TEACHING RECIPROCAL IMITATION TRAINING TO PARENTS OF CHILDREN WITH AUTISM SPECTRUM DISORDER (ASD) THROUGH COMBINED INTERNET-BASED AND IN VIVO INSTRUCTION

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Children with autism spectrum disorder (ASD) are known to have significant difficulties with imitation observed across settings and situations leading to deficits in pivotal skills necessary for development. Research has shown us that imitation is especially absent for children with autism within naturalistic, play-based routines. Reciprocal Imitation Training (RIT) has emerged as an effective method to teach children with ASD to imitate within these types of situations. Similarly, evidence supports parent-implemented interventions as a reliable way to improve skills in children with ASD. This research study implemented a multiple probe single-subject design across four children with ASD and their parents to examine the effect of practitioner training on parental acquisition of RIT strategies, child imitation, and child social-engagement. Findings support the effectiveness of training parents through a combination of Internet-based and in-vivo instruction. All four parents met the intervention fidelity criterion during training sessions and three maintained their skills during follow up. Rate of spontaneous imitation improved greatly in one participant with moderate improvements in three. Slight increases in duration of social-engagement were observed in three participants with a moderate increase in one. Limitations regarding combining Internet-based and in-vivo instruction and recommendations for future research are discussed.

Keywords: autism, children, imitation interventions, parent training, distance-based instruction.

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PREFACE

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1.0 INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder categorized by levels of severity based on social-communication deficits and patterns of repetitive, rigid, and restrictive behaviors (American Psychiatric Association, 2013). Social-emotional challenges include limited eye contact, joint attention, gesture-language coordination, and failure to develop meaningful relationships. Communication and language problems are also prevalent and include unintelligible, delayed, non-functional, idiosyncratic and repetitive speech (Atwood, 1998; Barnhill, 2001, & Quill, 1995). Challenging behaviors are often present in the form of aggression, self-stimulation, compulsions, and atypical interests that significantly disrupt daily functioning (American Psychiatric Association, 2013). The prevalence rate of individuals diagnosed with an ASD is currently estimated to be 1 in 88, a 78% increase from 2002 (CDC, 2012). One out of every 54 boys in the United States is diagnosed with an ASD, with the rate in Pennsylvania being slightly higher at 1 in 45 (Rice, 2009).

Children with ASD are known to have significant imitation deficits persistent across individuals, settings, and situations (Hobson & Lee, 1999; Rogers, Hepburn, Stackhouse, & Wehner, 2003; Rogers & Pennington, 1991). However, children with ASD who do imitate have been shown to have better positive outcomes in the development of joint attention, play, and language (Curcio, 1978; Dawson & Adams, 1984; Ingersoll, 2008; Ingersoll & Wainer, 2013; Stone & Yoder, 2001).

Imitation in typically developing children is described as the ability to engage in a novel behavior succeeding the presentation of that behavior (Byrne & Russon, 1998; Whiten & Ham, 1992). Others have indicated that in order for a behavior to be considered imitation it must be intentional or meaningful (Baer & Sherman, 1964; Williams, Whiten, & Singh, 2004). The definition of imitation used among many ASD researchers and that will be used throughout this paper consists of: (a) physical movement, (b) behavior immediately following the presentation of a model (i.e., less than 5 seconds), (c) behavior that has formal similarity, and (d) a model that is the controlling variable for an imitative behavior (Cooper, Heron & Heward, 1987).

Imitation serves two functions in early development – it provides opportunities for children to develop novel skills and to participate in meaningful social relationships with others (Uzgiris, 1981). Typically developing children initially learn to imitate during reciprocal interactions (e.g., back and forth games) with their caregivers. Within these exchanges children are exposed to various social behaviors (e.g., eye contact, joint attention, engagement, etc.) leading to the development of imitation and more advanced social skills (Cook & Bird, 2012). Additional social-emotional skills, play, language, and communication, collectively known as collateral skills, have been shown to emerge concurrently with imitation (Meltzoff & Moore, 1977; Nadel, Guérini, Pezé, & Rivet, 1999; Uzgiris, 1981). Further, through imitation of peers, children learn to follow directions and participate in typical daily activities (Stone, Ousley, & Littleford, 1997).

Contrary to typically developing children, those with ASD often lack imitation skills (Sigman, Dijamco, Gratier, & Rozga, 2004; Volkmar, Lord, Bailey, Schultz, & Klin, 2004; Williams et al., 2004). Williams and colleagues (2004) reviewed 124 articles related to autism and imitation. Twenty-one of the 22 studies that met inclusion criteria reported imitation

difficulties in children with ASD with specific documentation of deficits in the replication of simple body movements, facial expressions, and motor behaviors with objects (DeMyer et al., 1972; Receveur et al., 2005; Rogers & Pennington, 1991; Stone et al., 1997). Although it is apparent that such deficits exist in children with ASD, research has demonstrated that as they develop imitation skills, language (Dawson & Adams, 1984; Thal & Bates, 1988), functional communication (Nadel et al., 1999), play skills (Užgiris, 1991), and joint attention (Carpenter, Nagell, Tomasello, Butterworth, & Moore, 1998) emerge simultaneously.

