age. Diagnoses were typically described as *autism, ASD, or at high risk for ASD*. The third category was used primarily for children less than three years of age who had not yet received a formal diagnosis, but exhibited characteristics consistent with a diagnosis on the autism spectrum. The majority of study participants were male, although five of 16 studies (31%) also included female participants.

Change agents included researchers, graduate level research assistants, therapists, classroom staff (including teachers and instructors), and primary caregivers. All primary caregivers who participated as change agents were parents, with the majority being mothers. When primary caregivers participated directly in studies, they did so in one of the following
roles: recipients of parent training, co-therapists, or primary interventionists.

Eleven of the 16 studies (69%) employed single-case multiple-baseline designs (across participants, across behaviors, or probe). One additional study used a single-case reversal design with alternating treatments. The remaining four studies employed group designs. Of these, three were randomized controlled trials, while the remaining study used a two-group (treatment versus waiting list control) pretest posttest design.

The studies included in the review varied with regard to underlying philosophical and theoretical orientations as well as corresponding procedural approaches. Both behavior analytic and naturalistic orientations were common, as were interventions that combined the two. Behavior analytic procedures included discrete trial training, prompting techniques, functional training, and time delay procedures. More naturalistic interventions ranged from Pivotal Response Training to Social Interactive Training, Social Developmental Therapy, and a developmental Mediated Learning approach. The most common intervention approaches, often used in combination, were components of discrete trial training and Pivotal Response Training. Other less common approaches included Improvisational Music Therapy, scripting, and childhood games modified to include children’s ritualistic interests.

Across studies, a lack of consistency in the conceptualization (as reflected in definitions) and measurement of joint attention actions was evident. The joint attention actions targeted could typically (some definitions were ambiguous) be categorized as joint attention responding or joint attention initiating actions (with many interventions targeting more than one category). However, within these categories, there was variation in the type and number of actions targeted and the specificity of definitions. Joint attention responding actions included gaze alternation, looking at an item, commenting, following an adult’s eye gaze and head turn, and responding to
showing, pointing, and gaze shifting. Joint attention initiating actions included pointing, directive statements, commenting, gaze alternation, showing, giving, physical direction of attention, scripted and unscripted verbal bids, and coordinated joint looks. Within and across studies, some of the specific actions labeled as RJA and IJA were equivalent, differentiated only by when they occurred in relation to adult joint attention behaviors.

Measurement systems for target joint attention actions tended to fall into two categories: structured measures, and behavioral observation systems. Structured measures most commonly included a version of the Early Social Communication Scales (Mundy et al., 1996; Siebert et al., 1982). Behavioral observation systems included researcher-developed coding schemes of varying complexity used to code observational data in vivo or from videotaped segments of adult-child interactions. Some coding schemes were relatively simple, while others were more complex and required the support of behavioral observation software programs. Several studies employed both structured measures and behavioral observation. While all studies measured child joint attention actions as a dependent variable, only one (Rocha et al., 2007) assessed a caregiver joint attention action (joint attention initiation) as well. However, in this study, the parent joint attention action was defined rather narrowly based upon the discrete forms trained in the intervention.

Limitations. While the reviewed studies contribute significantly to the literature on joint attention in young children with autism spectrum disorders and the potential benefit of targeted early interventions, they also display several conceptual and methodological limitations. Two key limitations are the lack of primary caregiver involvement evident in many of the studies, and the absence of comprehensive observational coding systems capable of reflecting the effect of interventions on a range of child and caregiver joint attention actions.
First, many of the studies failed to include primary caregivers in a central role with regard to intervention implementation. The inclusion of primary caregivers in central roles throughout children’s early development is a critical recommended practice for children with and without developmental disabilities (NAEYC, 2005; Sandall, et al., 2005) and is of particular importance considering the nature of joint attention (a transactional competency that develops within the context of early social relationships) and the specific joint attention deficits exhibited by children with autism spectrum disorders. The use of primary caregivers as change agents also has the potential to increase benefits to children by building on and supporting existing caregiver-child relationships, increasing the intensity of interventions without increasing cost or removing children from natural environments, and enhancing primary caregivers’ capacity to successfully meet the needs and promote the adaptive development of their children (McCollum & Yates, 1994; Schertz & Odom, 2004).

While some of the studies reviewed involved primary caregivers as consultants or change agents and two (Rocha et al., 2007, Schertz and Odom, 2007) even situated interventions within the context of the caregiver-child relationships by teaching parents to act as primary interventionists, their findings were affected by the methodological limitation of failing to use observational coding systems capable of reflecting changes in both child and caregiver joint attention skills. Only one of the 16 intervention studies reviewed (Rocha et al., 2007) included caregiver joint attention actions as a dependent variable. However, the coding scheme used in this study failed to capture a range of caregiver joint attention actions.

Based on the contributions of the existing joint attention intervention literature and the limitations identified, future research should attempt to examine changes in caregiver and child actions and transactions across the course of joint attention interventions for young children with
or at high risk for autism spectrum disorders. In particular, methodological advancements in the form of observational coding systems designed to measure and assess child and caregiver actions and provide insight into reciprocal joint attention interactions could be applied to interventions situating this critical social-cognitive competency within the context of child-caregiver relationships and typical family experiences. The present study attempted to do this by applying a detailed observational coding scheme including child and caregiver joint attention actions to existing digital video data of parent-child interactions from a study conducted by Schertz and colleagues (Schertz et al., 2007) further examining the use of the Joint Attention Mediated Learning intervention. Additionally, changes in related temporally associated child and caregiver actions were examined to provide information on how reciprocal child-caregiver interactions are affected by the implementation of a parent-mediated joint attention intervention.
Chapter 3: Methodology

The purpose of this chapter is to describe the methods that were used to conduct the present study. Because it was based upon an existing study (JAML; Schertz et al., 2007); as appropriate, methodological details of the JAML study will be presented prior to those of the present study. A description of the design will be followed by participant selection and eligibility criteria and characteristics. Next, the settings, change agents, and materials will be presented, followed by a description of the dependent measures, interobserver agreement procedures, and coding definitions. The study procedures will be detailed, followed by a description of the data analyses selected and the social validity procedures.

Study Design

The first phase of the JAML study (Schertz et al., 2007), from which participants were selected for the current study, employed a single-case multiple-baseline across targeted outcomes design. Single-case designs are highly rigorous experimental designs which allow for the examination of causal relationships among variables. Multiple-baseline designs are single-case designs in which the independent variable (in this case the JAML intervention) is systematically applied across participants, settings, behaviors, or targeted outcomes (Kazdin, 1982; Kennedy, 2005). In the case of the JAML study, the intervention was sequentially applied to new target child outcomes for each individual caregiver-child dyad as the child participant met criteria at each subsequent level or phase.

The present study used a descriptive design. Descriptive designs are non-experimental
designs which allow for the examination of relationships between variables but do not produce causal conclusions (Mitchell & Jolley, 2007). A descriptive design was necessitated by the fact that the current study was a secondary analysis of pre-existing data. While the study was based on pre-existing video-recorded data from the JAML study, new data were generated as video-recordings were coded using the Caregiver-Child Joint Attention Coding System. These observational data were then analyzed within the framework of a multiple-baseline across targeted outcomes design (not a true multiple-baseline design as the researcher did not have control over the independent variable or its sequential application to different child actions).

**Participants**

Participants in this study included five parent-child dyads representing a subset of the participants completing the first phase (single-case design) of an intervention study (Schertz et al., 2007) on the Joint Attention Mediated Learning model (JAML; Schertz, 2005a). A total of 22 parent-child dyads enrolled in phase one of the intervention study (JAML study) across three research sites, with 17 completing the full intervention. Initial recruitment and participation occurred in compliance with the approved protocol from the Institutional Review Board at the University of Northern Colorado. Participants were recruited through pediatricians, early intervention providers, diagnostic clinics, and parent and professional associations in and around three research sites. Parent participants provided informed consent for participation in the intervention study (Schertz et al., 2007).

Eligibility for the JAML study (Schertz et al., 2007) was determined using the following criteria for children: (a) age between 15 and 25 months, (b) evidence of high risk for autism, (c) lack of joint attention, and (d) no confounding diagnosis. Additional criteria for parents included (a) residence within the geographical limits of a research site, and (b) willingness to carry out the
parent-mediated intervention protocol. The age criteria for child participants reflected age at intake, while risk for autism was assessed using the Modified-Checklist for Autism in Toddlers (M-CHAT) followed by the M-CHAT Follow-Up Interview (Robins, Fein, Barton, and Green, 2001). With children for whom “at risk” determinations were unclear on the basis of the M-CHAT (Robins et al., 2001) alone, the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, Risi, 1999) was administered, with the results of this assessment used for final eligibility determination. The presence or absence of joint attention was assessed using observational coding of at least two video-recordings of parent-child interactions. Confounding diagnoses leading to study exclusion included failure to thrive, premature birth (greater than six weeks premature), sensory impairment, global developmental impairment, or other developmental disabilities such as Down syndrome.

Criteria for participation in the present study included (a) participation in the first phase of the JAML study at Site 1 (site with greatest number of participants completing intervention), (b) participation in all four phases of the intervention with at least three data points (videotaped interaction sessions) in each phase, and (c) provision of informed consent indicating agreement to allow intervention data to be used subsequently for educational purposes. The first criterion served to reduce potential variation due to uncontrolled factors among participating dyads by ensuring that general geographical location and intervention coordinator remained consistent, while maximizing the number of potential participants. The second criterion was intended to ensure sufficient data to assess child and parent actions across the full course of the intervention. Five of the seven parent-child dyads participating at Site 1 were eligible for the present study based on the above criteria. Dyad 5 met these criteria and was included in the present study; however, information was received after completion of the study that this participant may have
had a confounding condition (i.e., in utero drug exposure), which if known ahead of time, would have excluded him from the original JAML study. Two dyads did not complete the minimum of three sessions in the final phase of intervention, Initiating Joint Attention, and were therefore excluded. Video data from the excluded dyads was instead used in order to provide authentic situations for purposes of development and refinement of the observational coding system as well as observer training. All five eligible dyads included mothers and sons from middle class families. Additional demographic characteristics of the participants are presented below.

Table 3-1

**Participant Demographics**

<table>
<thead>
<tr>
<th>Dyad #</th>
<th>Son’s Age (mo.)</th>
<th>Vineland Communication</th>
<th>Vineland Socialization</th>
<th>ADOS Communication</th>
<th>ADOS Reciprocal Social Int.</th>
<th>ADOS Classif.**</th>
<th>Mother’s Age (yrs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>74</td>
<td>72</td>
<td>Not Available*</td>
<td>Not Available*</td>
<td>ASD</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>27</td>
<td>54</td>
<td>75</td>
<td>Not Available*</td>
<td>Not Available*</td>
<td>ASD</td>
<td>31</td>
</tr>
<tr>
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<td>80</td>
<td>5</td>
<td>10</td>
<td>Autism</td>
<td>35</td>
</tr>
<tr>
<td>4</td>
<td>22</td>
<td>64</td>
<td>73</td>
<td>6</td>
<td>13</td>
<td>Autism</td>
<td>29</td>
</tr>
<tr>
<td>5</td>
<td>22</td>
<td>64</td>
<td>75</td>
<td>6</td>
<td>10</td>
<td>Autism</td>
<td>34</td>
</tr>
</tbody>
</table>

*No scores provided for ADOS scales, however report provided indicating ADOS classification
**ADOS Classification – Communication (autism cut-off = 4, autism spectrum cut-off = 2), Reciprocal Social Interaction (autism cut-off = 7, autism spectrum cut-off = 4)

**Settings, Change Agents, and Materials**

This section provides information on the settings in which the JAML study (Schertz et al., 2007) occurred and the change agents who carried out various aspects of the study. The materials used in the JAML study as well as those used in the present study are also presented.

**Settings.** All baseline and intervention activities including intervention coordinator (IC) home-visits, video- and audio-recording, and completion of measures occurred in participants’ homes. The IC met individually with each parent-child dyad on a weekly (approximate) basis
for between 60 and 90 minutes. These home visits occurred in rooms in participants’ homes conducive to discussions between the IC and parent participant, and play between the parent and child participant (i.e., adequate space, access to play materials). Participating parents were encouraged to use intervention strategies with their children for approximately one hour per day in natural environments, which may have included participants’ homes or other environments in which they typically interacted with their children (Schertz, 2005a).

**Change agents.** The JAML study employed a collaborative model in which the IC worked with parent participants to support them as they implemented the intervention with their children. The IC at Site 1 (for all dyads included in the present study) was a licensed Clinical Psychologist with several years of experience providing family-centered services to caregivers of young children with or at high risk for ASD. The IC used the principles of mediated learning (i.e., focusing, giving meaning, expanding, encouraging, organizing/planning; Klein, 2003) to assist parent participants in building their understanding of joint attention development, mediated learning, and individually selected strategies and activities that would support caregiver-child interactions. The IC provided information (written and verbal) on joint attention development and mediated learning to parent participants as they progressed through the four phases of the intervention. These four phases followed the theoretical course of the typical development of precursor and joint attention skills (i.e., focusing on faces, turn taking, responding to joint attention, initiating joint attention; Schertz, 2005a). See Appendix B for a brief description of the content of each phase.

With the guidance of the IC, each parent participant functioned as the primary change agent, working directly with her child using the principles of mediated learning and weekly plans designed collaboratively with the IC to promote child precursor or joint attention actions based
on the phase of the study (e.g., Focusing on Faces, Turn-Taking, Responding to Joint Attention, Initiating Joint Attention). The existing parent-child relationship served as the foundation for the development of child joint attention and general social-communicative competency as parent participants mediated child learning in the context of typical daily routines and activities (Schertz, 2005a).

**Materials.** Materials used during the course of the JAML study by the IC and participating parent-child dyads will be described, followed by materials required for the implementation of the present study. Intervention Coordinator materials included the Joint Attention Mediated Learning Model: Intervention Manual (Intervention Manual; Schertz, 2005a), Monthly Record of Other Services Received Form (Monthly Record), digital video camera, digital audio recorder, and assessment instruments. The Intervention Manual (Schertz, 2005a) included a project overview and specific procedures for recruitment of study participants and implementation of intervention components. The Monthly Record form was used by the IC to track other services received by child participants. These data were gathered on a monthly basis from interviews with parent participants during home visits. A digital video camera was used to record 10- to 15-minute parent-child interaction sessions at each weekly home visit, while an audio recorder was used to record all home visit sessions for the purpose of examining implementation fidelity and collecting data for later qualitative analysis (Schertz, 2005a). Assessment instruments used during baseline data collection included an Initial Interview Protocol to gather demographic information from parent participants, the M-CHAT (Robins et al., 2001), the Infant Social-Communication Questionnaire (Schertz, 2003), the Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984), the Mullen Scales of Early Learning (Mullen, 1995), and the Autism Diagnostic Observation Schedule (Lord et al., 1999).
Parent participants received the Joint Attention Mediated Learning Parent Manual (Parent Manual; Schertz, 2005b). The Parent Manual was shared with parent participants in sections as they progressed through the phases of the intervention. It included basic information on mediated learning principles, information regarding the importance of the target precursor or joint attention skill, and examples for parent-child interactional activities that corresponded to the mediated learning principles as applied to each phase and stage of the intervention.

During daily intervention-related parent-child interactions and weekly video-recorded interaction sessions, materials included play materials present in participants’ homes. Parent participants were encouraged to engage in face-to-face interactions with their children with and without toys that were of high interest to their children and conducive to interaction (e.g., toys as opposed to books; Schertz et al., 2005a).

Materials required for the present study included: data from the JAML study (Schertz et al., 2007; access provided with permission of Schertz and colleagues); the Caregiver-Child Joint Attention Coding System, an observational coding system developed for the present study with the purpose of examining child and caregiver joint attention skills; Procoder for Digital Video (ProcoderDV; Tapp, 2003); and the Multi-Option Observation System for Experimental Studies (MOOSES; Tapp & Wehby, 1993). JAML study data provided to the authors included the following for each of the seven dyads from Site 1: digital video recordings of weekly caregiver-child interactions and demographic information. Scores from the Vineland Adaptive Behavior Scales (Sparrow et al., 1984) and Autism Diagnostic Observation Schedule (Lord et al., 1999) were provided for some children, and are included in Table 3-1 as available. ProcoderDV (Tapp, 2003) was used to code real time observational data from the digital video recordings, while MOOSES was used for data analysis purposes.
Dependent Measures and Interobserver Agreement

Dependent measures. The primary dependent measures were child and caregiver joint attention actions. These included child – gaze alternation, child – point, child – show, child – responding joint attention, child – initiating joint attention, caregiver – gaze alternation, caregiver – point, caregiver – show, caregiver – responding joint attention, and caregiver – initiating joint attention. Gaze alternation, pointing, and showing are discrete forms of behavior associated with joint attention, often described as conventional joint attention gestures. Initial observations of child-caregiver interactions completed by the researcher indicated that these forms of behavior did not always meet the definition of joint attention (e.g., sometimes occurred in the absence of mutual interest, positive affect, or a commenting function) or did not occur in anticipated patterns (i.e., sometimes pointing or showing occurred without a corresponding gaze alternation). As a result, these discrete forms were measured in addition to joint attention responding and initiating, which required the presence of child and caregiver gaze alternations and additional indicators of the occurrence of a joint attention interaction (e.g., mutual interest or excitement, a commenting function, and positive affect). All targeted actions were measured using a researcher-developed observational coding scheme called the Caregiver-Child Joint Attention (CCJA) Coding System. The CCJA was developed for and refined during the present study. This coding system is novel due to its inclusion of caregiver actions, which was intended to allow for the analysis of change in both child and caregiver actions and interactions across the course of the JAML intervention (Schertz et al., 2007). Units of measure included rate of caregiver and child actions and percentage of opportunities in which joint attention occurred.

Interobserver agreement. The primary observer for the present study was a trained fourth year undergraduate student in Psychology. The secondary observer was a doctoral
candidate in Education. Reliability between the primary and secondary observer was assessed by calculating time-window agreement on the occurrence of all parent and child action codes using the following formula: Agreements divided by Agreements plus Disagreements multiplied by 100 (Kazdin, 1982; Yoder & Symons, 2010). However, low rates of certain target actions made the examination of agreement based on occurrence only problematic (Kennedy, 2005). As a result, agreement was calculated on occurrence and nonoccurrence for those actions occurring at low rates, defined as less than one time per minute in baseline or any subsequent intervention phase. Caregiver gaze alternation was the only action meeting the standard for use of occurrence only interobserver agreement, occurrence and nonoccurrence was used for all other actions.

Prior to coding data from the five participating dyads, the two observers established 80% or greater reliability on all codes across at least three 10-minute video-recorded parent-child interaction sessions. Following the establishment of initial reliability, the secondary observer coded a total of 32% of videos. Videos coded by both observers were randomly selected from each phase of the intervention for each dyad. Mean interobserver agreement across dyads was as follows: caregiver gaze alternation was 80% (range = 61% - 93%), caregiver point was 93% (range = 84% - 100%), caregiver show was 91% (range = 77% - 98%), child gaze alternation was 97% (range = 84% - 100%), child point was 95% (range = 88% - 100%), child show was 97% (range 84% - 100%), caregiver joint attention responding was 82% (range = 53% - 100%), caregiver joint attention initiating was 99% (range = 97% - 100%), child joint attention responding was 82% (range = 54% - 100%), and child joint attention initiating was 99% (range = 98% - 100%).

**Coding Definitions**

The coding definitions section provides definitions for each code in the Caregiver-Child
Joint Attention Coding System. All definitions indicate the agent (caregiver or child) and the action (gaze alternation, point, show, responding joint attention, initiating joint attention). The definitions of discrete joint attention actions (first pass codes) are presented below, followed by joint attention responding and initiating definitions (second pass codes). The full version of the Caregiver Child Joint Attention Coding System Manual (including coding rules, definitions, examples, and non-examples) can be found in Appendix C.

**Discrete caregiver actions.**

**Caregiver - gaze alternation.** [d] Caregiver alternates gaze (at least one shift) between child’s face and target object or event in an attempt to direct or follow the attentional focus of the child. Gaze alternation may start at child’s face or target object/event. NOTE: Gaze alternations are often subtle and relatively rapid.

**Caregiver – point.** [s] Caregiver extends isolated index finger in direction of object or event to direct or follow attentional focus of child. Index finger may touch object or not. Do not code instances when a caregiver “points” with an object other than the index finger (e.g., crayon). Note: Caregiver finger must be fully in video frame to code. If in frame, but partially obstructed by an object code, if fully obstructed by object do not code.

**Caregiver – show.** [a] Caregiver uses hand(s) to present object to child for at least 1 second (one-one-thousand) without releasing object, in an attempt to draw child’s attention to object. Recode Rule: If caregiver fully releases the object and then picks it up again to begin another show, code caregiver-show again. Exclusions: If child is already touching/engaging with object, do not code caregiver-show. If caregiver’s primary purpose is to give object to child, do not code caregiver-show. If object is not
clearly visible to child (i.e., hand fully encloses object, or if child’s back is turned), do not code caregiver-show.

Discrete child actions.

Child - gaze alternation. [k] Child alternates gaze (at least one shift) between caregiver’s face and target object or event in an attempt to direct or follow the attentional focus of the caregiver. Gaze alternation may start at caregiver’s face or target object/event. NOTE: gaze alternations are often subtle and relatively rapid.

Child – point. [l] Child extends isolated index finger in direction of object or event to direct or follow attentional focus of caregiver. Index finger may touch object or not. Do not code instances when a child “points” with an object other than the index finger (e.g., crayon).

Child – show. [p] Child uses hand(s) to present object to caregiver for at least 1 second (one-one-thousand) without releasing object, in an attempt to draw caregiver’s attention to object. Recode Rule: If child fully releases the object and then picks it up again to begin another show, code child-show again. Exclusions: If caregiver is already touching/engaging with object, do not code child-show. If child’s primary purpose is to give object to child, do not code child-show. If object is not clearly visible to caregiver (i.e., hand fully encloses object, or if caregiver’s back is turned), do not code child-show.

Caregiver joint attention.

Caregiver – responding joint attention.[w] Any instance of caregiver – gaze alternation in a qualifying joint attention interaction (i.e., following within 7 seconds of a child – gaze alternation to the same target object/event, mutual social awareness, mutual positive affect, commenting function) that is NOT the first qualifying action in the sequence.
**Caregiver - initiating joint attention.** [g] Any *caregiver – gaze alternation* in a qualifying interaction (i.e., followed within 7 seconds by a *child – gaze alternation* to the same target object/event, mutual social awareness, mutual positive affect, commenting function) that begins a joint attention sequence.

**Child joint attention.**

**Child – initiating joint attention.** [h] Any *child – gaze alternation* in a qualifying joint attention interaction (i.e., followed within 7 seconds by a *caregiver – gaze alternation* to the same target object/event, mutual social awareness, mutual positive affect, commenting function) that begins a joint attention sequence.

**Child – responding joint attention.**[o] Any instance of *child – gaze alternation* in a qualifying joint attention interaction (i.e., following within 7 seconds of a *caregiver – gaze alternation* to the same target object/event, mutual social awareness, mutual positive affect, commenting function) that is NOT the first qualifying action in the sequence.

**Procedure**

This section outlines the procedures used to guide the implementation of the JAML study (Schertz et al., 2007) followed by a description of the procedures used in the present study. The JAML intervention is a parent-implemented mediated learning model based on mediated learning theory (Feuerstein 1980; Vygotsky, 1978) and the intervention work of Klein and colleagues to promote child development through mediated learning techniques in various populations (e.g., very low birth weight infants, gifted children, children with Down syndrome; Klein, 1996). JAML was developed to apply the principles of mediated learning (i.e., focusing, giving meaning, expanding, encouraging, organizing and planning) to the promotion of precursor and joint attention actions (focusing on faces, turn-taking, joint attention responding, and joint
attention initiating) in parent-child dyads in which the toddler-aged child is at high risk for autism. In the model, the Intervention Coordinator (IC) mediates the learning of each parent as she develops the knowledge, skills, and confidence to mediate her child’s learning during typical daily experiences with the goal of promoting joint attention precursor, responding, and initiating actions (Schertz, 2005a).

The JAML study (Schertz et al., 2007) included a baseline phase followed by four intervention phases with two stages at each phase. During baseline, the IC met with each participating dyad to administer parent interviews and child assessments and collect baseline video-recordings of parent-child interactions and audio-recordings of verbal IC-parent interactions (video- and audio-recordings were collected throughout baseline and intervention phases). Baseline video recordings of 10- to 15-minute parent-child interaction sessions were collected on at least three different dates with at least three days separating each session. Participant dyads remained at baseline until coded video data indicated a stable pattern in child performance of the code focusing on faces (three to five sessions) as measured by the observational coding scheme (Schertz, 2007) initially developed for the JAML study (Schertz, 2005a). This coding scheme included four target child actions: focusing on faces, turn-taking, responding to joint attention (RJA), and initiating joint attention (IJA); and employed interval recording (10-second intervals). A decision process was used for coding RJA and IJA, which indicated that only intervals in which focusing on faces had occurred could be coded for RJA or IJA. See Appendix D for specific coding definitions from the original JAML coding scheme.

Following the establishment of behavioral stability in baseline, intervention sessions commenced. Each parent participant learned about mediated learning principles and joint attention development with the assistance of the IC during weekly home visits and then used
activities based on this information to promote the target competency (determined by intervention phase) with her child during face-to-face interaction sessions and typical daily routines. All IC home visits were audio-recorded and all home visits included the 10- to 15-minute video-recorded parent-child interaction session (with the exception of home visits in which a new phase was introduced). Parent participants were requested to spend one half hour to one hour per day in face-to-face interaction with their children and to embed intervention-based interactions into routines throughout the day. Rather than prescribing specific activities, the IC (during home visits) and Parent Manual (Schertz, 2005b) provided sample activities and encouraged each parent participant to develop novel activities, based on her knowledge of her child, that would assist the child in developing the targeted competency.

Participating dyads progressed through the series of four developmentally sequenced phases including 1) Focusing on Faces, 2) Turn-Taking, 3) Responding to Joint Attention, and 4) Initiating Joint Attention. Within each phase were two levels, with the first level emphasizing parental initiative (more support for child participants), and the second emphasizing child initiative (less support, more independence for child participants). Participant dyads progressed to new levels and phases as child participants met the following criteria: a) the targeted behavior was observed in at least three consecutive sessions, b) one of the Principal Investigators confirmed the stability of the targeted child action based on visual analysis of graphed data, and c) the IC and parent participant agreed that the child’s performance was stable. Visual analysis (including trend-lines) of graphed observational data from video-recordings of weekly parent-child interaction sessions was used to determine stability in targeted child actions.

In Phase 1: Focusing on Faces, parent participants developed and implemented activities that would promote their children’s tolerance for focusing on a social partner’s (the parent) face.
In Phase 2: Turn-Taking, parent participants introduced their children to activities that promoted reciprocal interaction, both face-to-face and with toys. During Phase 3: Responding to Joint Attention, intervention-related interactions and activities focused on the child’s ability to respond to bids for joint attention (i.e., participate in joint attention interactions following an initiation by another individual). Finally, in Phase 4, parent participants emphasized the initiation of joint attention interactions in their toddlers. Participants completed the full intervention in between 24 and 47 sessions, or between 9 and 11 months. See Appendix B for a summary of the content and purpose of each phase.

The present study was a secondary analysis of video-recorded caregiver-child interaction sessions collected during the JAML study (Schertz et al., 2007). The procedures followed the protocol approved by the Virginia Commonwealth University Institutional Review Board. The primary component of this study was the refinement and application of the Caregiver-Child Joint Attention (CCJA) Coding System to a portion of the existing digital video data collected during the weekly parent-child interaction sessions recorded throughout the course of the JAML study. The CCJA Coding System was developed following a detailed examination of the joint attention measurement systems used in published literature. Specifically, the studies included in the above systematic review of literature were examined for types of measurement used, joint attention actions measured, and specific definitions of actions. Actions selected were those representing forms and functions consistent with the majority of published studies, theoretical notions about joint attention, and the JAML (Schertz et al., 2007) study. Next, observations of caregiver-child interaction videos (of the non-participating dyad and sessions not selected for the study of participating dyads) were used to inform the coding system structure and definition refinement. Of note, the three discrete forms of joint attention related actions selected based on previous
research (gaze alternation, pointing, and showing), though often considered conventional joint attention gestures and used as indicators of joint attention, were observed to occur in some cases in absence of joint attention. As such, each form was considered a joint attention related action (as opposed to joint attention) and placed on the first level of a two-tiered coding system. The second level of this system included child and caregiver joint attention initiations and responses which were coded during second pass coding. Joint attention actions were only coded when child and caregiver gaze alternations (used due the centrality of gaze as an indicator of attention in published literature) occurred in temporal proximity (within 7 seconds of one another) and met additional criteria based on the definition of joint attention used in this study (e.g., neutral or positive affect, commenting function, mutual awareness). Conceptual and discrepancy discussions led to further refinement until the CCJA Coding System Manual was finalized. Prior to data collection, the two observers memorized the coding scheme and practiced coding data using Procoder for Digital Video (ProcoderDV; Tapp, 2003) on a desktop computer with video sessions from the non-participating dyad and participating dyads (sessions not selected for study). Once the two coders established 80% reliability on all codes (using MOOSES [Tapp and Wehby, 1993] to calculate interobserver agreement) across three or more video sessions, the primary coder (undergraduate student) coded the full length of pre-specified videos for each participating dyad. Videos to be coded included all baseline videos ($M = 4.2$, range = 4-5) and the last three videos of each intervention phase for each dyad. The reliability coder independently coded 32% of the videos. These double coded videos were selected randomly from each intervention phase for each dyad. The observational data resulting from video coding have been used to address the research questions.
Data Analysis

The Data Analysis section provides a description of the procedures used in analyzing and evaluating coded behavioral data. Once coded, behavioral observation data were transferred from ProcoderDV (Tapp, 2003) to MOOSES (Tapp & Wehby, 1993) to facilitate analysis. Coded behavioral observation data were analyzed in three primary ways. First, the data were analyzed using descriptive statistics to determine the frequency of all child and caregiver actions during each coded observation session. Frequencies were then converted to rate for comparison across sessions of differing lengths, and mean and range of coded actions were computed in each phase for each dyad. Next, graphical representations of the data were produced and examined for changes across phases and patterns across dyads. Graphs were visually examined within phases (stability calculated using a 20% stability criterion) and across phases (level changes [mean rate per minute] and percentage overlap). Between phase comparisons occurred between each pair of adjacent phases (Baseline and Focusing on Faces, Focusing on Faces and Turn-Taking, Turn-Taking and Responding to Joint Attention, Responding to Joint Attention and Initiating Joint Attention) and between Baseline and the final intervention phase for each action for each participant. For each phase comparison, mean levels and percentage overlap were examined for indicators of meaningful change (increases in mean with minimal overlap between phases). Across participants (all children, all caregivers), graphs and data were examined for patterns of change. Finally, percentages of opportunities in which joint attention occurred were calculated. Percentage was selected as the unit of measurement for examining sequentially associated actions because it is easily interpretable, even in cases in which sequences of interest occur at low rates. Pooled frequency data for each participant in each phase were used for these calculations. Gaze alternations were used as an estimate of opportunities for joint attention (i.e.,
one social partner presents a bid for joint attention by alternating his or her gaze between the other social partner and the object or event of interest). Percentages were calculated on the following two sequences of actions: 1) caregiver gaze alternation followed by child responding to joint attention, and 2) child gaze alternation followed by caregiver responding to joint attention. The outcomes of these calculations reflected the percentage of opportunities in which 1) children engaged in joint attention by responding to a caregiver gaze alternations and 2) caregivers engaged in joint attention by responding to a child gaze alternation, respectively. These data were then analyzed descriptively for changes in interaction patterns across the course of the intervention and trends across parent-child dyads.

**Social Validity**

Social validity was assessed by having two untrained observers who were unaware of the purpose of the present study or the JAML study observe randomly selected and counterbalanced five-minute video interaction segments from baseline and the final intervention phase (Initiating Joint Attention) for each dyad. The observers included one undergraduate student in Psychology and one graduate student in Counselor Education. The results of these observational rating scales were analyzed descriptively for changes based on intervention time point (baseline or final phase of intervention) and caregiver-child dyad. See Appendix E for a list of items in the social validity rating scale.
Results

The purpose of this study was to examine changes in the occurrence of child and caregiver joint attention actions and the association between child and caregiver actions across the course of a joint attention intervention. Data were collected by applying the Caregiver-Child Joint Attention (CCJA) Coding System to videotaped caregiver-child interaction sessions (all Baseline sessions \[M = 4.2, \text{ range } = 4-5\] and the last three sessions for each intervention phase for each dyad) recorded throughout the course of the Joint Attention Mediated Learning study (JAML; Schertz et al., 2007). Child and caregiver actions (discrete actions and joint attention responding and initiating) were measured and analyzed for changes within and between intervention phases for each participating dyad. The discrete actions (gaze alternation, point, and show) measured for each child and caregiver represented forms of behavior often associated with joint attention and considered conventional joint attention gestures. These forms can occur as part of or independent of successful joint attention interactions between a caregiver and child in a particular case. These were measured and examined for change across the phases of the intervention. Additionally, gaze alternation served as an estimate for opportunities for joint attention and the basis for coding joint attention responding and initiating during second pass coding. In other words, gaze alternation set the stage for successful joint attention, and instances of temporally associated child and caregiver gaze alternation (within 7 seconds of one another) were reviewed to determine if they met the criteria for joint attention (responding or initiating). The percentage of opportunities in which each social partner displayed a joint attention response
to a gaze alternation was also examined. Social validity data were also collected and descriptively analyzed.

**Research Question 1**

*What changes take place in the occurrence of joint attention responding and initiating actions in toddlers with early risk for autism spectrum disorders during the course of a parent-mediated joint attention intervention?* In order to address this research question, line graphs were produced and visually analyzed within and across phases for each child action coded (gaze alternation, pointing, showing, responding to joint attention, initiating joint attention). The resultant individual child data are presented below followed by summaries across children. Refer to figures 4-1 and 4-2 below for line graphs of child actions. Tables 4-1 and 4-2, which display within and between phase data (stability, mean, range, and percentage overlap) for each child, are presented in Appendix F.

**Child gaze alternations.** Child 1 displayed variable levels of gaze alternations during Baseline and within each phase of the intervention. Mean levels of gaze alternations increased steadily with the introduction of each subsequent phase; however, percentage overlap between phases was moderate to high, indicating a lack of clear and immediate level change between phases. Between Baseline and the final intervention phase (Initiating Joint Attention) child 1’s gaze alternations demonstrated a large increase in mean level (from 0.97 to 3.95) with 0.00% overlap, indicating a marked improvement. Child 2 displayed variable levels of gaze alternations during Baseline and within each phase of the intervention. A comparison of adjacent phases indicated increasing mean levels of gaze alternations and low to moderate overlap with the exception of the change between the Responding to Joint Attention phase and the Initiating Joint Attention phase. Between Baseline and the final phase, child 2 displayed an increase in the mean
level of gaze alternations from 0.31 to 2.26 with no overlap, indicating a large positive change. Child 3 displayed variable levels of gaze alternations during Baseline and within each phase of the intervention. While a comparison of adjacent phases indicated increases in mean level of gaze alternations with the exception of the change from Responding to Joint Attention to Initiating Joint Attention, there was substantial overlap between phases indicating a lack of clear and immediate changes in level between phases. Between Baseline and the final phase of intervention, there was a moderate positive change in mean level (from 1.44 to 3.21) with 33.3% (1 data point) overlap, indicating a moderate improvement between Baseline and the final phase of intervention. Child 4 displayed variable levels of gaze alternations within and between phases. The mean level of gaze alternations was highest during the Turn-Taking phase and overlap between phases was moderate to high, indicating a lack of clear improvement spanning all phase changes. However, there was a large increase in mean level between Baseline and the final intervention phase from 0.90 to 3.25 with 0.00% overlap, indicating significant improvement by the end of the intervention. Child 5 displayed variable levels of gaze alternations within and between phases. There was no clear pattern of change in gaze alternations across phases. While there was a positive change in mean level (from 1.16 to 2.57) between Baseline and the final phase of intervention, substantial overlap (66.67%) indicated inconclusive findings.