It has been suggested that children with ASD are more likely to imitate behaviors that address the learning function (i.e., meaningful actions with objects or body movements) than behaviors that target the social function (e.g., non-functional movements, non-verbal communication, spontaneous imitation; Rogers, Cook, & Greiss-Hess, 2005). In addition, children with ASD were more likely to engage in imitation when it is specifically elicited in highly structure conditions and are less likely to imitate spontaneously (Ingersoll, 2008). Researchers have hypothesized that higher rates occur in more structured conditions because they are associated with attention following skills (or the learning function of imitation) and are more predictable, while the naturalistic-social condition is associated with social interactions, an area of deficit in children with ASD (Stone, Coonrod, Turner, & Pozdol, 2004). However, some researchers have suggested that children with ASD are more likely to develop spontaneous imitation if interventions are performed within naturalistic conditions that expose the child to novel stimuli and behaviors, because such conditions are more closely related to what they experience in real life. When behaviors presented to children are varied and novel, imitation has been shown to emerge in the absence of explicit reinforcement and training contingencies, requiring the child to select when to imitate without specific environmental cues (Ingersoll,

Schreibman, & Tran, 2003; Rogers, Hepburn, Stackhouse, & Wehner, 2003). Therefore, researchers that study naturalistic intervention approaches have suggested that by teaching in conditions more similar to a child's everyday surroundings within the context of interactions with others, spontaneous generalized imitation across people, situations, toys, and activities will be more likely to occur than in controlled, structured-elicited conditions (McDuffie et al., 2007; Whiten, Brown, & Bråten, 1998).

Social interactions with peers and caregivers provide children with opportunities to observe models, and then imitate novel behaviors. Children with ASD have deficits in imitation; therefore, they miss these learning opportunities and consequently fail to develop the skills that emerge from these social interactions. Although children with ASD have been shown to produce high rates of imitation in "structured-elicited" conditions, these conditions do not represent the naturally occurring, socially motivated circumstances that address the core social-communicative deficits in children with autism. Therefore, it would seem imperative to develop interventions to teach children with ASD to imitate within naturalistic, social conditions as early in life as possible.

1.1 STATEMENT OF THE PROBLEM

Children with ASD have been taught to imitate effectively through several different approaches (e.g., structured-elicited, in vivo modeling, video modeling); however, one approach -- Reciprocal Imitation Training (RIT) -- has more evidence supporting its use than others. Over the past six years, Ingersoll and colleagues (Ingersoll, 2010, 2012; Ingersoll & Lalonde, 2010; Ingersoll et al., 2007; Ingersoll & Gergans, 2007; Ingersoll & Schreibman, 2006; Wainer &

Ingersoll, 2012) and Cardon & Wilcox (2011) have established a wealth of studies demonstrating that imitation can be improved through the use of a naturalistic intervention using both child and adult directed strategies. Nonetheless, only two studies (Ingersoll & Gergans, 2007; Wainer & Ingersoll, 2012) have evaluated training parents to implement RIT. Furthermore, no studies have been conducted using a combination of in vivo and distance-based instruction as the method of delivering training. As the amount of services prescribed for children with ASD early in life are typically limited and many children live in rural areas without frequent access to services, it is necessary for research to be conducted on parent training programs that include a combination of in vivo and distance-based training methods. The present study investigated this combination of methods to teach parents to implement RIT with high fidelity and the extent to which such parent-implemented interventions led to improvements in child imitation and social-engagement.

2.0 LITERATURE REVIEW

The literature reviewed in this chapter explores two areas of research: (1) interventions addressing imitation deficits in children with ASD and (2) training programs to teach parents of children with developmental disabilities to deliver interventions to their children. Each section begins with a brief introduction identifying issues critical to each topic.

2.1 APPROACHES TO IMITATION INTERVENTIONS FOR CHILDREN WITH ASD

Imitation interventions for children with ASD can be categorized into three basic approaches -- structured-elicited, video modeling, and naturalistic. The earliest intervention approaches developed in the 1970s to teach imitation in children with ASD relied heavily on adult-directed strategies, principles of applied behavior analysis (ABA), and instruction in the learning function of imitation, targeting specific rather than spontaneous responses (Lovaas, 1977; Maurice, Green, & Luce, 1996). These so-called structured-elicited interventions (Hobson & Lee, 1999) which are still used in present day programs for children with ASD, are conducted in controlled environments (e.g., sitting at a table in a distraction free environment). The interventions include systematic adult modeling of behaviors and an accompanying discriminative stimulus (S^D; e.g., "do like me"). The learner imitates modeled behaviors and in some cases, an adult prompts a

correct response. Prompts are then faded (i.e., gradual decrease of prompt intrusiveness) as the child's accuracy improves, and reinforcement is delivered contingent on correct responses (Cooper, Heron, & Heward, 1987).

Video modeling is another approach that has been used to teach children with ASD. Play skills (D'Ateno, Mangiapanello, & Taylor, 2003; Reagon, Higbee, & Endicott, 2006), social skills (Maione & Mirenda, 2006), toy construction (Tereshko, MacDonald, & Ahearn, 2010), and self-help skills (Lasater & Brady, 1995) have been taught successfully through observation of video models. Additionally, video modeling has been used to teach children with ASD to socially engage with peers (Nikopoulos & Keenan, 2004) and siblings (Reagon et al., 2006; Taylor, Levin, & Jasper, 1999). In most cases, video modeling includes the child observing a video of a behavior or chain of behaviors. This is followed by the presentation of materials identical to the ones viewed in the video. In some studies, the child was instructed prior to the activity to do what he or she saw in the video (Cihak, Fahrenkrog, Ayres, & Smith, 2010). However, in others, no instructions were provided (LeBlanc et al., 2003). The video modeling approach is based on Bandura's social learning theory, which suggests that children learn to imitate behaviors through modeling, not just personal experiences (Bandura, 1969; Bandura & Walters, 1963).

Intervention approaches that are strongly grounded in naturalistic and/or developmental principles have also been used to teach imitation skills. Geared towards the social aspect of imitation, these interventions seek to elicit spontaneous imitation in naturalistic situations; they differ from the structured-elicited and video modeling approaches because they occur in play-based interactions with toys and materials similar to those in the child's typical environment (McDuffie et al., 2007) rather than in controlled, clinical settings. Additionally, this context is

varied, while the previously described interventions present behaviors systematically with targets determined prior to the intervention (Cardon & Wilcox, 2011).