Across child participants, gaze alternations were characterized by within phase variability. However, child 1, child 2, and child 3 displayed increases in gaze alternations across subsequent phases of the intervention, with the exception of the change from the Responding to Joint Attention phase to the Initiating Joint Attention phase for child 2 and child 3 (gaze alternations highest during Responding to Joint Attention). All children, with the exception of
child 5, demonstrated meaningful increases in the mean level of gaze alternations between Baseline and the Initiating Joint Attention phase, suggesting that most children experienced improvements in this competency by the end of the intervention.

**Child pointing.** Child 1 demonstrated pointing at low, variable levels both within and across phases of the intervention. Means levels of pointing varied between phases without displaying a clear pattern of change. From baseline to the final intervention phase there was a small increase in mean level (0.33 to 0.59); however, 100.00% overlap occurred, which indicated inconclusive findings. Child 2 demonstrated pointing at variable levels within and across phases of the intervention with moderate to high overlap between adjacent phases, resulting in no clear pattern of change across all phases. However, from Baseline to the final phase of intervention there was a moderate increase in mean level from 1.14 to 2.63 with no overlap, indicating some improvement by the end of the intervention. Child 3 displayed variable levels of pointing within and across phases of the intervention. Inconsistent changes in mean level and moderate to high overlap indicated no clear pattern of improvement spanning all phases. While there was a small increase in mean from Baseline to the final intervention phase (0.58 to 0.77), substantial overlap (66.67%) indicated inconclusive findings. Child 4 demonstrated pointing characterized by within and across phase variability. Variable mean levels and moderate to high overlap between adjacent phases indicated no clear pattern of change across phases of the intervention. While there was a moderate change in mean level between Baseline and the final intervention phase (0.15 to 0.77), a high percentage of overlap (66.67%) indicated inconclusive findings. Child 5 displayed variable levels of pointing within and between phases. Mean levels of pointing between adjacent phases displayed no clear pattern of change. Between Baseline and the final phase of intervention there was a moderate increase in mean level (0.02 to 0.56) with 33.33%
overlap. However, both phases included at least one session in which no instances of this action occurred, suggesting a lack of clear improvement from Baseline to the end of intervention.

Across child participants pointing was characterized by variability both within and across phases. There were no clear patterns of change for any of the participants that spanned the full course of the intervention. While a comparison of means between Baseline and the final phase of intervention indicate increases in the mean level of pointing for all children, there was substantial overlap, with the exception of child 2, suggesting that there was no clear change in pointing across children by the end of the intervention.

**Child showing.** Child 1 demonstrated showing at low, variable levels within phases. This action was absent in at least one session per phase with the exception of the Responding to Joint Attention phase. Across adjacent phases, mean level of showing did not display a clear pattern of change. From Baseline and the final intervention phase, minimal change (0.07 to 0.09) and considerable overlap indicated no meaningful change in showing. Child 2 demonstrated showing at low, variable levels within phases. Across phases, showing occurred at low, variable levels, with a significant amount of overlap, indicating no clear pattern of improvement spanning all phase changes. From Baseline to the final intervention phase there was a small increase in mean level; however moderate overlap and a session with no instances of this action in the final phase suggest no clear change. Child 3 displayed low, variable levels of showing within and across phases with moderate to high overlap indicating no clear pattern of change across the course of intervention. A comparison between Baseline and the final intervention phase revealed a small increase in mean level (0.15 to 0.32) with moderate overlap and one session with no showing in the final phase, suggesting no clear differences. Child 4 exhibited showing at low, variable levels within and across phases with moderate to high overlap
between phases indicating no clear pattern of change spanning all phases of the intervention. From Baseline to the final phase of intervention, there was a small increase in mean level (0.00 to 0.13); however, moderate overlap and one session with no showing in the final phase suggested no clear differences. Child 5 demonstrated showing at variable levels within and across phases, with moderate to high overlap, and at least one session with no showing in each phase. This suggested that there was no clear pattern of improvement spanning all phases of the intervention. Between Baseline and the final phase of intervention, there was an increase in mean level; however, moderate overlap and a session with no showing in the final phase indicated a lack of clear differences.

Across children, showing was characterized by within and between phase variability and a lack of any clear pattern of change across the full course of intervention. While comparisons between Baseline and the final intervention phase indicated increases in mean level for all children, moderate to high levels of overlap and sessions with no showing during the final intervention phase suggested that these changes were not meaningful.

**Child responding to joint attention.** Child 1’s joint attention responding was variable within phases. Between adjacent phases, joint attention responding occurred at increasing mean levels with the exception of the change from the Turn-Taking phase to the Responding to Joint Attention phase. However, moderate to high overlap between phases indicated a lack of clear and immediate change between phases. An examination of joint attention responding between Baseline and the final intervention phase revealed a large increase in mean level (from 0.30 to 2.00) with no overlap, indicating a clear improvement in this competency by the end of intervention. Child 2 demonstrated joint attention responding at variable levels within phases, but at increasing levels with the introduction of each subsequent intervention phase, with the
exception of the phase change between Responding to Joint Attention and Initiating Joint Attention. Overlap was low to moderate with the exception of the last phase change, suggesting meaningful increases across phases with the exception of the final phase change. Between Baseline and the final phase of intervention, joint attention responding displayed a large increase in mean level (0.07 to 1.39) with no overlap, suggesting a significant improvement in this skill by the end of intervention. Child 3 displayed variable levels of responding to joint attention within phases, but increasing levels across adjacent phases. However, moderate to high levels of overlap indicated a lack of clear and immediate changes in level. Between Baseline and the final phase of intervention, joint attention responding displayed a large increase in mean level (0.38 to 1.59) with no overlap indicating a meaningful improvement in this competency by the end of intervention. Child 4 displayed joint attention responding at variable levels within and across phases with moderate to high overlap between adjacent phases, indicating no clear pattern of change spanning all phases. The highest mean level of joint attention responding occurred during the Turn-Taking phase. Between Baseline and the final phase of intervention, there was an increase in mean level (0.20 to 0.83) with no overlap, indicating a moderate improvement in responding to joint attention by the end of the intervention. Child 5 demonstrated joint attention responding at variable levels within and between phases, with moderate to high overlap between adjacent phases, indicating no clear pattern of change across adjacent phases. Between Baseline and the final phase of intervention, there was a small increase in mean level (0.62 to 0.79) and considerable overlap, indicating no improvement by the end of intervention.

Across all children, responding to joint attention was characterized by within phase variability. Child 1, 2, and 3 demonstrated positive changes in mean level across adjacent phases, with the exception of one phase change each for child 1 and child 2. However, only child 2
displayed these changes with low levels of overlap (with the exception noted above), indicating a clear pattern of improvement across adjacent phases. A comparison between Baseline and the final intervention phase indicated increases in mean level with no overlap for all children, with the exception of child 5. These changes indicated substantial improvements in responding for child 1, child 2, and child 3, and a moderate improvement for child 4 by the end of intervention.

**Child initiating joint attention.** Child 1 exhibited joint attention initiations at variable levels within phases. Between adjacent phases initiating occurred at slightly increasing mean levels with moderate to considerable overlap, with the exception of the last phase change for which there was a clear increase in initiating joint attention. Between Baseline and the final phase of intervention there was a moderate increase in initiating joint attention (0.02 to 0.74) with no overlap, indicating a meaningful improvement by the end of the intervention. Child 2 initiated joint attention at variable levels within phases. Between adjacent phases initiating increased with the exception of the final phase change, however moderate to large overlap indicated a lack of clear and immediate improvement spanning all phase changes. From Baseline to the final intervention phase, joint attention initiations increased in mean level (0.02 to 0.33) with no overlap indicating a small but clear improvement by the end of intervention. Child 3 demonstrated variable levels of joint attention initiations within and across phases. This variability, in combination with substantial overlap between adjacent phases, suggested that there was no clear improvement. Between Baseline and the final phase, there was a small decrease in mean level with considerable overlap, suggesting no clear change in initiating joint attention for this child by the end of intervention. Child 4 demonstrated joint attention initiations at variable levels within and between phases, indicating a lack of a pattern of improvement spanning all phase changes. However, an examination of Baseline and the final intervention phase suggest an
improvement by the end of intervention, with a moderate increase in mean level (0.08 to 0.80) and no overlap. Child 5 exhibited joint attention initiations at variable levels within and between adjacent phases, with no clear pattern of improvement across all adjacent phases. A comparison of Baseline and the final phase reveal a moderate improvement, suggested by an increase in mean level (0.02 to 0.49) and no overlap.

Across children, initiating joint attention was variable within phases. While none of the children displayed clear and immediate improvement across all adjacent phases, all children (with the exception of child 3) displayed small to moderate improvements in initiating joint attention between Baseline and the final phase of intervention as indicated by increases in mean level and no overlap.

**Summary of changes in child actions.** Three discrete forms of joint attention related actions (gaze alternation, point, and show) were measured and analyzed within and between phases for all child participants. All children displayed within phase variability in all three actions. Gaze alternations increased in mean level for child 1, child 2, and child 3 across adjacent phases with the exception of the final phase change; however, moderate to high levels of overlap indicated a lack of clear and immediate improvement following each phase change. A comparison of Baseline and the final phase of intervention revealed moderate to large improvements in gaze alternation for all children with the exception of child 5. This would suggest that while there was not necessarily a clear stepwise pattern of improvement across phases, this skill improved meaningfully by the end of the intervention for most child participants. Pointing was variable within and across phases for all children and no clear pattern of improvement emerged. While mean level of pointing increased for all children from Baseline to the final phase of intervention, substantial overlap (with the exception of child 2) suggested no
meaningful change in pointing across children by the end of the intervention. Similarly, showing was characterized by within and between phase variability and a lack of any clear pattern of change across adjacent phases. While comparisons between Baseline and the final intervention phase indicated increases in mean level for all children, moderate to high levels of overlap and sessions with no showing during the final phase suggested a lack of clear improvement in this action.

Two joint attention actions (responding and initiating) that were part of transactional exchanges between children and caregivers were measured and analyzed. Both responding and initiating displayed within phase variability across children. Child 1, child 2, and child 3 demonstrated positive changes in mean level of responding to joint attention across adjacent phases, with the exception of one phase change each for child 1 and child 2. However, only child 2 displayed these changes with low levels of overlap (with the exception noted above), indicating a clear pattern of improvement across adjacent phases. A comparison between Baseline and the final intervention phase indicated increases in mean level with no overlap for all children, with the exception of child 5. These changes suggested substantial improvements in responding for child 1, child 2, and child 3, and a moderate improvement for child 4 by the end of intervention. For initiating joint attention, while none of the children displayed clear and immediate improvements across all adjacent phases, all children (with the exception of child 3) displayed small to moderate improvements in initiating between Baseline and the final phase of intervention as indicated by increases in mean level and no overlap.
Figure 4-1. Child Gaze Alternation, Pointing, and Showing

BL = Baseline, FF = Focusing on Faces, TT = Turn Taking, RJA = Responding to Joint Attention, IJA = Initiating Joint Attention
BL = Baseline, FF = Focusing on Faces, TT = Turn Taking, RJA = Responding to Joint Attention, IJA = Initiating Joint Attention

Figure 4-2. Child Joint Attention Responding and Initiating

Research Question 2

What changes take place in the occurrence of joint attention facilitating actions (responding and initiating) of caregivers of toddlers at early risk for autism spectrum disorders as they implement a parent-mediated joint attention intervention? In order to address this research question, line graphs were produced and visually analyzed within and across phases for each caregiver action coded (gaze alternation, pointing, showing, responding to joint attention,
initiating joint attention). The resultant individual caregiver data are presented below and then summarized across caregivers. Refer to figures 4-3 and 4-4 for line graphs of caregiver actions. Tables 4-3 and 4-4, displaying within and between phase data (stability, mean, range, and percentage overlap) for each caregiver are presented in Appendix F.

**Caregiver gaze alternation.** Caregiver 1 displayed variable levels of gaze alternations with and between conditions (with the exception of the final phase) with no clear pattern of change across adjacent phases. A comparison of Baseline to the final phase of intervention revealed a moderate decrease in mean level (6.19 to 5.59) with considerable overlap, suggesting no clear change in this action. Caregiver 2 demonstrated variable levels of gaze alternations within conditions (with the exception of the final phase), but increasing levels across phases. However, moderate to high levels of overlap between most phases indicated a lack of clear and immediate improvements at each phase change. Between Baseline and the final phase of intervention there was a large increase in gaze alternations (6.00 to 9.21) with no overlap, indicating a notable increase in the display of this action by the end of intervention. Caregiver 3 demonstrated variable levels of gaze alternations within conditions, but increasing levels across adjacent phases, with the exception of the last phase change. However, moderate to high percentages of overlap between phases suggested that there was not a clear and immediate change in level at each phase change. Between Baseline and the final phase of intervention there was a large increase mean level (4.24 to 7.24) with moderate overlap (33.33% or 1 data point), suggesting an increase in the display of this action by the end of the intervention. Caregiver 4 displayed variable levels of gaze alternations within and across phases with no clear pattern of improvement spanning all phase changes. Between Baseline and the final intervention phase there was a large increase in mean level (2.98 to 4.43) with moderate overlap (33.33%)
indicating an increase in the display of this action by the end of the intervention. Caregiver 5’s demonstration of gaze alternations was characterized by variability within and between phases (with the exception of within phase data for Responding to Joint Attention). There was no clear pattern of change across the course of the intervention. From Baseline to the final phase of the intervention there was a large decrease in mean level (7.46 to 5.50) with considerable overlap, suggesting no clear change in this action.

Across caregivers, gaze alternations were displayed at variable levels within phases. Across phases, caregiver 2 and caregiver 3 demonstrated increasing mean levels of gaze alternations with the exception of the final phase change for caregiver 3. However, moderate to high levels of overlap occurred between phases. From Baseline to the final phase caregiver 2, caregiver 3, and caregiver 4 displayed increases in gaze alternations with either no overlap or moderate overlap (1 data point) suggesting meaningful increases in this skill by the end of intervention for these participants.

**Caregiver pointing.** Caregiver 1 displayed pointing at variable levels within and between phases with no clear pattern of change spanning all phases. While a comparison of Baseline to the final intervention phase indicated an increase in mean level (0.54 to 1.31), substantial overlap suggested no clear or meaningful change. Caregiver 2 exhibited pointing at variable levels within and between phases, displaying no meaningful pattern of change in this action across all phases. From Baseline to the final phase of intervention, pointing increased in mean level (1.97 to 3.41) with moderate overlap (33.33% or 1 data point), indicating a moderate to large increase in the use of pointing by the end of intervention. Caregiver 3 demonstrated variable levels of pointing within and between phases with no clear pattern of change across all adjacent phases. From Baseline to the final intervention phase there was a large decrease in
mean level with moderate overlap (33.33%) suggesting a reduction in the use of this action by the end of the intervention. Caregiver 4 displayed variable levels of pointing within and between phases with no clear pattern of change across all adjacent phases. Between Baseline and the final phase of intervention, there was a small to moderate decrease in mean level; however, substantial overlap indicated no clear change. Caregiver 5 exhibited pointing at variable levels within and between phases and no clear pattern of change spanning all adjacent phases. From Baseline to the final phase of intervention, there was a small decrease in mean level with moderate overlap, suggesting a small reduction in the use of this action by the end of intervention.

Across caregivers, pointing occurred at variable levels within and between phases, with no clear patterns of change spanning all adjacent phases for any of the caregivers. From Baseline to the final phase of intervention, some caregivers displayed increases in this action, while others displayed decreases. There was no clear pattern of change between Baseline and the final phase that characterized the majority of caregivers.

**Caregiver showing.** Caregiver 1 displayed showing at variable levels within and between phases, with no clear pattern of change across all phases. Between Baseline and the final phase of intervention, caregiver 1 displayed a decrease in mean level of showing (1.02 to 0.41) with moderate overlap (33.33% or 1 data point), indicating a moderate reduction in the use of this action by the end of the intervention. Caregiver 2 demonstrated showing at variable levels within phases. Mean levels of showing increased across adjacent phases with moderate to high levels of overlap with the exception of a decrease following the final phase change. However, there was no clear or immediate pattern of change spanning all adjacent phases. Between Baseline and the final phase of intervention, there was a large increase in mean level
with moderate overlap (33.33%), indicating an increase in the use of showing by the end of intervention. Caregiver 3 demonstrated showing at variable levels within and across phases, displaying no clear pattern of change across all phases. Between Baseline and the final phase there was a moderate increase in showing; however, considerable overlap suggests that this change was not meaningful. Caregiver 4 demonstrated variable levels of showing within and between phases, with no clear pattern of change across all phases. From Baseline to the final intervention phase, there was a moderate decrease in mean level of showing; however, substantial overlap suggested that this was not a clear change. Caregiver 5 displayed variable levels of showing within phases. Between adjacent phases, there was no clear pattern of change spanning all phase changes due to some high levels of overlap and a large decrease in mean level at the final phase. From Baseline to the final phase of intervention there was a moderate decrease in mean level with no overlap. However, it is unclear if this difference was meaningful as it was inconsistent with all other phase changes for this action by this participant.

Across caregivers showing was characterized by within phase variability. Between adjacent phases, no caregivers displayed clear patterns of change (mean level and percentage overlap) spanning all phases. Between Baseline and the final phase of intervention showing increased meaningfully for caregiver 2 and decreased meaningfully for caregiver 1. There was no consistent pattern of change between Baseline and the final phase characteristic of the majority of caregivers.

**Caregiver responding to joint attention.** Caregiver 1 responded to joint attention at varying levels within phases. Across adjacent phases, responding increased across the course of the intervention, with the exception of the phase change between Turn-Taking and Responding to Joint Attention. However, some of these changes were unclear due to considerable overlap,
resulting in a lack of clear and immediate increases across all phases. Between Baseline and the final phase of intervention, caregiver 1 displayed a large increase in joint attention responding (0.20 to 1.69) with no overlap, suggesting a meaningful increase in responding by the end of the intervention. Caregiver 2 responded to joint attention at variable levels within phases, but at increasing mean levels across adjacent phases. However, the last two phase comparisons occurred with considerable overlap, resulting in a pattern of change that was not clear and immediate across phases. From Baseline to the final phase of intervention, joint attention responding increased in mean level (0.03 to 1.30) with no overlap, suggesting a large meaningful increase in responding for caregiver 2 by the end of intervention. Caregiver 3 demonstrated joint attention responding at variable levels within phases, but at increasing levels across adjacent phases, with the exception of the change from Baseline to Focusing on Faces. However, with moderate to large overlap between phases, the pattern of change across all phases was not clear. Between Baseline and the final intervention phase, caregiver 3 displayed a small to moderate increase in joint attention responding (0.37 to 0.88); however, considerable overlap (66.67%) suggests no clear difference. Caregiver 4 displayed joint attention responding at variable levels within and between phases, with no clear pattern of change spanning all intervention phases. However, the comparison between Baseline and the final intervention phase revealed a large increase in joint attention responding (0.12 to 1.08) with no overlap, suggesting a meaningful increase in this action. Caregiver 5 demonstrated variable levels of joint attention responding both within and across phases. There was no clear pattern of increase across all adjacent phases. Between Baseline and the final phase of intervention there was an increase in mean level of joint attention responding (0.45 to 0.92); however, considerable overlap indicated that this was not a clear change.
Across caregivers, joint attention responding was variable within phases. While none of the caregivers displayed clear and immediate level changes in responding in all phase comparisons, all caregivers displayed increases in responding to joint attention by the end of the intervention. This change was meaningful with large increases and no overlap for caregiver 1, caregiver 2, and caregiver 4.

**Caregiver initiating joint attention.** Caregiver 1 demonstrated variable levels of joint attention initiations within phases. Across adjacent phases, joint attention initiating increased in mean level, with the exception of Turn-Taking to Responding to Joint Attention. However, moderate to large overlap between phases resulted in the lack of a clear pattern of change across all adjacent phases. A comparison of Baseline and the final phase of intervention revealed a large increase in mean level (0.28 to 1.17) with no overlap, suggesting a meaningful increase in initiating by the end of intervention. Caregiver 2 initiated joint attention at variable levels within phases, but increasing levels across phases with low to moderate overlap, with the exception of the last phase change, suggesting meaningful changes in all but the last phase. From Baseline to the final phase of intervention, joint attention initiations increased in mean level (0.07 to 0.97) with no overlap, indicating a large and meaningful change in this action by the end of intervention. Caregiver 3 initiated joint attention at variable levels within phases, but at steadily increasing levels across adjacent phases; however, some moderate to high overlap indicated that not all of these changes were clear or immediate. From Baseline to the final intervention phase, initiating joint attention increased (0.32 to 1.36) with no overlap, indicating a large meaningful increase by the end of intervention. Caregiver 4 exhibited joint attention initiations at varying levels within phases, but at increasing mean levels across adjacent phases with the exception of Turn-Taking to Responding to Joint Attention. However, moderate to high overlap between
adjacent phases resulted in a lack of clear and immediate change at each phase comparison. Between Baseline and the final phase of intervention, caregiver 4 displayed a large, meaningful increase in joint attention initiations as evidenced by a mean level increase (0.17 to 1.15) and no overlap. Caregiver 5 demonstrated variable levels of joint attention initiations within and between phases. There was no clear pattern of change spanning all adjacent phases. While there was a small increase in mean level (0.32 to 0.53) from Baseline to the final intervention phase, a high level of overlap suggested that this did not represent a clear difference.

Across caregivers initiating joint attention was characterized by within phase variability. Four of the five caregivers displayed increasing patterns of joint attention initiations across adjacent phases, with the exception of no more than one phase change. However, due to moderate to high levels of overlap between phases, these patterns of change could not be characterized as clear or immediate. A comparison of Baseline to the final intervention phase indicated large increases with no overlap, suggesting meaningful changes for all caregivers with the exception of caregiver 5.

**Summary of changes in caregiver actions.** Three discrete forms of joint attention related actions (gaze alternation, point, and show) were measured and analyzed within and across phases for all participating caregivers. Gaze alternations were displayed at variable levels within phases across caregivers. While some caregivers displayed increases in gaze alternations across adjacent phases, moderate to high overlap resulted in the lack of a clear pattern of change spanning all phases. On the other hand, an examination of Baseline and the final phase indicated that caregiver 2, caregiver 3, and caregiver 4 displayed increases in gaze alternations with either no overlap or moderate overlap (1 data point) suggesting meaningful increases in this action by the end of intervention for these participants. Across caregivers, pointing occurred at variable
levels within and between phases, with no clear pattern of change spanning all adjacent phases for any of the caregivers. From Baseline to the final phase of intervention, some caregivers displayed increases in this action, while others displayed decreases. There was no clear pattern of change in pointing between Baseline and the final phase that characterized the majority of caregivers. Across caregivers, showing was characterized by within phase variability. Between adjacent phases, no caregivers displayed clear patterns of change (mean level and percentage overlap) spanning all phases. Nor was there any consistent pattern of change in showing between Baseline and the final phase characteristic of the majority of caregivers.

Two joint attention actions (responding and initiating) that were part of transactional exchanges between caregivers and children were measured and analyzed. Across caregivers, joint attention responding was variable within phases. While none of the caregivers displayed clear and immediate level changes in responding in all phase comparisons, all caregivers displayed increases in responding to joint attention by the end of the intervention. This change was meaningful with large increases and no overlap for caregiver 1, caregiver 2, and caregiver 4. Initiating joint attention was also marked by within phase variability across caregivers. Across adjacent phases, though four caregivers displayed increasing patterns of joint attention initiations (with the exception of no more than one phase change) moderate to high levels of overlap resulted in a lack of any clear pattern of change across all phases. On the other hand, a comparison of Baseline and the final intervention phase revealed large increases with no overlap, suggesting meaningful changes for all caregivers with the exception of caregiver 5.
BL = Baseline, FF = Focusing on Faces, TT = Turn Taking, RJA = Responding to Joint Attention, IJA = Initiating Joint Attention

Figure 4-3. Caregiver Gaze Alternation, Pointing, and Showing
BL = Baseline, FF = Focusing on Faces, TT = Turn Taking, RJA = Responding to Joint Attention, IJA = Initiating Joint Attention

Figure 4-4. Caregiver Joint Attention Responding and Initiating

Research Question 3

What changes occur in the sequential association between caregiver and child joint attention actions during the course of a parent-mediated intervention for young children at early risk for autism spectrum disorders? In order to address this research question, the percentage of opportunities for joint attention (gaze alternations) to which each social partner responded (joint attention responding) was calculated and examined across phases and across dyads. These
percentages are presented in Table 4-5 and changes across phases and dyads are described below.

Child 1 responded to his caregiver’s gaze alternations with joint attention at increasing levels across each phase of the intervention. During Baseline he displayed joint attention responses following 4.84% of his caregiver’s gaze alternations. This increased as each developmentally sequenced phase was introduced and was at the highest level in the final phase in which he displayed joint attention responding following 35.79% of his caregiver’s gaze alternations. An examination of Baseline and the final phase indicated a large improvement (4.84% to 35.79%) in child 1’s responsiveness. Caregiver 1 displayed joint attention responding following 19.97% of her child’s gaze alternations during Baseline. This number increased across phases with the exception of the Responding to Joint Attention phase (25.45%) in which it declined following its highest level in the previous phase, Turn-Taking (48.31). Between Baseline and the final phase of intervention Caregiver 1 increased her responsiveness to her child’s gaze alternations from 19.67% to 40.30%.

Child 2 demonstrated joint attention responding following 1.11% of his caregiver’s gaze alternations during Baseline. This percentage increased across the phases of the intervention, with the exception of the final phase change, in which it declined slightly from 19.19% to 15.08%. From Baseline to the final intervention phase, child 1’s percentage of joint attention responses increased from 1.11% to 15.08%, indicating moderate improvement. Caregiver 2 responded to her child’s gaze alternations with joint attention responses during 11.11% of opportunities in Baseline. This number increased across the phases of the intervention, with the exception of Responding to Joint Attention in which it declined following a large increase in the previous phase, Turn-Taking. Caregiver 2’s responsiveness was highest in the final phase at
57.22% of opportunities, which represented a large increase from her Baseline level of 11.11%.

Child 3 responded to his caregiver’s gaze alternations with joint attention during 8.73% of opportunities in Baseline and at increasing levels across the phases of the intervention, with the exception of a slight decrease in the Responding to Joint Attention phase. Child 3’s joint attention responsiveness was at its highest level in the final phase at 21.97%, which represented a moderate increase from its Baseline level. Caregiver 3 responded to her child’s gaze alternations with joint attention during 25.33% of opportunities during Baseline. This level declined in the first intervention phase, Focusing on Faces, but then increased with each remaining intervention phase. Caregiver 3 displayed joint attention responses in 27.27% of opportunities in the final phase of intervention, just slightly above her Baseline level.

Child 4 responded to his caregiver’s gaze alternations with joint attention in 6.74% of opportunities during Baseline and at increasing levels across phases of the intervention, with the exception of a decline in the Responding to Joint Attention phase following a high level in the previous phase, Turn-Taking. Child 4’s responsiveness was at its highest level at 31.65% in the final phase, which represented a large increase from Baseline. Caregiver 4 followed 13.56% of her child’s gaze alternations with joint attention responses in Baseline. This number increased across phases, with the exception of the Responding to Joint Attention phase in which it declined following its highest level in the previous phase, Turn-Taking. Between Baseline and the final phase Caregiver 4’s responsiveness increased from 13.56% to 25.75% of opportunities, indicating a moderate increase by the end of the intervention.

Child 5 responded to 8.31% of his caregiver’s gaze alternations with joint attention during Baseline, and at variable levels (up to 18.51%) across the phases of the intervention, with no clear pattern across all phases. Between Baseline and the final intervention phase, child 5
demonstrated a small increase in the percentage of joint attention responses that he displayed following his caregiver’s gaze alternations (8.31 to 14.37). Caregiver 5 responded to her child’s gaze alternations with joint attention at the highest level of any caregiver during Baseline with 38.98%. Her level of responsiveness varied across the subsequent phases of the intervention with between 13.91% and 46.88% and no clear pattern across all phases of the intervention. From Baseline to the final phase of intervention, there was slight decrease in her responsiveness (38.98% to 35.90%).

**Summary of changes in sequentially associated actions.** All children and caregivers exhibited joint attention responses to their social partners during a higher percentage of opportunities by the end of intervention than in Baseline, with the exception of caregiver 5 who exhibited joint attention responding at a high level in Baseline. All children and caregivers also displayed increasing responsiveness, with no more than one exception, across adjacent phases, with the exception of dyad 5. In general, children displayed a greater increase in percentage of opportunities in which joint attention responding was exhibited than caregivers, with the exception of dyad 2. In addition to the final phase, the percentage of opportunities in which joint attention occurred were high in the Turn-Taking phase, particularly on the part of caregivers.
Table 4-5

Percentage of Partner’s Gaze Alternations followed by Joint Attention Response

<table>
<thead>
<tr>
<th>Dyad</th>
<th>Phase</th>
<th>BL</th>
<th>FF</th>
<th>TT</th>
<th>RJA</th>
<th>IJA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Child</td>
<td>4.84</td>
<td>10.04</td>
<td>16.39</td>
<td>17.67</td>
<td>35.79</td>
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<td></td>
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<td>25.45</td>
<td>40.30</td>
</tr>
<tr>
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<td>13.85</td>
<td>19.19</td>
<td>15.08</td>
</tr>
<tr>
<td></td>
<td>Caregiver</td>
<td>11.11</td>
<td>24.24</td>
<td>46.55</td>
<td>39.45</td>
<td>57.33</td>
</tr>
<tr>
<td>3</td>
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<td>16.15</td>
<td>15.95</td>
<td>21.97</td>
</tr>
<tr>
<td></td>
<td>Caregiver</td>
<td>25.33</td>
<td>9.33</td>
<td>18.48</td>
<td>19.63</td>
<td>27.27</td>
</tr>
<tr>
<td>4</td>
<td>Child</td>
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<td>31.52</td>
<td>21.49</td>
<td>31.65</td>
</tr>
<tr>
<td></td>
<td>Caregiver</td>
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</tr>
<tr>
<td></td>
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<td>27.56</td>
<td>46.88</td>
<td>13.91</td>
<td>35.90</td>
</tr>
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</table>
Social Validity

Social validity was assessed by having two untrained observers view randomly selected and counterbalanced five-minute video interaction segments from baseline and the final intervention phase (Initiating Joint Attention) for each dyad. The results of these observational ratings are presented below in Table 4-6.

Item 1 “The child shared interest and excitement around objects or events with the caregiver,” most closely approximated the definition of joint attention used for the current study. Both observers indicated a positive change in this item for dyad 1 from “some of the time” to “all of the time,” between baseline and the final phase of intervention. For dyad 2, this item was rated as occurring “all of the time,” at both time points. These ratings suggested that both dyad 1 and 2 appeared to share interest and excitement around objects or events at high levels at both time points. For dyad 3, dyad 4, and dyad 5 both observers rated this item lower during the Initiating Joint Attention phase than during Baseline. While there were decreases for these three dyads, dyads 3 and 4 were still scored at moderate to high levels at both time points. Dyad 5 was the only dyad rated as sharing interest and excitement around objects or events “rarely” during the final phase of the intervention, which represented the perception of a significant counter-therapeutic change from the Baseline assessment.

For item 2, observers rated the appearance of interactions between the caregiver and child. For dyad 1, dyad 2, and dyad 4, this item was rated highly (between “somewhat typical” and “totally typical”) by both observers with no change between Baseline and the final intervention phase. For dyad 3, one observer indicated a positive change from “somewhat typical” to “totally typical” between Baseline and Initiating Joint Attention. This would suggest that dyads 1, 2, 3, and 4 exhibited interactions that appeared somewhat to totally typical at both
time points with positive changes for one of these dyads. For dyad 5, both observers rated this item lower in the final phase of intervention than in Baseline, suggesting that interactions between this dyad appeared less typical by the end of the intervention.

For item 3 “the child visually attended to the caregiver,” both observers indicated a positive change for dyad 1 (from “some of the time” to “most of the time” or “all of the time”). With a consistent rating of “most of the time,” neither observer indicated a change between Baseline and the final phase for dyad 2. For dyad 3, one observer indicated a positive change, while the other indicated a negative change. These data suggested that the children in dyads 1, 2, and 3 appeared to visually attend to their caregivers at moderate to high levels at both time points with some improvements by the end of the intervention. For dyad 4 and dyad 5 both observers indicated negative changes between Baseline and the final phase of intervention. However, dyad 4 was still rated as attending to his caregiver at moderate levels by the end of the intervention, while dyad 5 was rated as “rarely” visually attending to his caregiver, indicating a significant decline.

Item 4 related to the quality of the caregiver and child’s nonverbal communication. For dyad 1 and dyad 2, Observer A indicated an increase between Baseline and the final phase, while Observer B indicated uniformly high performance on this item. For dyad 3 both observers indicated that nonverbal communication was “somewhat typical” at both time points. For dyad 4, one observer indicated a change from “totally typical” to “somewhat typical,” while the other did not indicate a change. These data suggested that for dyads 1, 2, 3, and 4 nonverbal communication was perceived as moderately to highly typical. For dyad 5 both observers indicated a change from “somewhat typical” at Baseline to “neutral” in the final intervention phase, suggesting a decline in perceived quality of nonverbal communication for this dyad.
Item 5 addressed the overall quality of caregiver-child interactions. Both observers indicated an increase in overall quality between Baseline and the final phase of intervention for dyad 1, and uniformly high quality (“excellent”) across time points for dyad 2. For dyad 3, one observer indicated a positive change in interaction quality, while the other indicated a negative change. For dyad 4, one observer indicated a decrease in quality, however all ratings were either “good” or “excellent.” For dyad 5, both observers indicated a decrease in interaction quality from “good” at Baseline to “moderate” during the final phase of intervention. All dyads were rated as having moderate to high levels of overall interaction quality at both time points, with no clear pattern of change across dyads between the two time points.
Table 4-6. Social Validity

<table>
<thead>
<tr>
<th>Item and Dyad</th>
<th>Obs. A</th>
<th>Obs. B</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BL</td>
<td>IJA</td>
<td>BL</td>
</tr>
<tr>
<td>1. The child shared interest and excitement around objects or events with the caregiver:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dyad 1</td>
<td>3.0</td>
<td>5.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Dyad 2</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Dyad 3</td>
<td>5.0</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Dyad 4</td>
<td>4.0</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Dyad 5</td>
<td>5.0</td>
<td>2.0</td>
<td>5.0</td>
</tr>
<tr>
<td>2. Interactions between the caregiver and child appeared:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dyad 1</td>
<td>4.0</td>
<td>4.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Dyad 2</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Dyad 3</td>
<td>4.0</td>
<td>5.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Dyad 4</td>
<td>4.0</td>
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<td>5.0</td>
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<tr>
<td>Dyad 5</td>
<td>5.0</td>
<td>4.0</td>
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<tr>
<td>3. The child visually attended to the caregiver:</td>
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<td></td>
<td></td>
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<tr>
<td>Dyad 1</td>
<td>3.0</td>
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<td>3.0</td>
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<tr>
<td>Dyad 2</td>
<td>4.0</td>
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<td>Dyad 3</td>
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<td>Dyad 4</td>
<td>4.0</td>
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<tr>
<td>Dyad 5</td>
<td>4.0</td>
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<tr>
<td>4. The caregiver and child’s nonverbal communication appeared:</td>
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<tr>
<td>Dyad 1</td>
<td>3.0</td>
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<td>Dyad 2</td>
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<td>Dyad 4</td>
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<tr>
<td>Dyad 5</td>
<td>4.0</td>
<td>3.0</td>
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<tr>
<td>5. The overall quality of the caregiver-child interactions were:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dyad 1</td>
<td>3.0</td>
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<tr>
<td>Dyad 2</td>
<td>5.0</td>
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<td>Dyad 3</td>
<td>3.0</td>
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<td>Dyad 4</td>
<td>4.0</td>
<td>4.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Dyad 5</td>
<td>4.0</td>
<td>3.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

For Items 1 and 3 (1 = Never, 2 = Rarely, 3 = Some of the Time, 4 = Most of the Time, 5 = All of the Time), For Items 2 and 4 (1 = Totally Atypical, 2 = Somewhat Atypical, 3 = Neutral, 4 = Somewhat Typical, 5 = Totally Typical), For Item 5 (1 = Poor, 2 = Fair, 3 = Moderate, 4 = Good, 5 = Excellent), BL = Baseline, IJA = Initiating Joint Attention Phase
Discussion

The purpose of this chapter is to present an overview and interpretation of the results of the present study. It will also clarify the contributions that this study makes to the existing literature as well as its limitations. Finally, conclusions, and recommendations for future research are provided.