The use of developmental strategies in naturalistic teaching approaches for young children with ASD is based on the theory that the sequence of imitation learning is similar to that of typically developing children (Maratos, 1982; Uzgiris, 1973). Several examples of these intervention strategies include responsive interaction (e.g., strong affect, animation, and excitement), encouragement of gestures prior to vocal-verbal language, reinforcement of all communication attempts, and adjustment of adult social/language abilities and communicative interactions (Wetherby & Prizant, 2000).

Although developmental strategies are foundational in naturalistic approaches, the principles of ABA, the foundation of the structured-elicited approach, have been incorporated by embedding structured instruction into the child's typical play/activity routines and child initiated interactions (Risley & Hart, 1968). In these approaches child-directed strategies often guide the activity choice but adults prompt and reward a correct response. The adult then continues to teach and systematically reinforces the child until the best response is reached (Kaiser, Yoder, & Keetz, 1992).

Because the approach used in an imitation intervention along with its theoretical underpinnings do not always clearly identify the form of instruction, it is also useful to think about imitation interventions in terms of the extent to which adult-directed and/or child-directed teaching strategies are used. Adult-directed strategies have been defined as practices during which an adult prompts, provides support, or models a behavior to elicit a child's behavior. Strategies that have been described as adult-directed include fading, prompting, or reinforcing behaviors (Odom et al., 2003). Conversely, child-directed strategies have been described as any

interaction during which the child leads the activity or the adult responds to a child's behavior by imitating or discussing what he or she observes. Child-directed strategies used with children with ASD have included child choice, observation, adult description of behaviors, or modeling of a child's behavior without a predetermined response (Risley & Hart, 1968).

2.2 IMITATION INTERVENTION LITERATURE

In order to review the literature evaluating imitation interventions for young children with ASD, a systematic search of literature databases (i.e., Education Resources Information Center, PubMed, PsychARTICLES, and PsychINFO) was conducted. Descriptors and all possible truncations included *autism, pervasive developmental disorder, Autistic Disorder, Asperger's Disorder, PDD, ASD, imitation, modeling, and intervention.* An ancestral search of identified articles and pertinent literature reviews followed the computerized search. An Internet search of Google Scholar and a hand search of the *Journal of Applied Behavior Analysis, Journal of Autism and Developmental Disorders, Journal of Positive Behavioral Interventions, Research in Autism Spectrum Disorders,* and *Autism* were also conducted to identify additional articles.

2.2.1 Inclusion criteria

To be included in this review, articles needed to have: (a) been published in a peer-reviewed journal before August 2012; (b) included participants clinically diagnosed with Autistic Disorder, Asperger's Disorder, Pervasive Developmental Disorder-Not otherwise specified (American Psychiatric Association, 2000) or Autism Spectrum Disorder (American Psychiatric

Association, 2013); (c) included children less than ten years of age; (d) directly measured the effects of at least one dependent variable of the participants' motor imitation, especially gesture or object imitation, pre and post treatment; (e) identified at least one imitation intervention strategy (i.e., independent variable) and measured its effects; and (f) used an experimental design reporting baseline measures. This review focused on the earliest forms of imitation; therefore, the review was restricted to motor imitation, principally gestural and imitation with objects. However, studies that measured vocal or verbal imitation in addition to motor imitation were included. Studies were excluded that involved children with a co-morbid diagnosis (e.g., intellectual disability, epilepsy) or children suspected of (but not officially diagnosed with) having ASD.

2.2.2 Literature search results

The computerized search generated 443 articles, 8 of which met inclusion criteria. An ancestral search of these articles and pertinent literature reviews resulted in the identification of six additional articles meeting criteria. The search revealed 14 studies that met inclusion criteria (Appendix A).

2.2.2.1 Imitation intervention approaches

In this section, the 14 identified studies are categorized into the previously discussed approaches to teaching imitation plus one additional approach (i.e., in vivo modeling). One study (Cardon & Wilcox, 2010) compared two intervention approaches; therefore, this investigation is discussed in two categories. Within each category, the studies are synthesized in terms of the following

aspects: the instructional strategies, dependent variables, measurement procedures, and outcomes. The components the studies are displayed in Appendix A.

(a) Structured-elicited studies

Two studies (Ingersoll, Tran, & Schreibman, 2003; Metz, 1965) used a structured-elicited approach to teach children with ASD to imitate. Both studies delivered imitation targets through discrete trials; they were both designed to address the learning function of imitation. Using a group design, Ingersoll et al. (2003) compared the changes in object imitation of 15 children with ASD to 14 typically developing peers matched for mental age. Metz (1965), on the other hand, taught two seven-year-old children with ASD using a single-subject multiple-baseline design. Both studies used only adult-directed strategies; during treatment conditions an adult provided a discriminative stimulus (S^D), or mand for imitation (e.g., "Do this) and the child imitated (or did not imitate) the modeled behavior.

Ingersoll, Tran and Schreibman (2003) presented three modeled actions with toys with sensory effects and without sensory effects three times to each child. If the child imitated the action the toy was delivered. If the child did not respond, he or she was asked, "What can you do with this?" If the child did not respond within a 20 second period after this request, the toy was removed and another trial was begun.

Metz (1965) interspersed trials that led to no reinforcement with trials that provided token or food reinforcement for correct responses. In this study, behaviors were modeled every 10 seconds in six testing conditions. The conditions were: (a) pre-testing, (b) preliminary training, (c) early testing, (d) intensive training, (e) later tests, and (f) post-testing. In the pre-testing condition, tasks were presented to the child every 10 seconds without reinforcement. During the preliminary training period, tokens were established as rewards through a pairing and fading

procedure (fixed ratio of reinforcement was gradually increased over time). Preliminary training also involved teaching the child to attend to a discriminative stimulus and respond using prompts and fading procedures. In the early testing period, tasks taught in the pre-training period were administered and interspersed with novel tasks. In the intensive training period, the child was trained to imitate responses he answered incorrectly in the early testing period. During the later testing period, novel tasks were presented with a similar structure as the intensive training period. Tokens and food were delivered for correct responses in the preliminary training, early testing, intensive teaching, and later testing period. Finally, in the post-testing period, tasks were presented without tokens or food to test for generalization of skills.

The two structured-elicited studies discussed above both measured imitation with objects; however, different measurement techniques were used. Ingersoll, Tran and Schreibman (2003) scored behaviors on a three-point scale with zero indicating failure to imitate the modeled action and two indicating the child imitated the modeled action exactly. The results showed that children with ASD and typically developing children both had a higher imitation score when modeling actions with sensory toys; however, the results were not significant for typically developing children. On the other hand, children with ASD performed significantly better when the action used a toy with sensory effects than when the toy did not. Metz (1965) measured the frequency of correct responses elicited in each trial, and assessed generalized imitation in the pre and post testing sessions. In this study, the number of elicited behaviors increased throughout intervention sessions and across conditions; improvements in generalized imitation were observed in the post-testing sessions.

These structured-elicited studies demonstrated several important aspects of imitation in children with ASD. First, the Ingersoll study revealed that the children with ASD were more

likely to imitate if the modeled action with a toy had a sensory aspect. Second, Metz (1965) demonstrated that children with ASD generalized imitation skills to novel tasks without reinforcement. Third, both studies provided supporting evidence that children with ASD learn to imitate through structured-elicited conditions involving interspersal of novel tasks within the various conditions and the provision of intermittent reinforcement (Metz, 1965) and repeated presentation of modeled actions with discrete trials (Ingersoll Tran, & Schreibman 2003). Limitations existed, including the use of only two participants in Metz (1965). Without the use of three participants, a threat to internal validity (i.e., experimental control) existed. In addition, Ingersoll, Tran, and Schreibman (2003) noted that several children had received structured behavior training prior to the intervention, which may have affected their imitation performance as the intervention progressed.

(b) Video modeling studies

Video modeling (VM) was used to teach children with ASD to imitate in two studies (Cardon & Wilcox, 2011; Kleeberger & Mirenda, 2010). These two studies used a multiple-baseline design across participants and conditions (Cardon & Wilcox, 2011) and activities (Kleeberger & Mirenda, 2010). Cardon and Wilcox compared the use of Reciprocal Imitation Training (RIT) and VM with six dyads matched for chronological age, autism severity, and language age. Participants in this study were reported to be interested in television and watched a minimum of one hour of television per day. Kleeberger and Mirenda (2010) investigated the use of video modeling with a four-year-old child with ASD. The child's parents and teacher reported that he was capable of attending to television or videotapes for at least 10 consecutive minutes.

Some similarities existed across these two VM studies including the design and overall approach used; however, the independent variables were substantially different. Cardon and

Wilcox (2011) conducted intervention sessions three times per week for three weeks. During the intervention phase, each child was shown the video of an action with an object and a corresponding phrase (e.g., my horse is jumping) modeled by an adult on a small DVD player while sitting at a small therapy table. The children were provided with three opportunities to imitate the video using identical toys; if they did not imitate then the next video was shown. Ten imitations were shown at least two times during each session. After a child imitated 80% of the time he was shown the 10 modeled actions, a novel set of videos were introduced. Kleeberger and Mirenda (2010) conducted a total of 28 sessions, which was three times the number of sessions in Cardon and Wilcox (2011). However, similar to Cardon and Wilcox, the videos were shown using a DVD player. Treatment sessions were conducted in the child's home. Each video included an adult and two children modeling the target actions. The type of modeled actions included novel toy play activities, finger plays, and gross motor songs; the novel toy play was reminiscent of the Cardon and Wilcox tasks.

The video modeling approach in Kleeberger and Mirenda (2010) was comprised of five phases: (a) baseline, (b) video modeling alone, (c) video modeling and verbal highlighting of the models features (VMH), (d) video modeling and highlighting and in vivo prompting and reinforcement (VMHPR), and (e) final phase of VM with generalization probes. During baseline sessions, the child was present while the researcher sang or played with toys. No prompting was provided. In the video modeling alone condition the researcher instructed the child to watch the people in the videotape. She labeled important aspects of the behaviors (e.g., "Look, they are doing the same thing as the teacher!"). Imitation did not emerge as the sessions progressed; therefore, the VMH and VMHPR conditions were added to the intervention. Verbal highlighting was added to the intervention in the VMH condition. The adult provided additional descriptions

as the child watched the video (e.g., Look that person is jumping!). Prompting and reinforcement were added to the VMH condition in the VMHPR condition. In the final phase, video modeling alone was implemented. Kleeberger and Mirenda (2010) reported they had intended to implement the video modeling without prompting, shaping, or reinforcement; however, when the child failed to imitate after three video modeling sessions alone they changed the number of intended conditions.

Both studies assessed behavior change using an observational measure and generalization of imitation skills. Cardon and Wilcox (2011) measured the frequency of accurate motor imitations during sessions. Generalized imitation was assessed using the Motor Imitation Scale (MIS) pre and post intervention and generalization data was collected in a session three weeks post intervention. During the generalization session the children were provided with 10 different opportunities to imitate novel actions modeled by their caregiver and the experimenter. Kleeberger and Mirenda (2010) measured behaviors using a four-point-scale with zero representing no imitation at all and three representing an exact imitation. Generalization was briefly assessed using video of novel actions during session 4, 12, 15, 16, 20, 25, 26 and 27. In sessions 26 and 27 an unfamiliar adult presented in vivo models in a non-training environment.