Research Question 1

What changes take place in the occurrence of joint attention responding and initiating actions in toddlers with early risk for autism spectrum disorders during the course of a parent-mediated joint attention intervention? Three discrete forms of joint attention related actions (gaze alternations, pointing, and showing) and two transactional joint attention competencies (responding and initiating) were examined for all participating children across the course of the Joint Attention Mediated Learning intervention (JAML; Schertz, et al., 2007). Two general patterns emerged that will shape the discussion of these results. First, all children displayed within phase variability in all measured actions. Second, examinations of the differences between Baseline and the final phase of intervention yielded clearer findings about change or lack thereof, than examinations of changes between adjacent phases. These findings are consistent with the nature of the JAML intervention, which supported caregivers to mediate child learning rather than training children to achieve mastery on specific skills, occurred in natural settings (variable settings, materials, and types of activities) and applied the intervention in a developmental sequence to target theoretical precursor skills prior to joint attention responding,
and finally initiating (Schertz et al., 2007). As a result of these patterns, the primary focus of this discussion will be on the outcomes of the comparison between data from Baseline and the final phase of intervention (Initiating Joint Attention) in order to draw conclusions about changes that occurred by the completion of the intervention.

Gaze alternation occurs when an individual alternates his visual attention between a social partner’s face and a target object or event, and is a necessary component of joint attention. All children, with the exception of child 5, demonstrated moderate to large increases in mean levels of gaze alternation between Baseline and the final intervention phase. This finding suggests that the majority of the children in this study experienced moderate to large improvements in this skill by the time they completed the intervention. This is consistent with previous studies in which children with or at risk for ASD demonstrated gains in their ability to alternate or coordinate their gaze with adults following participation in joint attention interventions (e.g., Kim et al., 2008, Martins & Harris, 2006, Whalen & Schreibman, 2003). These findings are significant due to the fact that visual attention to social partners, and specifically faces, is often atypical or impaired in children with ASD (Bhat, Galloway, and Landa, 2010; Chawarska, Volkmar, Klin, 2010). Child 5’s failure to demonstrate a meaningful increase in gaze alternations and high level of variability between phases was characteristic of his performance across actions. While this child’s profile (available demographic and assessment data) did not look substantially different from the other children in this study, he and his caregiver displayed baseline levels of joint attention related skills that were often higher than the other dyads and then highly variable levels across phases, often differing from the other dyads in Baseline to final phase comparisons. One possibility is that in utero drug exposure either contributed to a diagnosis of ASD or affected the behaviors and interactions of this child,
impacting his responsiveness to the intervention. In utero alcohol and drug exposure have been associated with changes in child emotional regulation (e.g., higher levels of irritability, reactivity, and negative affect; Coles & Platzman, 1997; Eiden, McAuliffe, Kachadourian, Coles, Colder, & Schuetze, 2009), and the quality of caregiver-child interaction patterns and attachments (Goodman, Hans, & Cox, 1999; O’Conner, Kogan, & Findly, 2002; O’Connor, Sigman, & Kasari, 1992). During coding it was anecdotally noted that this child displayed higher levels of negative affect and challenging behavior than other participating children (e.g., anger, frustration, throwing toys at caregiver, hitting caregiver). Additionally it was noted that the caregiver responded to these episodes with frustration (e.g., raising voice, saying “no” repeatedly). Such negative affect and challenging behavior on the part of the child and frustration on the part of the caregiver may have affected the ongoing relationship and transactions of this caregiver-child dyad as well as their responses to the intervention.

Pointing is a developmental skill associated with joint attention (Franco, 2005) which is often impaired in children with ASD (Baron-Cohen, 1989). While one child in this study demonstrated a moderate increase in pointing by the end of the intervention, there was no clear pattern of improvement in pointing across children. There are three potential reasons why pointing may not have increased in this study, while it has improved in other studies of joint attention interventions. First, in comparison to the JAML intervention, the majority of joint attention intervention studies in which children demonstrated improvements in pointing used structured, behaviorally-oriented procedures to directly teach skills such as pointing to participating children (e.g., Taylor and Hoch, 2008, Kasari et al., 2006, Jones et al., 2006). It is possible that this level of direct instruction is required initially to elicit improvement in this skill. Second, the children in this study were younger than children in many of the other studies in
which pointing was targeted. The impairment in pointing in children with ASD appears to change over time in some children (Camaioni et al., 2003) so it is possible that age or developmental level affects the likelihood of observing improvements in this skill. Finally, pointing, particularly for the purpose of sharing interest, is a challenging skill for young children with ASD to acquire (Camaioni, Perucchini, Muratori, Parrini, & Cesari, 2003; Franco, 2005) and one that usually serves an attention-directing (initiating) purpose. As a group, the children in this study displayed smaller improvements in initiating joint attention (a more complex developmental competency) than in responding to joint attention. It is not surprising then, that they might fail to display clear improvements in pointing, an action typically used for the purpose of initiating the sharing of social interest.

Showing, like pointing, is linked to joint attention and typically used in order to direct the attention (initiate) of a social partner (Kidwell & Zimmerman, 2006). Also like pointing, showing did not display a pattern of increase by the end of the intervention across children. Instead, showing occurred at low variable levels across phases. Some of the same reasons that may explain the lack of change in child pointing may also explain the lack of change in child showing in the present study. First, showing is a developmentally based joint attention related skill that is impaired in children with ASD and either may not be enhanced by an intervention with a low level of structure, or may improve further as children progress to later ages or stages of development. Additionally, as an action typically used for initiating or attention-directing purposes, a lack of improvement in this skill is consistent with the relatively low level of change that was seen in the joint attention initiations of the participating children.

Child joint attention responding occurred following the initiation of a joint attention transaction by a caregiver and was characterized by the sharing of interest and excitement around
an external object or event. All children, with the exception of child 5, displayed moderate to large increases in joint attention responding between Baseline and the final phase of the intervention. The findings suggested that the majority of the children in this study experienced moderate to large improvements in their ability to participate in joint attention exchanges with their caregivers by the end of the intervention by responding to their caregivers’ bids for joint attention. This finding is consistent with previous studies, which have reported increases in child joint attention responding following the implementation of joint attention interventions (e.g., Jones et al., 2006; Kasari et al., 2005; Rocha et al., 2007). The lack of improvement displayed by child 5 may relate to a complicating condition, as discussed above.

Child joint attention initiating, the most complex child action assessed in this study, occurred when children initiated joint attention transactions with their caregivers in order to share interest and excitement around an external object or event of their choosing. All children, with the exception of child 3, displayed small to moderate increases in joint attention initiating between Baseline and the final phase of the intervention. This suggests that the majority of the children experienced small to moderate improvements in their ability to initiate joint attention exchanges with their caregivers. This is consistent with previous studies, which have found improvements in initiating joint attention for young children with ASD participating in joint attention related interventions (e.g., Naoi et al., 2008; Vismara and Lyons, 2007). Child 3 did not display an increase in joint attention initiations, but instead a low and slightly variable rate across phases with substantial overlap. This child demonstrated a higher mean rate during Baseline (0.28) than any of the other children (0.02 – 0.08) and may have failed to gain any additional benefit in this competency from participation in the intervention (i.e., ceiling effect).

Across actions, the majority of the children displayed improvements in gaze alternations,
joint attention responding, and joint attention initiating. These are significant findings, which bolster previous findings suggesting that the early and problematic deficit in joint attention can be reduced by early intervention. However, participating children generally did not demonstrate improvements in pointing or showing, possibly suggesting that these skills may require more direct instruction than was provided by this intervention if they are considered essential manifestations of joint attention. Overall, the findings suggest that parent-mediated developmental models occurring in natural settings may produce significant improvements in child joint attention, while supporting caregivers to meet the needs of their children and develop mediated learning skills that can be applied across time, target skills, and developmental levels.

**Research Question 2**

*What changes take place in the occurrence of joint attention facilitating actions (responding and initiating) of caregivers of toddlers at early risk for autism spectrum disorders as they implement a parent-mediated joint attention intervention?* Parallel actions to those assessed for participating children were examined in their caregivers across the course of their participation in the JAML study. These included the three discrete forms of joint attention related actions (gaze alternations, pointing, and showing) and two transactional joint attention competencies (responding and initiating). Additionally, the same two general patterns that characterized the child data, also affected the caregiver data including; 1) within phase variability and 2) the production of more meaningful conclusions by examining changes between Baseline and the final intervention phase. Again, it should be noted that these patterns are consistent with the nature of the JAML intervention and will inform the summary of findings provided in the following discussion. One important difference to note when examining the caregiver data is that caregivers, unlike their children, had presumably mastered all of the joint attention actions
prior to the start of intervention. As a result, it was expected that caregivers would display higher levels of selected actions than their children at Baseline; however, it was unknown whether their production of these actions would change across the phases of the intervention as they became the recipients of (from the IC) and providers of (to their children) mediated learning experiences related to joint attention.

Gaze alternations increased meaningfully between Baseline and the final phase of the intervention for three of the five caregivers (caregiver 2, caregiver 3, and caregiver 4). Those caregivers who did not demonstrate meaningful increases by the final phase of the intervention were those with the highest mean levels of gaze alternations during Baseline. It is possible that this parent-mediated intervention, which promoted caregiver-child engagement both with and without objects, provided caregivers with lower initial levels of gaze alternations with the mediation necessary to increase this action; but was not robust enough to increase it in caregivers already displaying higher levels. Mediated learning has been used in other populations to increase parental responsiveness (Klein, 1996), and the increase in gaze alternations in those caregivers displaying lower initial levels may be evidence of such a change. In the case of dyad 5, it is also possible that caregiver responsiveness was impacted by her child’s in utero drug exposure. Research suggests the quality of caregiver-child interaction patterns and attachments relationships, including caregiver sensitivity and responsiveness, may be negatively impacted by in utero alcohol or drug exposure (Goodman, Hans, & Cox, 1999; O’Conner, Kogan, Findly, 2002; O’Connor, Sigman, Kasari, 1992).

There were no uniform patterns of change in pointing or showing displayed across caregivers between Baseline and the final intervention phase. Some caregivers displayed a lack of meaningful change, while others displayed increases or decreases. It seems possible that
caregiver pointing and showing would increase if they were 1) intentionally being modeled for children learning to use them, or 2) reinforced by children consistently responded to them with joint attention. In the context of the JAML intervention, caregivers were provided with ideas for ways to promote joint attention, but were not specifically directed to use or model particular skills (Schertz, 2005b). Additionally, it is unclear whether the participating children, who did not demonstrate meaningful increases in the use of pointing and showing, were consistently able to comprehend or follow these actions when displayed by their caregivers. It is possible that more explicit instruction to model these skills for children would increase both caregiver and child usage of pointing and showing.

Joint attention responding increased meaningfully for three out of five caregivers between Baseline and the final phase of the intervention. Caregiver 1, caregiver 2, and caregiver 4 displayed large increases in their mean level of joint attention responding by the end of the intervention. Caregiver 3 and caregiver 5 demonstrated increases in their mean level of joint attention responding, however, these changes were not significant due to substantial overlap with Baseline. These two caregivers also displayed higher levels of joint attention responding than the others at Baseline. It is possible that the JAML intervention promoted joint attention responsiveness in caregivers not already displaying a high level of it prior to intervention (i.e., ceiling effect). It is also possible in the case of caregiver 5 that differences in this caregiver action reflected an underlying difference, as discussed above.

Joint attention initiations increase meaningfully for all caregivers, with the exception of caregiver 5, between baseline and the end of the intervention. These increases were large and clear (no overlap) suggesting that caregivers increased their successful initiations of joint attention with their children by the end of their participation in the JAML intervention. The lack
of this finding for caregiver 5 (relatively consistent across other caregivers) may again be related to the potential for in utero drug exposure to have impacted the interactions of this caregiver-child dyad, as discussed previously.

By the end of the intervention, three out of five caregivers increased their rates of gaze alternations and joint attention responses, and four out of five caregivers increased their rates of joint attention initiations. These findings are notable because caregiver joint attention actions are typically not assessed as outcomes of joint attention interventions. However, joint attention is a transactional social-cognitive competency that occurs within the context of the caregiver-child relationship. While caregivers of young children with or at risk for ASD have presumably mastered joint attention competencies, these findings suggest that they can learn to increase their use of these skills in order to promote joint attention in the children who they care for. An increase in caregiver responsiveness to child bids for joint attention may be particularly important considering its potential for reinforcing critical joint attention skills in children who struggle to master them. Finally, these findings suggest that a developmental parent-mediated intervention, which does not direct caregivers to train children in the use of particular manifestations of joint attention (e.g., pointing), can lead to meaningful changes for some caregivers.

**Research Question 3**

*What changes occur in the sequential association between caregiver and child joint attention actions during the course of a parent-mediated intervention for young children at early risk for autism spectrum disorders?* The sequentially associated actions of gaze alternations and joint attention responses were examined in order to determine if there were changes in the percentage of opportunities in which joint attention occurred for participating children and
caregivers. An examination of the percentage of gaze alternations that were followed in temporal proximity (7 seconds) by joint attention responses indicated that all children and caregivers, with the exception of caregiver 5, exhibited joint attention responses following their social partner’s gaze alternations in a higher percentage of opportunities by the end of the intervention than in Baseline. Additionally, all participants, with the exception of dyad 5, also displayed increasing percentages across adjacent phases of the intervention, with no more than one phase exception. This exception most frequently appeared to be the result of a large increase in the Turn-Taking phase. This could suggest that this phase provided a high degree of support for responding to opportunities for joint attention or could be an artifact of coding definitions. In addition to previously discussed differences from other dyads, the divergent findings here for dyad 5 strengthen the case that some idiographic factor, potentially related to the complicating condition of in utero drug exposure, differentiated this dyad from the others in this study.

Across dyads, with only one exception, children demonstrated greater gains (larger changes in percentage of opportunities from Baseline to the final phase) than their caregivers. This finding is consistent with the fact that children were acquiring a new competency (joint attention responding) while caregivers were learning to use this already familiar competency to support their children more effectively.

Overall, the increases in percentage of opportunities in which joint attention responding followed gaze alternations indicate that the majority of caregivers and children increased their responsiveness to their social partners as they progressed through the JAML intervention. These findings are significant because they suggest that in addition to changes in specific caregiver and child joint attention related actions, caregiver and child transactions can improve over the course of a parent-mediated joint attention intervention with both social partners
becoming more responsive to one another.

Social Validity

Social validity was assessed by having untrained observers rate video clips of caregiver-child interactions from Baseline and the final phase of the intervention on items including sharing of excitement and interest, the appearance of interactions, visual attention, nonverbal communication, and overall interaction quality. The ratings tended to be moderate to high at both time points and patterns across dyads did not consistently indicate improvements between Baseline and the final phase of the intervention on any of the items. There are three methodological reasons that could explain the lack of findings in the social validity data. First, the high level of variability across sessions within phases of each dyad seen in the observational data would suggest that one video clip each from Baseline and the final intervention phase was not sufficient to produce a representative sample of interactions for observers to code. Second, observers were undergraduate and graduate level students with experience working with children, but were not parents or teachers, and were not particularly familiar with ASD. It is possible that observers with more experience with young children (i.e., parents or teachers) and with children with ASD may have been able to make more fine-grained assessments about the quality of interactions displayed by the participating dyads. Finally, a 5-point Likert-type scale may not have allowed for sufficient variability or detail in the rating of the selected items.

Limitations

While the researcher found increases in child and caregiver joint attention related actions and the percentage of opportunities in which joint attention occurred, there were a number of methodological limitations that may have had an effect on outcomes. A primary limitation was the small number of data points collected for each dyad in each phase and the fact that stable data
paths were not established between phases. This may have reduced the representativeness of the data within phases, and affected the interpretability of between phase comparisons (Kennedy, 2005; Yoder & Symons, 2010). A larger number of data points per phase could have clarified patterns in the data, particularly considering the high level of variability displayed by participants in targeted actions. Additionally, the small number of sessions coded meant that even with pooling of within phase data, there were not always sufficient data available to enable interpretation of certain statistics. In particular, there were insufficient data to interpret recommended indices of sequential association such as Yule’s Q, which would have produced a clearer answer to Research Question 3 regarding the sequential association between related child and caregiver actions (Yoder & Symons, 2010). The lack of a sufficient number of data points in combination with the high level of variability in the data also likely impacted the outcomes of the assessment of social validity.

More generally, this study used a non-experimental design, which meant that the researcher did not have experimental control and could not draw causal conclusions (Mitchell & Jolley, 2007). Specifically, the researcher did not systematically manipulate the independent variable (the JAML intervention) by applying it to different behaviors and therefore could not establish a functional relation between the intervention and outcomes (Kennedy, 2005).

The small number of participants was also a limitation. While detailed data were collected on the participating dyads, the sample size reduced the external validity of the study (Kazdin, 1982; Kennedy, 2005). In combination with the lack of experimental control, and the high level of variability in the data, the small sample size reduced the generality of the findings (Kennedy, 2005). Additional demographic data and collateral assessment scores could have also aided in the interpretation of the data and the reader’s ability to determine if the participants in
this study shared characteristics with the caregivers and children with whom they work. Another sample related limitation is that one of the dyads may not have been comparable to the others prior to intervention. While a certain degree of variability across participants is anticipated and can add to the robustness of findings, inclusion criteria are intended to ensure that participants are relatively comparable on selected key characteristics. The lack of this comparability may have affected the researcher’s ability to interpret findings and draw clear conclusions across participants (Kennedy, 2005). Finally, treatment fidelity of caregivers’ implementation of skills taught was not obtained for all of the participants in the original study by Schertz et al. (2007). Thus, it is unclear if the caregivers in the current study implemented the parent-mediated intervention with full fidelity. Treatment fidelity data on parents’ implementation of the parent-mediated intervention, if examined across all dyads, could have assisted in the interpretation of findings. Specifically, if caregiver treatment fidelity varied, this could have contributed to differences in outcomes seen across dyads. Conversely, high levels of treatment integrity, would suggest that differences in outcomes were due to factors outside of intervention implementation.

There were also methodological limitations related to the CCJA Coding System. First, the structure of the coding system did not allow for the direct comparison of the related child and caregiver actions of joint attention initiating and joint attention responding. This occurred because these two actions were dependent (i.e., in order to meet the definition of joint attention at least one initiating and one responding action were required). Instead, gaze alternations had to be used as an estimate for opportunities for joint attention in calculations of the percentage of opportunities in which joint attention responding occurred. Finally, interobserver agreement was variable for some actions. While mean levels of agreement were acceptable, there were instances of low interobserver agreement.
Conclusions

The purpose of this study was to examine changes in the occurrence of child and caregiver joint attention actions and the association between child and caregiver actions across the course of a joint attention intervention. The results of this study suggest that toddlers with or at high risk for ASD can experience increases in joint attention related actions and joint attention initiating and responding over the course of a parent-mediated joint attention intervention. This finding was consistent with findings from previous studies which have demonstrated improvements in young children’s joint attention related competencies following intervention (e.g., Kasari et al., 2006; Whalen & Schreibman, 2003; Kim et al., 2008), including those in which caregivers serve as the primary change agents (e.g., Rocha et al., 2007; Schertz and Odom, 2007).

The findings of this study also provided support for the argument that caregivers may experience changes in their use of joint attention related actions as they implement joint attention interventions with their children. This is consistent with the finding from Rocha et al. (2007) in which parents increased their bids for joint attention (joint attention initiations) following intervention. This finding is significant considering that caregiver actions are rarely assessed, perhaps because caregivers are assumed to have mastered these skills. While caregivers may already demonstrate mastery of joint attention actions, it is possible that participation in the implementation of joint attention interventions can support their ability to use such actions and joint attention facilitating strategies more effectively to support their children. The findings from the present study also suggest that such changes may also be possible within developmentally oriented intervention models in which caregivers and children are not trained to use specific joint attention related actions, but rather are provided with support within a mediated learning
framework (Schertz & Odom, 2007). This is significant because such developmentally oriented caregiver-mediated interventions may be more supportive of the caregiver-child relationship than more prescriptive interventions because they can be implemented within and across typical daily routines and activities, and may promote the general responsiveness and competence of caregivers (Klein, 1996).

Finally, the results of this study indicate that both children and caregivers may respond to a greater percentage of opportunities for joint attention over the course of a parent-implemented joint attention intervention. This is consistent with the finding from Rocha et al. (2007) that children responded to a greater proportion of their caregiver’s bids for joint attention following intervention. Transactional theory (Sameroff, 1995) would suggest that children and caregivers mutually influence one another during the course of their interactions and across time. If this is the case, then it seems likely that an intervention aimed at promoting an interactional competency such as joint attention might impact child-caregiver transactional processes; affecting not only the individual actions of the two social partners, but their interactions and relationship as well.

**Recommendations**

The findings and limitations of the present study informed the following recommendations for future research and practical implications in the area of joint attention interventions for young children with or at risk for ASD. First, it is recommended that future research examine larger quantities of observational data using sequential analyses across the course of joint attention interventions. Larger quantities of data would allow for the use of recommended indices of sequential association in order to clarify the transactional relationship between child and caregiver actions (Yoder & Symons, 2010). Additionally, such data could be
collected and examined prior to intervention, during intervention, and following intervention to inform our understanding of how interventions affect child-caregiver transactions over time, and how well these effects are maintained when intervention is withdrawn.

Such assessment may require the refinement of observational measurement tools that make it feasible to collect a greater quantity of data at a relatively fine-grained level of detail in natural settings, enabling examinations of sequential associations and other interaction-related measurements (Yoder & Symons, 2010). Specifically, the CCJA Coding System could be refined to focus on actions most likely to reflect changes in key child outcomes, increase the level of efficiency, and support the analysis of child-caregiver transactions. Initiating joint attention could be redefined to include attempted initiations (i.e., initiations not followed by responses). This would allow for the direct sequential analysis of initiating joint attention and responding joint attention, eliminating the need to use gaze alternations as an estimate of opportunities for joint attention. Joint attention initiating and responding could be marked during first pass coding, then differentiated during second pass coding. This would include the use of indicators for conventional gestures (gaze alternation, pointing, and showing) and/or other facilitating actions (identified through an exploratory analysis). This refined coding system could then be applied to a greater number of videotaped or live child-caregiver interactions sessions from the JAML intervention, as well as other joint attention interventions. This would allow for the analysis of more representative sample of data and the comparison of changes in child and caregiver actions and transactions between interventions.

Additionally, it would be of practical importance for researchers to focus on identifying factors that make caregiver-child dyads more or less likely to benefit from various types of joint attention interventions. Detailed examinations of caregiver and child characteristics in addition
to observational data collected on dyads participating in different joint attention interventions could shed light on which interventions are most likely to be beneficial for dyads with particular characteristics.

The current study would suggest that caregivers may experience changes in their usage of joint attention related actions within the context of joint attention interventions. Additional investigation of these changes could provide insight into the specific impact that caregiver-mediated interventions have on caregivers, as well as potential mechanisms for change in children. Specifically, it would be informative for future studies to examine not only those joint attention actions paralleling those hypothesized to change in children, as was done in the present study, but additional joint attention actions and strategies used to facilitate joint attention development. Strategies and actions that are both intervention related (i.e., part of the intervention, provided to caregivers) and caregiver initiated (i.e., spontaneously produced by caregivers) could be identified and assessed. For example, investigators might examine the use of intervention specific strategies, such as focusing in mediated learning interventions, or training a child to point in behavioral interventions. This would provide outcome data on changes in caregiver behavior, as well as treatment integrity data. They could also examine caregiver generated facilitating actions, such as pairing words and conventional gestures (e.g., pointing while saying “I see a car!”), exaggerating conventional gestures (e.g., slow head turn with gaze alternation), modeling (e.g., showing object to child with look of excitement), drawing attention to objects and faces (e.g., shaking or tapping object, moving object near face), or physical contact (e.g., tapping the child on the hand or shoulder while alternating gaze). This could shed light on the ways in which caregivers spontaneously attempt to promote joint attention, and inform intervention development based on the success of these strategies with
children with ASD.

Future research should also examine the relative importance of different manifestations of joint attention or conventional gestures, such as gaze alternations, pointing, and showing. A deeper understanding of how central various skills are to the development and competent use of joint attention could help to focus and improve the efficiency of both intervention and measurement efforts. Finally, treatment integrity data could be examined in relation to intervention effects on caregivers and children in order to determine what level of integrity is required to achieve the desired intervention effects. Specifically, determining the level of adherence to intervention protocols and competence in implementing intervention components required of caregivers and other interventionists could inform intervention refinement efforts and assist in the interpretation of outcome data.

The present study also had several practical implications. First, it is recommended that joint attention interventions involve primary caregivers in substantive ways. As a competency that typically develops within the context of the child-caregiver relationship (Bruinsma, Koegel, & Koegel, 2004; Sandall, Hemmeter, Smith, & McLean, 2005), and with growing research suggesting the feasibility and potential effectiveness of caregiver-implemented interventions (Kasari et al., 2010; Schertz & Odom, 2007; Rocha et al., 2007), this appears to be a promising avenue for the promotion of joint attention in young children with or at high risk for ASD.

A related recommendation is that caregiver behavior and transactional caregiver-child exchanges are emphasized in addition to specific child skills and competencies when child joint attention is the target of intervention. This could help caregivers understand and play a larger role in their child’s ongoing development of joint attention and other social-cognitive competencies. Finally, it is recommended that interventions for young children with ASD are
implemented early in order to guide children toward more adaptive developmental trajectories, reduce the impact of the core deficits associated with ASD, and promote positive and supportive child-caregiver relationships.
References


use of pointing in autism: Developmental profile and factors related to change. European Psychiatry, 18, 6-12.


Appendices
## Appendix A

### Literature Review Study Characteristics

**Table 2-1**

**Joint Attention Intervention Studies: No Primary Caregiver Involvement**

<table>
<thead>
<tr>
<th>Study (First Author, Date)</th>
<th>Child Particip. (#, Gender, Age, DX)</th>
<th>Setting</th>
<th>Change Agent</th>
<th>Caregiver Role</th>
<th>Design</th>
<th>Intervention Type</th>
<th>Dependent Variable (JA Type)</th>
<th>Measurement</th>
<th>Outcome</th>
<th>Generalization/ Social Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hwang 2000</td>
<td>3M 32-43 mos, autism</td>
<td>University based Early Intervention program</td>
<td>Research Assistants</td>
<td>None</td>
<td>Multiple baseline across partic.</td>
<td>Social Interactive Training</td>
<td>IJA (referential looking, pointing, showing)</td>
<td>Behavioral Observation (supported by observational software)</td>
<td>Increases in IJA</td>
<td>Yes/Yes</td>
</tr>
<tr>
<td>MacDuff 2006</td>
<td>3M 3-5 yr autism</td>
<td>University based Special Education preschool</td>
<td>Researcher Instructor</td>
<td>None</td>
<td>Multiple probe design across partic.</td>
<td>Script &amp; Script fading</td>
<td>IJA (verbal bid for JA, scripted bid for JA, unscripted bid for JA, pointing)</td>
<td>Behavioral Observation (Continuous event and per opportunity measures)</td>
<td>Increases in IJA</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Martins 2006</td>
<td>3M 3-4 yrs autism</td>
<td>University based Special Education preschool</td>
<td>Classroom Staff &amp; Researcher</td>
<td>None</td>
<td>Multiple baseline w/ reversal across partic.</td>
<td>Combined ABA (DTT, time delay) &amp; naturalistic (e.g., child selected materials)</td>
<td>RJA (following adult’s gaze and head turn)</td>
<td>Behavioral Observation (Responses per trial)</td>
<td>RJA increased IJA (not targeted) did not increase</td>
<td>Yes/No</td>
</tr>
<tr>
<td>Taylor 2008</td>
<td>2M 3 &amp; 5 yrs autism</td>
<td>Behaviorally based school program</td>
<td>Researcher</td>
<td>None</td>
<td>Multiple baseline across partic.</td>
<td>ABA (prompting procedures)</td>
<td>RJA (looks, comments) &amp; IJA (point, statement, comment)</td>
<td>Behavioral Observation (Responses per trial)</td>
<td>Increases in IJA and RJA</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>
### Table 2-2

**Joint Attention Intervention Studies: Primary Caregiver as Consultant**

<table>
<thead>
<tr>
<th>Study (First Author, Date)</th>
<th>Child Partic. (#, Gender, Age, DX)</th>
<th>Setting</th>
<th>Change Agent</th>
<th>Caregiver Role</th>
<th>Design</th>
<th>Intervention Type</th>
<th>Dependent Variable (JA Type)</th>
<th>Measurement</th>
<th>Outcome</th>
<th>Generalization Social Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baker 2000</td>
<td>2M 5 yrs autism</td>
<td>University based playrooms Generalization: home and school</td>
<td>Research Assistants as therapists, siblings as play partners</td>
<td>Caregiver interview, survey (to determine ritualistic Interests), Rating (social validity)</td>
<td>Multiple baseline across partic.</td>
<td>Games modified to include ritualistic interest</td>
<td>JA (supported JA, coordinated JA)</td>
<td>Behavioral observation (Interval recording during probes)</td>
<td>Increases in JA</td>
<td>Yes/Yes</td>
</tr>
<tr>
<td>Naoi 2008</td>
<td>1M 4 yrs autism</td>
<td>University based lab (Japan)</td>
<td>Researcher</td>
<td>Caregiver interview to select stimuli</td>
<td>Multiple baseline across partic.</td>
<td>Functional Training (antecedent intervention)</td>
<td>IJA (gaze shift, pointing, physical interaction, vocal response, combination)</td>
<td>Behavioral observation (frequency if IJA following stimulus presentation)</td>
<td>Increases in IJA, including untrained behaviors</td>
<td>Yes/Yes</td>
</tr>
<tr>
<td>Jones 2006</td>
<td>5M 2-3 yrs ASD</td>
<td>Behaviorally based preschool</td>
<td>Teachers</td>
<td>Caregivers identified reinforcers</td>
<td>Multiple baseline probe across behaviors</td>
<td>Combined ABA and naturalistic (DTT and PRT components)</td>
<td>RJA (gaze alternation) IJA (gaze alternation and point)</td>
<td>Behavioral observation (per opportunity recording)</td>
<td>Increases in RJA and IJA</td>
<td>(presented as separate study)</td>
</tr>
<tr>
<td>Kasari 2006</td>
<td>46M 12F 3-4 yrs autism</td>
<td>Behaviorally based EI program</td>
<td>Research Assistants</td>
<td>Mother-child interaction observed (Generaliz), demographics, ADI-R, report on other interventions</td>
<td>Randomized controlled intervention</td>
<td>Combined ABA (prompting reinforcement) and naturalistic (similar to milieu teaching)</td>
<td>RJA &amp; IJA (pointing, showing, giving, coordinated joint looks)</td>
<td>ESCS</td>
<td>Increases in JA (showing, RJA)</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>
Table 2-2 (continued)

**Joint Attention Intervention Studies: Primary Caregiver as Consultant**

<table>
<thead>
<tr>
<th>Study (First Author, Date)</th>
<th>Child Participants (#, Gender, Age, DX)</th>
<th>Setting</th>
<th>Change Agent</th>
<th>Caregiver Role</th>
<th>Design</th>
<th>Intervention Type</th>
<th>Dependent Variable (JA Type)</th>
<th>Measurement</th>
<th>Outcome</th>
<th>Generalization</th>
<th>Social Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kim 2008</td>
<td>10M 3-5 yrs autism</td>
<td>Private practice clinic (Korea)</td>
<td>Therapist</td>
<td>Mothers completed Korean version PDDBI (social validity), observed sessions through TV monitor</td>
<td>Randomized Controlled: Repeated measures comparison design</td>
<td>Improvisational music therapy Compared to Play therapy</td>
<td>Precursor – (eye contact, turn-taking) IJA-low level (eye contact, gaze alternation), high level (pointing, showing), RJA (following a point, gesture)</td>
<td>Abridged ESCS, &amp; Behavioral Observation (precursor only)</td>
<td>Increases in JA greater after IMT, failure to increase higher level JA</td>
<td>No/Yes</td>
<td></td>
</tr>
<tr>
<td>Whalen 2003</td>
<td>3M 1F 4 yrs ASD</td>
<td>University based autism research laboratory</td>
<td>Researcher</td>
<td>Parents used during generalization to assess gen. to untrained adult</td>
<td>Multiple baseline design across participants</td>
<td>Combined ABA and Naturalistic (components of DTT and PRT)</td>
<td>RJA (responding to show, point, gaze shift) IJA (coordinated gaze shift, point)</td>
<td>Unstructured JA Assessment, Structured lab observation (adapted from ESCS) Behavioral Observation</td>
<td>Increases in RJA and IJA</td>
<td>Yes/Yes</td>
<td></td>
</tr>
<tr>
<td>Study (First Author Date)</td>
<td>Child Partic. (#.Gender, Age, DX)</td>
<td>Setting</td>
<td>Change Agent</td>
<td>Caregiver Role</td>
<td>Design</td>
<td>Intervention Type</td>
<td>Dependent Variable (JA Type)</td>
<td>Measurement</td>
<td>Outcome</td>
<td>Generalization</td>
<td>Social Validity</td>
</tr>
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</tr>
<tr>
<td>Jones 2008</td>
<td>2M 2-3 yrs autism, probable ASD</td>
<td>Home and Community</td>
<td>Teacher (concurrent intervention) Parents (1 mother, 1 father)</td>
<td>Co-therapist</td>
<td>Multiple baseline probe across behaviors</td>
<td>Combined ABA and naturalistic (DTT and PRT components)</td>
<td>RJA (gaze alternation) IJA (gaze alternation and point)</td>
<td>Behavioral observation (per opportunity recording)</td>
<td>Increases in RJA and IJA</td>
<td>Yes/ Presente d as separate study</td>
<td></td>
</tr>
<tr>
<td>Rocha 2007</td>
<td>2M, 1F 26-42 mos autism</td>
<td>University based clinic playrooms Gen: homes</td>
<td>Parents (1 father, 2 mothers)</td>
<td>Primary interventio nist</td>
<td>Multiple baseline across participant pairs</td>
<td>Combined ABA and naturalistic (DTT and PRT)</td>
<td>RJA (coordinated joint attention, joint attention responding) *Caregiver IJA bids</td>
<td>Behavioral observation (interval recording), Unstructured Joint Attention Assessment</td>
<td>Increases in child RJA and caregiver IJA bids</td>
<td>Yes/ Yes</td>
<td></td>
</tr>
<tr>
<td>Salt 2002</td>
<td>14M, 3F M(T) 42.36 mos M(C) 37.67 mos autism</td>
<td>Preschool treatment center for autism</td>
<td>Therapists</td>
<td>Parent training component</td>
<td>Two-group (treatment vs waiting list control) pretest posttest</td>
<td>Social-developmen tal therapeutic, individualized</td>
<td>JA (not defined more specifically)</td>
<td>Abridged ESCS</td>
<td>Treatment group greater increases in JA</td>
<td>No/ No</td>
<td></td>
</tr>
<tr>
<td>Schertz 2007</td>
<td>3M 22-33 mos High risk for autism</td>
<td>Home</td>
<td>Parents (3 mothers)</td>
<td>Primary interventio nist</td>
<td>Multiple baseline across behaviors</td>
<td>Parent-mediated developmenta l (Mediated Learning)</td>
<td>Precursor (focusing on faces, turn-taking), RJA, IJA</td>
<td>Behavioral observation</td>
<td>2 increased all behaviors, 1 increased precursors only</td>
<td>Yes/ Yes</td>
<td></td>
</tr>
</tbody>
</table>

*Caregiver joint attention behaviors measured
### Table 2-3 (continued)

**Joint Attention Intervention Studies: Primary Caregiver as Change Agent**

<table>
<thead>
<tr>
<th>Study (First Author, Date)</th>
<th>Child Particip. (#, Gender, Age, DX)</th>
<th>Setting</th>
<th>Change Agent</th>
<th>Caregiver Role</th>
<th>Design</th>
<th>Intervention Type</th>
<th>Dependent Variable (JA Type)</th>
<th>Measurement</th>
<th>Outcome</th>
<th>Generalization</th>
<th>Social Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vismara 2008</td>
<td>3M 26-38 mos autism</td>
<td>Clinic or home</td>
<td>Researcher Parent</td>
<td>Received training, acted as co-therapists</td>
<td>Reversal design with alternating treatments</td>
<td>PRT &amp; child’s perseverative interests</td>
<td>IJA (gaze alternation, point, show, give, comment)</td>
<td>Behavioral observation (supported by software)</td>
<td>Increases in IJA</td>
<td>Yes/ No</td>
<td></td>
</tr>
<tr>
<td>Yoder 2006</td>
<td>31 M, 5 F 1.8-4.5 yrs ASD</td>
<td>University clinic</td>
<td>Researcher Parent training component</td>
<td>Randomized controlled</td>
<td>RPMT vs PECS</td>
<td>IJA (broad definition)</td>
<td>Abridge ESCS Behavioral Observation, pretreatment IJA predictor differential response</td>
<td>High pretreatment IJA – more ben. from RPMT, low pre. IJA – more ben. From PECS</td>
<td>No/ No</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B

Joint Attention Mediated Learning Intervention Components

Components of the intervention. The intervention protocol includes four developmentally sequenced phases aimed to establish child competency with joint attention. These phases build from developmentally related but less complex skills. Each phase includes two levels. For the first, the parent encourages the child to respond; the second level expects greater child initiation. Parents and interventionists will jointly decide when to move from Level 1 to Level 2 within a phase; however, transition to a new phase will depend on the child having reached criteria on the prior phase.