The outcomes of both studies indicated video modeling was an effective way to teach children with ASD to imitate. All three children in Cardon and Wilcox (2010) imitated by the third intervention session. One child met the criteria to change to a novel set of videos twice during the treatment; the other two children did not. However, rates of imitation increased for all three children as sessions progressed and maintained higher than baseline at follow-up. Additionally, all three children generalized to novel actions presented by the caregiver and experimenter. The outcomes of the VM condition compared to RIT will be discussed later in this

section. In Kleeberger and Mirenda (2010), the child did not imitate until the third phase (VMHPR). After video modeling was paired with highlighting, prompts, and reinforcement, the child's imitation improved; however, it occurred at low rates before these components were added to the intervention. Similar to Cardon and Wilcox (2011), the child generalized to untrained imitative responses; imitation was higher with gross motor than fine motor play. The results of the two studies differed in that Cardon and Wilcox (2011) evaluated maintenance of skills while Kleeberger and Mirenda (2010) did not.

The two studies discussed above demonstrated that video modeling was an effective option for teaching children with ASD to imitate. In these studies, children imitated novel actions with toys, finger plays, and gross motor activities. However, Cardon and Wilcox (2011) demonstrated video modeling alone is adequate as an intervention, while the results of Kleeberger and Mirenda (2010) suggested that video modeling alone is insufficient. In this case, prompts and reinforcement were needed in addition to facilitate imitation improvement. In addition, both studies included children that were identified as being interested in videos and television; therefore, a limitation to both studies may be that the results are not generalizable to the larger population. Further, the child in Kleeberger and Mirenda participated in 15 to 20 hours per week of ABA programming in the home. The learning objectives of this program were not identified in the written report; it is difficult to determine if the results of the intervention were a result of Kleeberger and Mirenda's video modeling approach alone.

(c) In vivo modeling study

Stephens (2008) implemented a musical social milieu (MSM) intervention with four children with ASD under the age of nine using a multiple-probe design across behaviors (i.e., three action-word pairs). The action-word pairs were behaviors the child had imitated during the pre-

test screening. The pairs were identified prior to the intervention condition and were different for each child. Two examples of pairs were: (a) the motor movement of pulling the ear and the vocalization, “pull ear” and (b) the movement of rubbing the arm and the vocalization, “rub arm.”

The MSM intervention was conducted in the teacher’s kitchen area at the children’s school. Treatment sessions occurred one time per day when the children were in attendance at school. The frequency of sessions differed across children ranging from 27 to 69. Four conditions comprised MSM: (a) probe procedure (non-imitating child condition), (b) imitating child’s dance, play and vocalizing (IC condition), (c) imitating child with expansion (ICE condition), and (d) follow-up. The action-word pairs did not involve movements with the musical instruments although they were placed in the training environment for the researcher and child to use during treatment sessions.

During the probe procedure condition, 15 trials were performed. In each trial, the child chose an instrument directly after entering the room. The researcher picked up a different instrument and started a pre-recorded increment of music. Each increment was 30 seconds in length and included 20 seconds of Bob Marley music followed by a 10 second silent pause. Throughout the 20 seconds of music the researcher danced and engaged in *linguistic mapping* (i.e., adult described child’s play) when the children engaged in gross motor movements. When the music paused, the researcher turned towards the child’s face, smiled, looked expectantly, and modeled the action-word pair (e.g., push nose – “push,” touch toes – “toes”). The action-word pair was a four second motor model followed by a verbal model. After the verbal model was presented, the child had four seconds to imitate or not imitate the model. No prompts or reinforcement was provided. Then, a new increment of music started.

In the IC condition the adult used *contingent imitation,* a strategy that involved facing the child and imitating the child's behaviors, for a fifteen second period with a toy identical to the one chosen by the child. The contingent imitation period was followed by five seconds of non-imitation. The researcher indicated that the contingent imitation and non-imitation period was designed to engage the child with the adult. Then five imitation trials were conducted during which the adult modeled one action-word pair. The procedures used by the adult were consistent with those described above in the probe condition. To master an action-word pair, the child had to imitate the adult's behavior in four out of five trials for at least three consecutive sessions. During this condition, if the child did not imitate, the researcher moved to the next trial without providing a corrective prompt. Children that did not meet mastery criteria in the IC condition continued into the ICE condition.

During this ICE condition, five trials of each action-word target were conducted again. In this case, children that imitated either the action or word (but not both) were provided with an additional cue from the researcher (e.g., "Also do" and modeled action) after the incorrect response. If the child still did not imitate, then the researcher said, "do," modeled the action or "say" and said the word. The conditions ended after the child imitated four out of five action-word pairs in three consecutive sessions. Follow-up was implemented with three of the four children. One child had entered summer vacation at the time of follow-up and was not available. The procedures conducted during follow-up were identical to those used in the probe condition.

The dependent variable was the child's imitation of three action-word pairs modeled by the researcher. During intervention sessions, five trials were conducted with each action-word pair. After each trial, an occurrence or non-occurrence of behavior imitated was recorded. The results of the study indicated that spontaneous imitation increased during the MSM intervention

for all children. However, the study fell short of demonstrating experimental control and the effect of the intervention because the children had 52 opportunities to imitate collectively (13 opportunities per child) and overall they met the mastery criteria (4 out of 5 trials for three consecutive days) only eight times. One child improved in spontaneous imitation two times only after entering the ICE condition. On the other hand, a second child replicated positive effects across all conditions and two had rates of spontaneous imitation in the follow-up probe that was higher than the initial probe. However, the parents anecdotally reported that generalization of spontaneous imitation did not extend beyond the intervention condition into the home and community.

Stephens (2008) indicated the purpose the MSM intervention was to teach children with ASD to imitate spontaneously within a naturalistic context to address the social function of imitation. However, aside from contingent imitation and linguistic mapping, the instructional procedures were adult-directed (e.g., prompting procedures, predetermined targets). Experimental control was not demonstrated through the use of the MSM intervention for all participants; those that did show intervention effects did not maintain these effects during the follow-up sessions. Stephens (2008) indicated that limitations existed including the notion that the children may not have understood the changes in conditions thereby producing carryover effects. Additionally, two children required the additional intervention components provided in the ICE condition to imitate action-word pairs. This result supported the notion that contingent imitation alone is not a sufficient strategy to teach imitation.

(d) Naturalistic studies

Nine articles investigated the use of a naturalistic approach to establish imitation skills in children with ASD (Cardon & Wilcox, 2011; Ingersoll, 2010, 2012, Ingersoll & Gergans, 2007;

Ingersoll & Lalonde, 2010; Ingersoll, Lewis, & Kroman, 2007; Ingersoll & Schreibman, 2006; Wainer & Ingersoll, 2012; Walton & Ingersoll, 2012). Two articles discussed behavioral changes in participants in the same study (Ingersoll 2010, 2012); therefore, eight studies (but nine reports) are reviewed below. All naturalistic studies implemented Reciprocal Imitation Training (RIT). This approach was designed to address the social function of imitation and included a combination of naturalistic, developmental, and behavioral principles (Vismara, Young, Stahmer, Griffith, & Rogers, 2009). All studies used a combination of child and adult-directed strategies. Seven of the eight studies conducted sessions in a clinic and created an environment that closely resembled the child's typical daily activities and play routine.

Although the intervention agent, phases, or conditions of the RIT studies varied, the general procedures used in RIT stayed consistent and included child and adult-directed behaviors. The procedures began with child-directed behaviors: (a) adult used contingent imitation; (b) adult imitated appropriate behaviors, enforced rules, and provided consequences (i.e., removal of access to toys contingent upon the presence of maladaptive behaviors); (c) adult used linguistic mapping, a strategy also used (but described using different terminology) in Stephens (2008), involving the adult's continuous description of the child's play actions (e.g., "You're dancing); (d) adult stated simple sentences and phrases repetitively using a slow place and emphasized important words; and (e) adult expanded the child's language by suggesting novel words to add to a phrase (e.g., if the child says "ball" the adult might have said, "that's a large ball" or "you're rolling that ball). Adult-directed activities were implemented after the child expressed the motivation to interact with the adult and frequently engaged in reciprocal interactions.

The adult-directed strategies focused on gradually introducing imitation teaching opportunities into the child-directed activities and were: (a) adult modeled behaviors with the same toy the child had played with earlier; (b) adult repeated the same behavior as the child using exaggerated movements one time per minute while also ensuring the child was attending to stimuli; (c) adult provided a verbal description for the imitative behavior (e.g., ball rolling is described as "roll"), short in length and just above the developmental level of the child; (d) teaching opportunities began with actions that the child was likely to imitate (i.e., actions the child already performed or matched to the developmental level of the child); (e) adult used least to most strategies to prompt the child to imitate; (f) the behavior was modeled three times; (g) adult waited 10 seconds after each discriminative stimulus; (h) adult physically prompted children that did not respond by the third opportunity; and (i) adult used social praise (i.e., verbal praise, physical affection) to reward the child directly following the occurrence of an imitation.

After the child consistently imitated with his or her favorite toys or other stimuli in the environment the adult introduced novel items that he or she had not previously been interested in. The adult increased the variety of play with a favorite toy by presenting the child with multiple novel exemplars of play with the toy and later on mixed novel with old, familiar toys. The focus was placed on providing the child with play schemas that were slightly above his or her developmental level. Finally, the adult transferred the same skills to novel toys by engaging in similar actions the child used with the old toys while playing with new toys (Ingersoll & Dvortcsak, n.d.).

Of the eight studies investigating RIT, seven were single-subject designs, one was a group design, and one was a randomized control trial (RCT). The first investigation of RIT (Ingersoll and Schreibman, 2006) was a single-subject multiple-baseline design with five

children diagnosed with ASD under the age of 45 months. Researchers proposed that the application of RIT techniques would teach children to imitate movements with objects, while concurrently seeking to improve other social-communicative behaviors (i.e., joint attention, language, pretend play). Treatment sessions were conducted three days a week for 10 weeks (i.e., two hours and 40 minutes per week) and were broken into 20 minute segments each. Generalization sessions were conducted at the conclusion of treatment and at the one-month follow-up visit. Dependent variables included object and imitation, language, pretend play, and coordinated joint attention. The Motor Imitation Scale (MIS), Joint Attention Assessment (JAA), and Structured Language Observation (SLO) were used to assess imitation, joint attention, and play pre and post treatment. The results indicated the spontaneous object imitation skills of all children improved during treatment, skills maintained, and imitation was generalized. Although this study provided preliminary evidence towards the efficacy of RIT, limitations existed due to variability in child responding. One child increased in seven behaviors, while another had only small changes in three behaviors. Additionally, the intervention did not increase all targeted social-communication skills. Only two children showed improvement in spontaneous language and pretend play.

Ingersoll and Gergans (2007) further examined the use of RIT with three children diagnosed with ASD under the age of 42 months. This investigation differed from Ingersoll and Schreibman (2006) because it examined the efficacy of parent-implemented RIT. Each parent training session was 30 to 40 minutes, two days a week, for 10 weeks. This study expanded Ingersoll and Schreibman's (2006) investigation by teaching gesture imitation to children in addition to object imitation. However, only one child reached a developmental level during treatment considered by the researchers to be appropriate for gesture imitation training.