Phase 1, Focusing on Faces in informed by retrospective infant video studies that compared 12-month-old infants with and without later diagnoses of autism. The greatest difference in those with later diagnoses was their lack of looking at others’ faces (Osterling & Dawson, 1994). Looking at faces is an important component of joint attention – a means for the child to communicate with the parent nonverbally. Typically emerging at around 3 months (McArthur & Adamson, 1996), it is a straightforward concept for parents to understand and facilitate. Activity suggestions include manipulating desired objects close to the parent’s face or moving the parent’s face in and out of the child’s live of vision, taking care to avoid overwhelming the child.

Phase 2, Turn-taking activities begin with imitation of child actions, establishing a rhythm or reciprocal actions, then extending the interaction and varying the routine. Turn-taking requires “give and take” with another person. Parents can follow the child’s lead, imitating child actions to encourage interactive repetitive play (Siller & Sigman, 2002). Combining focusing on faces with turn-taking can set the stage for joint attention.

Phase 3, Responding to Joint Attention is evident when a child follows another’s point or eye gaze, signifying awareness of the partner’s interest in the object. This is apparent as the child exchanges glances between the object and the caregiver’s face. In typical development, infants respond to others’ bids with the help of parent scaffolding (Adamson & Russell, 1999) such as adding a toy to face-to-face play or holding a toy close to the parent’s face while talking to encourage looks between the toy and the
Phase 4, *Initiating Joint Attention* is the final phase. Typically, joint attention is fully consolidated in both responding and initiating forms with increased frequency and length of engagement by age 18 months (Bakeman & Adamson, 1984; Carpenter, et al., 1998). To promote initiating joint attention, the parent responds to the child’s toy play as if it has social intent. Toys with surprise elements can encourage the child to include the parent in the excitement by “showing” the toy to the parent in response to the surprise.

**Initiating Joint Attention: Features**
- Includes social elements
- Child engages in nonverbal “commenting” to “show” object
- Does not include “requesting”, which serves one’s own needs

**NOTE:** The above descriptions constitute a section of the Joint Attention Mediated Learning Model: Intervention Manual (Schertz, 2005a). Formatting reflects original hardcopy version shared with the authors.
Appendix C

Caregiver-Child Joint Attention (CCJA) Coding Manual

Research Questions

The overall goals of the present study are to examine (a) the occurrence of child and caregiver joint attention actions, and (b) the sequential association between child and caregiver joint attention actions across the course of a parent-mediated joint attention intervention for young children with autism spectrum disorders. Specifically, the research questions that will be addressed are:

4. What changes take place in the occurrence of joint attention responding and initiating actions in toddlers with early risk for autism spectrum disorders during the course of a parent-mediated joint attention intervention?

5. What changes take place in the occurrence of joint attention facilitating actions (responding, initiating) of caregivers of toddlers at early risk for autism spectrum disorders as they implement a parent-mediated joint attention intervention?

6. What changes occur in the sequential association between caregiver and child joint attention actions during the course of a parent-mediated intervention for young children at early risk for autism spectrum disorders?

Conducting Coding Sessions

Target video files (all baseline sessions and last three sessions of each intervention phase) will be selected and downloaded to the designated External Hard Drive and from there to the password-protected VCU computer by the student investigator. All study files will be saved to a folder named CCJA within the Documents folder.

- **Open the CCJA Video Coding Checklist** (excel file):
  - Select the Documents folder
  - Select the CCJA folder
  - Select the CCJA Coding Checklist
  - Determine the next video to be coded
  - Check the excel file against the paper printout

- **Open Procoder**:
  - Double click on Procoder icon to open Procoder for Digital Video window
  - Select File
  - Select New
  - Select Observation Data File
  - Under File Name, enter name according to the following naming system:
    - Training data files: t_[video file name]_[coding date as yy.mm.dd]_coder ID (p,s)_[repetition number]
      - Examples: t1.08.04.24_10.01.24_s_2 or
Study data files: [dyad number]_[video file name]_[coding date (yy.mm.dd)]_[coder ID (p, s)]
  o Examples: d1.08.01.09_10.03.21_p or d3.07.12.28_10.04.06_s.
  o Save the Observation Data File:
    ▪ In the CCJA folder, Select the Data Files folder
    ▪ After each completed coding session Save again to Data Files
  o Setting up your coding session
    ▪ In the window that opens, you will see two tabs
    ▪ In the first tab, enter the following session identifying information:
      ▪ Subject ID: Enter dyad ID (t1, t2, d1, d2, d3, d4, d5, or d6)
      ▪ Do not fill out Date, Time, or Location
      ▪ Session Code: Enter the name of the video file and the coding session (e.g., t1.10.03.22_s_2 or d1.10.04.19_p)
      ▪ Date Started and Date Completed are left blank (this information is in the session code)
      ▪ Under Media File click Browse and go to My Documents – CCJA – Videos then select the correct video
      ▪ Under Code File click Browse and go to My Documents – CCJA – and select the most updated coding file (.cod) e.g., CCJA2010.02.23
  o Select the Data tab
    ▪ Click the Media button at the top of the Data box to bring up the video in the Media box
    ▪ Adjust the size of the Data box and Media box so that they are not overlapping and the Media box size is optimized (large enough to see, not so large that the picture becomes distorted/blurred)
    ▪ During coding make sure that the Data box is always selected, not the Media box
    ▪ DO NOT use controls on the Media box
    ▪ Adjust the time column (make it larger) so that there is enough space to see the 8 digit time
    ▪ You will need to use the following to control the video (and some of the data):
      ▪ Play: CTRL + D
      ▪ Stop: CTRL + F
      ▪ Go to Start: CTRL + G
      ▪ Frame Back: F7
      ▪ Frame Ahead: F8
      ▪ Mark: CTRL + E
      ▪ Find/Seek: CTRL + R
      ▪ Replay: CTRL + A
      ▪ Pre-roll and Play: CTRL + B
      ▪ Add/Mark/Stop: CTRL + X
• Three Quarter Speed: F5
• Jump backwards: F6
• To organize your data by time: F12
  
  o To start coding (primary coder):
    ▪ Press Play (CTRL+D) and watch the video until you see the point at which you will begin coding
    ▪ When (a) both child and caregivers faces are in the frame, (b) the intervention coordinator is not in the frame, (c) the caregiver and intervention coordinator are NOT talking), and (d) the camera is relatively steady
    ▪ As soon as you see this point hit Add/Mark/Stop (CTRL+X)
    ▪ The primary coder will write the 8-digit time into the CCJA video coding checklist (so that the secondary coder can begin at the exact same time)
    ▪ Press Play (CTRL + D)
    ▪ Begin coding
    ▪ Code the video one time with minimal stopping
    ▪ Code level 1 (discreet actions)
  
  o To start coding (secondary coder):
    ▪ Enter the exact (8 digit, e.g., XX:XX:XX.XX) start and stop times into the File info tab (under Start time and stop time) and the Data tab (Start time in first row under Time, Stop time in second line under Time)
    ▪ In the Data tab highlight the row with the start time and Seek (CTRL+R) to bring the video to the start time
    ▪ Press Play (CTRL+D)
    ▪ Begin coding
    ▪ Code the video one time with minimal stopping
    ▪ Code level 1 (discreet actions)
  
  o Save coded data files
    ▪ Save the data file again (by clicking Save under File) to the CCJA folder
    ▪ Complete the required portions of the CCJA Video Coding Checklist (excel spreadsheet and printout) corresponding to that video session

Stop and Start Coding Rules
The primary coder will begin a coding session using the Add/Mark/Stop function (CTRL+X) upon the occurrence of ALL of the following the first time they occur in a video: a) both child and caregivers heads are in the frame, b) the intervention coordinator is NOT in the frame, c) the caregiver and intervention coordinator are NOT talking, and d) the camera is relatively steady. The primary coder will record the 8-digit start time in the File Info tab and on the CCJA Tracking Spreadsheet. The secondary coder will copy and paste this 8-digit time in the File Info and Data tabs on her data file.

The primary coder will end a coding session using the Add/Mark/Stop function (CTRL+X) when one or more of the following occurs at or near the end of the video: (a) the child and/or caregiver are out of the frame, (b) the intervention coordinator and parent are talking to one another, (c) the intervention coordinator appears in the video. If none of these conditions occur
and instead the video ends abruptly, use the Add/Mark/Stop function (CTRL+X) at this point.
The primary coder will record the 8-digit end time in the File Info tab and on the CCJA Tracking Spreadsheet. The secondary coder will copy and paste the 8-digit start and stop times to her data file (Data and File Info tabs).

**Coding Definitions**

The coding definitions level provides definitions for each code in the CCJA Coding System. Both caregiver and child actions will be coded. The system will result in the coding of a) conventional joint attention gestures and b) instances of joint attention. The conceptual definition of joint attention that will be used for this study is *the coordination of attention between two social partners to an external object or event using eye gaze and conventional gestures, with the purpose of sharing interest or social engagement* (Bakeman & Adamson, 1984; Schertz & Odom, 2004, 2007; Tomasello, 1995).

Level I of the Coding Definitions portion of this manual describes conventional joint attention actions (gaze alternation, pointing, showing). Level II describes the methods used for assigning specific codes to instances of joint attention. See page 14 for visual representations of the coding scheme.

**Level I**

**Level I Decision Rules:**
1. Code all actions in order of onset of occurrence.
2. For multiple instances or repetitions of gaze alternations or points, code as separate any instances separated by 1 or more seconds (one-one-thousand).
   a. E.g., caregiver alternates gaze, pauses (one-one-thousand) and then alternates gaze again (code as two separate instances of *caregiver - gaze alternation*).
   b. E.g., child points to a picture on a board game, then lifts finger and points to a different picture on the board game (code as two instances of child – point).
   c. Non-E.g., caregiver taps index finger repeatedly in same location with less than one second pause (code as one instance of *caregiver – point*).
3. If child and caregiver actions occur simultaneously, code the caregiver action first.
4. If *gaze alternation* occurs simultaneously with a, *point*, or *show* - code *gaze alternation* first, however, if they occur at separate points in time code in order of onset of occurrence.
5. Actions must be coded based on visual data. While head orientation can be used as an indicator of gaze direction, do NOT code instances in which there is insufficient visual data to make a reasonable assumption about gaze.
6. For all actions: “In an attempt to direct or follow attentional focus” means that an action is a) intentional (the individual initiates the action in a purposeful manner), b) focused (target is clear to observer), c) social (intended to share with social partner), and d) communicative (intended to communicate with social partner).
7. Coding of caregiver and child actions is not contingent (i.e., an interaction does not have to occur in order to code an action). Instead, each social partner’s actions meeting specific definitions are coded whether or not the other social partner responds as anticipated.
8. Target objects or events are objects or events to which either social partner is
attempting to draw or follow the attention of the other social partner. Child and
caregiver body parts (e.g., feet, hands) CAN be considered objects IF they are clearly
the focus of attention and both social partners are capable of viewing them (excludes
faces, head, back, etc.).
9. If a qualifying action is directed at a third person, do not code (e.g., child is
alternating gaze with father who is not primary intervention agent).

Caregiver Actions

Caregiver - gaze alternation. [d] Caregiver alternates gaze (at least one shift) between
child’s face and target object or event in an attempt to direct or follow the attentional
focus of the child. Gaze alternation may start at child’s face or target object/event.
NOTE: Gaze alternations are often subtle and relatively rapid.

Examples:
Caregiver looks at child’s face, looks at ball, and repeats this pattern.
Caregiver looks pointedly at block tower, then looks at child’s face and smiles.
Caregiver looks at child’s face, then shifts gaze to doll.
Caregiver looks discretely from target object to child or vice versa.

Non-Examples:
Caregiver looks at a puppet, looks at the child’s back (child oriented away from
caregiver – not looking at face) then looks back at the puppet.
Caregiver looks at the child, then glances away (unclear what the target of the
gaze shift is).

Caregiver – point. [s] Caregiver extends isolated index finger in direction of object or
event to direct or follow attentional focus of child. Index finger may touch object or not.
Do not code instances when a caregiver “points” with an object other than the index
finger (e.g., crayon). Note: Caregiver finger must be fully in video frame to code. If in
frame, but partially obstructed by an object code, if fully obstructed by object do not
code.

Examples:
Caregiver extends index finger toward a bouncing ball.
Caregiver extends index finger, the tip of which touches a picture card.
Caregiver extends index finger toward the door after the doorbell rings.
Caregiver extends index finger toward own nose and says “nose.”
Caregiver extends isolated index finger to touch paper and taps two or more times
without a pause (code as one point).
Caregiver extends isolate index finger to location on board game, then lifts finger
again and moves to new location on board game (code as two instances of
caregiver – point).
Caregiver using finger to point and depress key on piano.

Non-Examples:
Caregiver holds out object to child (not using isolated index finger).
Caregiver’s finger unintentionally touches object (not intentional).
Caregiver puts index finger to lips to indicate “quiet” (not extending index finger in direction of object or event).
Caregiver extends all fingers straightened toward object (index finger not isolated).
Caregiver touches a board game with a game piece (uses an object to “point”).

**Caregiver – show.** [a] Caregiver uses hand(s) to present object to child for at least 1 second (one-one-thousand) without releasing object, in an attempt to draw child’s attention to object. **Recode Rule:** If caregiver fully releases the object and then picks it up again to begin another show, code caregiver-show again. **Exclusions:** If child is already touching/engaging with object, do not code caregiver-show. If caregiver’s primary purpose is to give object to child, do not code caregiver-show. If object is not clearly visible to child (i.e., hand fully encloses object, or if child’s back is turned), do not code caregiver-show.

**Examples:**
Caregiver extends open palm face up toward child with toy animal in palm.
Caregiver extends colored paper toward child, held in pincer grasp.
Caregiver extends large stuffed animal toward child held in two hands.
Caregiver pushes toy car slowly toward child while continuing to maintain grasp on it.
Caregiver demonstrates drawing action while holding onto crayon.

**Non-Examples:**
Caregiver extends two closed palms face down toward child with toy hidden inside one (visibility exclusion).
Caregiver extends hand holding ball toward child then immediately releases it so that it rolls away (not held out for at least 1 second).
Caregiver pushes toy car toward child, releasing it immediately (not held for 1 second).
Caregiver extends book toward child, whose back is turned (visibility exclusion).
Caregiver gives toy truck to child (give exclusion).

**Child Actions**

**Child - gaze alternation.** [k] Child alternates gaze (at least one shift) between caregiver’s face and target object or event in an attempt to direct or follow the attentional focus of the caregiver. Gaze alternation may start at caregiver’s face or target object/event. NOTE: gaze alternations are often subtle and relatively rapid.

**Examples:**
Child looks at caregiver’s face, looks at ball, and looks back at caregiver’s face, smiling.
Child looks at blocks, then looks pointedly at caregiver’s face.
Child looks at caregiver’s face, then looks at pet cat and says “cat.”
Child looks at stuffed animal, then orients face and eyes toward caregiver.

Non-Examples:
Child looks at caregivers back, then looks at toy car (shift did not occur between object and social partner’s face).
Child looks at caregiver’s face, then glances away (unclear what the target of the gaze shift is).
Child looks at toy, then scans the room, his gaze passing across the caregiver without recognition (not intentional, social, or communicative).

Child – point. [1] Child extends isolated index finger in direction of object or event to direct or follow attentional focus of caregiver. Index finger may touch object or not. Do not code instances when a child “points” with an object other than the index finger (e.g., crayon).

Examples:
Child extends index finger toward a half-hidden toy.
Child extends index finger, the tip of which intentionally touches a puzzle piece.
Child extends index finger toward the door after the doorbell rings.
Child extends index finger toward own ear and says “ee” while looking at caregiver.
Child extends index finger to point and depress piano key.

Non-Examples:
Child puts finger in ear (not intended to be social or communicative).
Child extends all fingers toward puppet (index finger not isolated).
Child unintentionally touches toy car while shifting position to go from sitting to standing (not intentional, social, or communicative).

Child – show. [p] Child uses hand(s) to present object to caregiver for at least 1 second (one-one-thousand) without releasing object, in an attempt to draw caregiver’s attention to object. **Recode Rule:** If child fully releases the object and then picks it up again to begin another show, code child-show again. **Exclusions:** If caregiver is already touching/engaging with object, do not code child-show. If child’s primary purpose is to give object to child, do not code child-show. If object is not clearly visible to caregiver (i.e., hand fully encloses object, or if caregiver’s back is turned), do not code child-show.

Examples:
Child extends open palm face up toward caregiver with toy animal in palm.
Child extends stuffed animal toward caregiver, held in fisted grip.
Child extends large stuffed animal toward caregiver held in two hands.
Child extends action figure toward caregiver held in pincer grasp.

Non-Examples:
Child extends closed palm toward caregiver (visibility exclusion).
Child is oriented away from caregiver and extends hand holding ball (visibility exclusion).
Child extends stuffed animal toward caregiver and then drops it immediately on the ground (object not held for at least 1 second).
Child gives toy top to caregiver (give exclusion).