Dependent variables included child spontaneous object and gesture imitation and parent use of RIT strategies. The MIS was given pre and post treatment. The results demonstrated imitation skill improvements and maintenance of skills over time for all children except one. In addition, all parents showed an increase in strategy use during treatment; however, one parent did not maintain the skills during follow-up. Due to the small sample size it was difficult to determine if the results would be similar with other children with ASD. In the discussion section of the study write-up, Ingersoll and Gergans (2007) indicated that parents used lower rates of contingent imitation and linguistic mapping when compared to the therapists in Ingersoll and Schreibman (2006). Therefore, it was difficult to determine if the children's responses would have differed significantly had the parents achieved the same rate of linguistic mapping and contingent imitation.

To further explore the application of RIT, a third single-subject investigation by Ingersoll, Lewis, and Kroman (2007) was conducted. RIT was used to improve spontaneous gestures (specifically, descriptive gestures) with five children (34 to 49 months of age) with ASD. Three, 20-minute sessions were conducted two times per week for 10 weeks (total of 2 hours per week). Researchers specifically noted that the behaviors modeled by the therapist included only upper extremities or head movements. Dependent variables were the percentage of total gesture imitation, combined gesture imitation, total spontaneous gesture imitation, and spontaneous combined gesture imitation occurring during one-minute intervals each session. Similar to Ingersoll and Schreibman (2006) and Ingersoll and Gergans (2007), the MIS was used to evaluate child outcomes pre and post intervention. The results showed an increase in the rate of imitative behaviors for all children and overall improvements on the MIS. Additionally, children that were identified pre-treatment with a lower language age used more spontaneous

descriptive gestures than children with a higher language age. Also, children with less language did not support their communication with gestures until trained to imitate gestures; this supports past research efforts showing children with autism do not use gestures to compensate for language deficits (Wetherby & Prutting, 1984). Again, researchers indicated that replication and a larger sample size was necessary to determine the efficacy of this approach and generalize to the general population of children with ASD (Ingersoll, Lewis & Kroman, 2007).

To address limitations existing in past investigations, Ingersoll (2010) published results of a RCT exploring the application of RIT with 21 children (mean age of 41.36 months) to teach spontaneous imitation skills. Collateral gains (e.g., language, joint attention, etc.) were also evaluated during treatment. Eleven children received therapist-delivered RIT three times per week for 10 weeks and 10 children continued with treatment per usual. The MIS and Unstructured Imitation Assessment (UIA) were used to determine the child's imitation ability pre and post treatment. The UIA (McDuffie, Turner, Stone, Yoder, & Wolery, 2007) was designed by the authors of this study to determine the child's ability to spontaneously imitate during unstructured play. All children received object training and nine received gestural training, which were alternated across sessions. The treatment group made significantly greater progress in spontaneous imitation skills on the MIS and UIA than the control group, which supported findings that RIT is an intervention designed to teach spontaneous and generalized imitation in past RIT studies (Ingersoll & Gergans, 2007; Ingersoll, Lewis, & Kroman, 2007; Ingersoll & Schreibman, 2006). One interesting finding of this study was that children that engaged in the highest rates of spontaneous actions with objects pre-treatment had significant imitation improvements post-treatment. Ingersoll (2012) suggested that this result indicated that children engaging in higher rates of spontaneous actions with objects might also have a greater intrinsic

interest in objects, or interact with toys more frequently; therefore, they may find it easier to imitate.

Ingersoll published an additional report in 2012 exploring the effects of RIT on the social functioning of the 21 children in the previous study (and six additional children, three assigned to each group). Specifically, this report investigated child changes in joint attention and parent reported social-emotional skills. A secondary objective was to evaluate the relationship between social functioning improvements and imitation skills. The Early Social Communication Scales (ESCS; Seibert & Hogan, 1982), Bayley Social-Emotional Scale (Bayley, 1969), MIS, and UIA were used to evaluate progress. Results showed the treatment group made significant gains post treatment in joint attention on the ESCS and social-emotional functioning. Children were found to maintain skills at two and three month follow-up sessions.

A modified multiple-baseline design was utilized by Ingersoll and Lalonde (2010) to evaluate changes in the gestures of four children (ages 35 to 41 months) already participating in object imitation training in the previously noted RCT. Researchers also examined the verbal imitation skills of these children, an outcome that had not been addressed in previous studies. All children received object and gesture imitation with alternating treatment sessions, three days per week for one hour, over 10 weeks. The child was prompted to imitate gestures or movements with objects within 10 seconds of the third failed imitation trial, a detail that was not previously included in descriptions of the RIT procedures. The results of this study indicated that the language of three children improved significantly and they generalized skills during follow-up. However, only three children showed gains in language ability as gesture training was introduced, which suggested that the fourth child's language use may have decreased as he became more familiar with the settings and materials. This study was limited because subjects

lacked a true baseline due to the ongoing treatment conducted through the RCT (Ingersoll & Lalonde, 2010).

Cardon and Wilcox (2011) compared two approaches (i.e., RIT and video modeling) to teach six young children with ASD to imitate using a multiple-baseline design. Sessions occurred three times per week for an average of 30 minutes each for 10 weeks. The video modeling procedures and results were described above in a previous section. RIT was implemented in two phases. Phase I (session 1 and 2) consisted of action, gesture, and vocal contingent reciprocal imitation strategies and linguistic mapping. Phase II (session 3 through 12) included introduction of developmentally appropriate novel play actions. The results of comparing RIT to VM indicated VM promoted a more rapid acquisition of skills than in vivo, RIT strategies; however, RIT generalized skills more effectively and maintained skills for a longer duration. Similar to Ingersoll and Lalonde (2010) the researchers reported that children that received RIT might have satiated on the toys provided for treatment. Also all children in the study were identified as having an interest in television, which may have maximized their ability to acquire skills more quickly through video modeling than RIT (Cardon & Wilcox, 2010).