**Level II: Joint Attention**
This level includes instructions for conducting second pass coding on all potential instances of joint attention. Use the following procedures to code all videos for specific joint attention actions. *Commenting* is used to describe an action performed for the purpose of sharing interest/excitement with another individual around an external object or event. *Requesting* is used to describe an action performed by the child for the purpose of obtaining the assistance of the caregiver to fulfill a need (e.g., obtaining an object, activating an object).

**Identifying Potential Instances of Joint Attention**

1. Following first pass coding of each video you will examine the data file a second time.
2. Ensure that data is properly sorted in time order (F12)
3. Begin at the start time with your cursor in the discrete action column and move down the column in time order.
4. For each instance in which child gaze alternation and caregiver gave alternation (either one may start a sequence) occur within 7 seconds of one another, use the replay function or the play function to watch the sequence one or more times until you are able to determine if the sequence meets the following criteria:
   a. Caregiver and child (either individual can initiate joint attention) both display a gaze alternation (may also display other actions from level I) in reference to the same target object/event within 7 seconds of one another. A brief (less than 1 second) gaze at nontarget object within the gaze alternation between social partner and target object does NOT disqualify the gaze alternation.
   b. Neither individual is displaying negative affect (e.g., frowning, crying, whining, harsh voice within 7 seconds on either side of their gaze alternation).
   c. The function (purpose) of the interaction is to comment (i.e., share mutual interest/excitement in object/event).

   i. **Requesting Exclusion**
      1. Exclude cases in which the child is using gaze alternation in order to request an object or activation of the object from the caregiver (e.g., child wants caregiver to give him toy, child wants caregiver to turn toy on).
      2. Only exclude cases if primary function is clearly requesting
         a. Must be able to see/hear other request-related behaviors (e.g., whining, physical movement toward object, placing caregivers hand on object, verbal requests such as “mommy help me,” trying to grab object)
      d. Both social partners display awareness of the other social partner’s focus
   5. NOTE: This can include instances in which non-physical prompts are used by the...
caregiver to support the gaze alternation. However, EXCLUDE cases in which the child only alternates his gaze because the caregiver makes a statement such as “look at me” or physically guides the child’s face with her hands.

6. If the exchange meets criteria, mark each included caregiver and child gaze alternation using the appropriate joint attention code (see below).

**Level II Decision Rules**

1. Assign a separate joint attention code to each qualifying caregiver and child gaze alternation in a joint attention exchange (e.g., caregiver – gaze alternation [caregiver – initiating joint attention], followed by child – gaze alternation [child – joint attention responding]).

2. Code joint attention actions on the same line (same 8-digit time) as the gaze alternation to which they correspond. However, caregiver and child codes may be reversed in the JA column (e.g., [g] on [k] line and [o] on [d] line) IF:
   a. The order of gaze alternations was clearly incorrect on level 1 OR
   b. The gaze alternation occur within .5 seconds of one another (ALWAYS code caregiver as initiating JA in these instances)

3. A joint attention interaction begins with the first qualifying action (initiation by child or caregiver [see definitions below] that is followed by a qualifying response by the other social partner).

4. A joint attention interaction ends when the joint attention criteria are no longer met (i.e., 5 seconds has elapsed and there has been no qualifying response in the form of a gaze alternation, OR affect is no longer positive, OR the target object/event changes).

5. Joint attention gaze alternations may be separated on the code file by instances of other child and caregiver actions (point, show, focus on face) as long as they meet the criteria for a joint attention sequence.

6. If a joint attention sequence continues but one social partner responds two times in a row, only code the first response. However, the other partner’s subsequent response can be coded.

**Caregiver Actions**

*Caregiver - initiating joint attention.*[g] Any caregiver – gaze alternation in a qualifying interaction (i.e., followed within 7 seconds by a child – gaze alternation to the same target object/event, mutual social awareness, mutual positive affect, commenting function) that begins a joint attention sequence.

*Examples:*
Caregiver alternates gaze from child’s face to stuffed rabbit and back (as the first in a series of gaze alternations between social partners to the rabbit) to express interest
Caregiver alternates gaze from block tower to child’s face and back (as the first in
a series of gaze alternations between social partners to the block tower) to express excitement

Non-Examples:
Following a child – gaze alternation to a toy truck, the caregiver alternates her gaze to the toy truck (not initiating sequence)
Caregiver alternates gaze between child’s face and pet dog, child looks at pet dog (not followed by child - gaze alternation)

**Caregiver – responding joint attention.**[w] Any instance of caregiver – gaze alternation in a qualifying joint attention interaction (i.e., following within 7 seconds of a child – gaze alternation to the same target object/event, mutual social awareness, mutual positive affect, commenting function) that is NOT the first qualifying action in the sequence.

Examples:
Caregiver alternates gaze between ball and child’s face following child’s show and gaze alternation to ball to share interest
Caregiver alternates gaze and says “yes, I see your fire truck” in response to child’s gaze alternation and point to a toy fire truck in order to share child’s excitement

Non-Examples:
Caregiver alternates gaze between musical toy and child’s face (not responding to a qualifying child – gaze alternation)
Caregiver points to the kitchen table, but does not alternate gaze, in response to child’s gaze alternation to the table (no gaze alternation)
Caregiver alternates gaze between child and toy top following a child’s requesting gaze alternation (requesting exclusion)

**Child Actions**

**Child – initiating joint attention.**[h] Any child – gaze alternation in a qualifying joint attention interaction (i.e., followed within 7 seconds by a caregiver – gaze alternation to the same target object/event, mutual social awareness, mutual positive affect, commenting function) that begins a joint attention sequence.

Examples:
Child alternates gaze from caregiver’s face to a slinky and back (as the first in a series of gaze alternations between social partners to the slinky) to share interest
Child alternates gaze from dollhouse to caregiver’s face and back (as the first in a series of gaze alternations between social partners to the dollhouse) to share excitement

Non-Examples:
Following a caregiver – gaze alternation to a stuffed animal, the child alternates his gaze to the stuffed animal (not initiating sequence)
Child alternates gaze between caregiver’s face and pillow, caregiver looks at pillow (not followed by caregiver - gaze alternation)
Child alternates gaze between caregiver’s face and interactive toy to request assistance activating toy (requesting exclusion)

Child – responding joint attention. Any instance of child – gaze alternation in a qualifying joint attention interaction (i.e., following within 7 seconds of a caregiver – gaze alternation to the same target object/event, mutual social awareness, mutual positive affect, commenting function) that is NOT the first qualifying action in the sequence.

Examples:
Child alternates gaze between crayons/paper and caregiver’s face following caregiver’s show and gaze alternation to crayons/paper to express interest
Child alternates gaze and points at a board game in response to caregiver’s gaze alternation and point to the board game to share excitement

Non-Examples:
Child alternates gaze between toy piano and caregiver’s face (not responding to a qualifying caregiver – gaze alternation)
Child points to the window, but does not alternate gaze, in response to caregiver’s gaze alternation to the window (no gaze alternation)

Figure 1. Coding Levels I & II across Time

Time (seconds) 0:00---------0:10----------------0:20-----------------0:30----------------0:40
Level I (discrete actions) ---------d-a--k--ad-kp--------s----kl--d--d----k-------------------------------
Joint Attention ----------------g-----o-----w-o------------------------------------------------
Figure 2: Visual Representation of CCJA Coding System

**Child & Caregiver Actions**

- JA conventional gestures
- Frequency codes
  - First Pass

- Caregiver - Gaze Alternation: [d]
- Caregiver - Point: [s]
- Caregiver - Show: [a]

- Child - Gaze Alternation: [k]
- Child - Point: [l]
- Child - Show: [p]

**Joint Attention**

- Frequency
  - Second Pass

- Caregiver - Initiating: [g]
- Caregiver - Responding: [w]

- Child Initiating: [h]
- Child - Responding: [o]
Appendix D

Joint Attention Mediated Learning Study Coding Definitions
(Original Coding Scheme from Schertz et al (2007) study)

Focusing on Faces (FF)

1. Code all instances in which the child looks at the parent's face (no matter what part of the face).

2. The child’s eyes must be visible to code a look unless it is clear from the position of the child’s and parent’s heads that the child is looking at parent’s face. Both the parent’s and child’s head must be visible to judge whether the child is looking at the parent’s face (exception: if the child is off camera, but the parent clearly indicates that he is looking at her, code as FF).

3. Do not code unless the look to the parent’s face was seen clearly and unambiguously. When in doubt, do not code.

Turn-taking (TT)

1. Child actions:
   a. All of the following occur (notate all):
      i. Child shows playful intent, not just repetitively following parents’ directions.
      ii. Child’s action is contingent on the parent’s action but does not have to be a direct imitation of the parent’s action.
      iii. Child engages repetitively with the parent in predictable sequences.
      iv. Child’s response/initiating is active (e.g., not just passively smiling in response to parent's action).
   b. One or more of the following occur (notate which occur): The child engages with the parent in an intended back-and-forth routine by:
      i. Imitating (copying) a parent’s actions.
      ii. Responding repetitively to a parent’s actions.
      iii. Initiating (beginning) a turn-taking routine.
      iv. Teasing (e.g., child performs a ‘prohibited’ activity as if it were a game.

2. Number of child actions (at least two).
   a. If parent begins the TT routine, child responds with a contingent action more than once.
b. If child begins the routine, he/she repeats the action at least once after parent responds.
c. Code each interval in which at least one child action occurs if it is part of a TT routine.

3. **Span of intervals.**
   a. Child completes full routine (2 actions) in no more than two consecutive intervals.
   b. If the TT routine spans two intervals, code both intervals (intervals in which at least one whole- or part-child action occurred). Notate where first action begins and second ends.

4. **Exclusions.**
   a. Conversations
   b. Following instructions such as "your turn" rather than responding or initiating of child’s own free will
   c. Actions the child takes without consideration of the parent’s action (e.g., the child is oblivious to what is going on around him)
   d. Response to tickling
   e. Open defiance, even if action is repetitive
   f. Ambiguous instances. Do not give credit unless TT was seen clearly and unambiguously. When in doubt, do not code.

**Joint Attention**

1. **Coding decision process**
   a. Consider only those intervals in which FF was observed.
   b. Is either person showing something to the other (i.e., initiating communication about the toy)? If so, go to #3. If not, do not code.
   c. Who is doing the showing, parent or child (to determine whether RJA or IJA)?
   d. Does child exchange looks between object and parent? If so, go to 1.e. If not, do not code.
   e. Does the child indicate social awareness of parent’s mutual interest in the object, showing positive affect? If yes, code as RJA or IJA (depending on #3). If not, do not code.

2. **Exclusions**
   a. Do not code as JA if either the child or parent is soliciting attention for the purpose of giving directions or requesting something. However, the parent saying “look” is OK if the purpose is sharing attention rather than getting the child to do another task.
   b. Do not code if sharing attention is secondary to another purpose.
   c. Ambiguous instances. Do not give credit unless JA was seen clearly and unambiguously. When in doubt, do not code.
3. **Responding to joint attention (RJA)**
   a. The parent draws the child’s attention to an object or event, for example, by
deliberately looking at it pointedly, showing the object by holding it toward the
child, tapping the object, pointing to the object, or commenting on it.
b. The child follows the parent’s eye gaze, point, or object showing, exchanging
looks between the parent and the object as an indication of awareness of their
mutual interaction in relation to the object. The child’s look to the parent’s face is
in relation to the parent’s “showing.”
c. The child shows positive affect or other indication of *social* interest as he/she
interacts with the parent in relation to the object.
d. Code once for each interval in which the child looks at the parent’s face as part of
a RJA encounter.

4. **Initiating joint attention (IJA)**
   a. The child uses alternating looks between the parent and object, pointing, or
showing to draw a parent’s attention to an object for the purpose of sharing
interest. The child’s look to the parent’s face is in relation to the child’s “showing.”
b. The child shows positive affect or other indication of *social* interest in interacting
in relation to the object.
c. Do not code *requesting* behavior in which the child seeks the parent’s aid in
obtaining something he or she wants.
d. Code once for each interval in which the child looks at the parent’s face as part of
an IJA encounter.

Definition of joint attention for this research (responding and initiating): Joint attention is
defined as visually coordinating attention with another person in relation to an object or
event, sharing social interest, and perceiving the partner’s mutual interest. For the
purposes of our intervention, joint attention takes the form of “commenting” as
distinguished from “requesting.”

NOTE: The above definitions constitute a section of the Early Intervention Research Study:
Promoting Joint Attention Coding Handbook (Schertz, 2007). Formatting reflects the original
hardcopy version shared with the authors.
Appendix E

Social Validity Rating Scale

Rating Scale

For each item select the number corresponding to your impression of the video clip you just observed (only consider the most recently viewed clip).

1. The child shared interest and excitement around objects or events with the caregiver:

<table>
<thead>
<tr>
<th>Never</th>
<th>Rarely</th>
<th>Some of the Time</th>
<th>Most of the Time</th>
<th>All of the Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

2. Interactions between the caregiver and child appeared:

<table>
<thead>
<tr>
<th>Totally Atypical</th>
<th>Somewhat Atypical</th>
<th>Neutral</th>
<th>Somewhat Typical</th>
<th>Totally Typical</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

3. The child visually attended to the caregiver:

<table>
<thead>
<tr>
<th>Never</th>
<th>Rarely</th>
<th>Some of the Time</th>
<th>Most of the Time</th>
<th>All of the Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

4. The caregiver and child’s nonverbal communication appeared:

<table>
<thead>
<tr>
<th>Totally Atypical</th>
<th>Somewhat Atypical</th>
<th>Neutral</th>
<th>Somewhat Typical</th>
<th>Totally Typical</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

5. The overall quality of the caregiver-child interactions were:

<table>
<thead>
<tr>
<th>Poor</th>
<th>Fair</th>
<th>Moderate</th>
<th>Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
# Appendix F

## Child and Caregiver Actions within and across Phases

<table>
<thead>
<tr>
<th>Table 4-1</th>
<th>Discrete Child Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Child Gaze Alternation</strong></td>
<td><strong>Phase</strong> (Phase Comparison)</td>
</tr>
<tr>
<td>Child 1</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>Percentage Overlap</td>
</tr>
<tr>
<td>Child 2</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>Percentage Overlap</td>
</tr>
<tr>
<td>Child 3</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>Percentage Overlap</td>
</tr>
<tr>
<td>Child 4</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>Percentage Overlap</td>
</tr>
<tr>
<td>Child 5</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>Percentage Overlap</td>
</tr>
</tbody>
</table>

## Child Point

| Child 1 | Mean | 0.33 | 0.00 | 0.56 | 0.26 | 0.59 |
| | Range | 0.10-0.78 | 0.00-0.00 | 0.49-0.60 | 0.17-0.33 | 0.45-0.71 |
| | Percentage Overlap | (0.00) | (0.00) | (0.00) | (100.00) | (100.00) |
| Child 2 | Mean | 1.14 | 0.54 | 0.97 | 1.04 | 2.63 |
| | Range | 0.00-1.17 | 0.00-1.10 | 0.47-1.95 | 0.46-1.99 | 1.27-3.63 |
| | Percentage Overlap | (100.00) | (66.67) | (33.33) | (33.33) | (0.00) |
| Child 3 | Mean | 0.58 | 2.07 | 0.66 | 0.77 | 0.74 |
| | Range | 0.14-1.10 | 0.35-3.17 | 0.43-0.82 | 0.20-1.63 | 0.39-1.25 |
| | Percentage Overlap | (33.33) | (100.00) | (33.33) | (100.00) | (66.67) |
| Child 4 | Mean | 0.15 | 0.22 | 0.18 | 0.84 | 0.77 |
| | Range | 0.00-0.67 | 0.00-0.58 | 0.00-0.37 | 0.35-1.39 | 0.29-1.34 |
| | Percentage Overlap | (100.00) | (100.00) | (33.33) | (66.67) | (66.67) |
| Child 5 | Mean | 0.02 | 0.68 | 0.18 | 2.01 | 0.56 |
| | Range | 0.00-0.08 | 0.32-1.00 | 0.00-0.36 | 0.67-2.93 | 0.00-1.20 |
| | Percentage Overlap | (0.00) | (33.33) | (0.00) | (33.33) | (33.33) |
Table 4-1 (continued)
Discrete Child Actions

<table>
<thead>
<tr>
<th>Child Show</th>
<th>Phase (Phase Comparison)</th>
<th>BL (BL-FF)</th>
<th>FF (FF-TT)</th>
<th>TT (TT-RJA)</th>
<th>RJA (RJA-IJA)</th>
<th>IJA (BL-IJA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child 1</td>
<td></td>
<td>0.07</td>
<td>0.11</td>
<td>0.00</td>
<td>0.23</td>
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Stability determined using a 20% stability criterion, within phase data is variable unless stability (S) is indicated. BL = Baseline, FF = Focusing on Faces, TT = Turn Taking, RJA = Responding to Joint Attention, IJA = Initiating Joint Attention.
### Table 4-2: Child Joint Attention

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<th>RJA (RJA-IJA)</th>
<th>IJA (BL-IJA)</th>
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Stability determined using a 20% stability criterion, within phase data is variable unless stability (S) is indicated.

BL = Baseline, FF = Focusing on Faces, TT = Turn Taking, RJA = Responding to Joint Attention, IJA = Initiating Joint Attention
**Table 4-3**

Discrete Caregiver Actions

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<th>Caregiver Gaze Alternation</th>
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<th>RJA (RJA-IJA)</th>
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<th>RJA (RJA-IJA)</th>
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Table 4-3 (continued)
Discrete Caregiver Actions

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Stability determined using a 20% stability criterion, within phase data is variable unless stability (S) is indicated.
BL = Baseline, FF = Focusing on Faces, TT = Turn Taking, RJA = Responding to Joint Attention, IJA = Initiating Joint Attention
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</tbody>
</table>

Stability determined using a 20% stability criterion, within phase data is variable unless stability (S) is indicated.
BL = Baseline, FF = Focusing on Faces, TT = Turn Taking, RJA = Responding to Joint Attention, IJA = Initiating Joint Attention
Vita

Abigail Klass Vo was born on May 29th, 1981 in Fairfax County, Virginia and is an American Citizen. She graduated from Falls Church High School in Falls Church, Virginia in 1999. She received her Bachelor of Arts in Psychology from the University of Virginia in Charlottesville, Virginia in 2005. She completed her Master of Education in Early Childhood Special Education at Virginia Commonwealth University in Richmond, Virginia in 2005. She taught early childhood special education in Richmond Public Schools from 2004 to 2005 and Henrico County Public Schools from 2005 to 2007.