Wainer and Ingersoll (2012) further investigated RIT by evaluating a training program for three parents and four undergraduate students using a multiple-baseline design. The trainees were asked to complete a self-directed, web-based training program. The program presented through a combination of five Internet-based modules. The students completed the modules in the clinic and then used the strategies with four children under the age of five. The parents were asked to complete the modules in their home and use the skills with their own children (also all under the age of five). All four therapists and two parents met high treatment criteria while completing the modules independently. The third parent participated in a post-training session

for an additional 30-minutes in the home. During this period the therapist demonstrated techniques, coached the parent, and observed the parent implementing the skills. An additional 10-minute parent-child play session was recorded post intervention to determine final parent fidelity measure. Two of the three children trained by parents showed substantial improvements in imitation during treatment. After the third parent was coached the rate of imitation in the third child increase drastically.

Walton and Ingersoll (2012) expanded further on RIT implementation by training six siblings of four young children with autism to use these techniques. Siblings completed two, 15 to 30-minute training sessions each week for 10 weeks. They progressed through four phases of treatment that focused on teaching contingent imitation (Phase I), linguistic mapping (Phase II), imitating their sibling, presenting new behaviors for their sibling to imitate, social praise (Phase III), and provision of physical prompts to teach imitation (Phase IV). Six siblings learned to use contingent imitation, but only four maintained the use of this skill after linguistic mapping was taught in Phase II. Sibling acquisition of imitation training techniques (i.e., model, prompt, reinforcement) was variable. Three children with autism increased in their ability to imitate and joint engagement increases were observed across children. The results suggested that some of the children had difficulty remembering to use the initial techniques presented in Phase I and II once the instructional techniques were taught.

The eight studies discussed above demonstrated that RIT, a naturalistic intervention focused on improving the social function of imitation, was an effective option for teaching young children with ASD to imitate. Ingersoll has provided a wealth of evidence supporting this intervention. The research conducted thus far on RIT has shown that it is effective when delivered by therapists (Ingersoll, 2010, 2012, Ingersoll & Lalonde, 2010; Ingersoll, Lewis, &

Kroman, 2007; Ingersoll & Schreibman, 2006), parents (Ingersoll & Gergans, 2007; Wainer & Ingersoll, 2012), undergraduate students (Wainer & Ingersoll, 2012), and in some cases siblings (Walton & Ingersoll, 2012). She also showed that parents and undergraduate students could be trained to deliver RIT with fidelity through in person (Ingersoll & Gergans, 2007) and web-based instruction (Wainer & Ingersoll, 2012). However, one parent in Wainer and Ingersoll (2012) required in vivo coaching to reach high treatment fidelity. Additionally, Cardon and Wilcox (2011) added to Ingersoll's evidence-base by demonstrating that RIT maintained imitation skill improvements longer than other interventions (i.e., video modeling).

The studies discussed previously showed that RIT improved the rates of various types of imitative behaviors (e.g., object, gesture, descriptive, combined). Behavior change was collected through observational and standardized measurements. Six studies used both observational and standardized measures; one used standardized instruments only (Ingersoll, 2010, 2012). The observational methods provided a visual analysis of imitation improvements, while standardized instruments provided an assessment of generalized imitation. The MIS was used in all eight studies to evaluate progress. This tool, designed to measure improvement in 16 elicited targets, was delivered in a structured, discrete trial format. This tool may not have sufficiently captured the imitation improvements within the RIT naturalistic context due to its design. Ingersoll developed the UIA and used this tool in three studies (Ingersoll, 2010, 2012; Ingersoll & Lalonde, 2007) in addition to the MIS. The use of both tools may have more accurately represented improvements in spontaneous imitation for this intervention.

Another point to mention is that Ingersoll provided evidence that improvements in imitation lead to improvements in other collateral areas of development (e.g., play, joint attention, social-emotional skills). This is an important finding because it indicates that an

intervention solely designed to teach children to imitate can promote development in many other areas. In addition, Ingersoll (2012) suggested that children with certain characteristics are more likely to engage in higher rates of imitation post treatment. She found that children that engaged in higher rates of spontaneous actions with toys pre-treatment (i.e., children with a greater interest in toys) had much higher rates of imitation during post-treatment than children with lower rates. Therefore, this indicates that children that enjoy playing with toys or have a greater intrinsic interest in toys may be more likely to learn to imitate.

2.2.2.2 Similarities across imitation studies

Several other similarities existed across studies aside from the evidence that they all improved imitation. First, all 13 studies used multi-component interventions. Nine studies used child and adult-directed strategies and four studies used adult-directed strategies alone. Adult-directed strategies included: (a) presentation of novel behaviors with an instructional cue (e.g., “now you try it), (b) time delay, (c) least to most physical prompting, (d) model prompting, (e) shaping and fading and f) instructional cues (e.g., “you can do the same thing like the video”). Child-directed strategies included: (a) following the child’s lead to determine the item or activity guiding the adult’s behavior, (b) contingent imitation (i.e., adult imitates child behavior), (c) linguistic mapping (i.e., adult describes child play), (d) modeling of child behavior, toy, activity, or instrument choice, and (e) non-contingent access to preferred songs. Second, generalized imitation with novel toys, individuals, and settings was measured using observational measurements (i.e., frequency count, percentage of intervals) or standardized tools (i.e., MIS) in all studies except Stephens (2008). Third, all studies that implemented RIT used the same sequence of procedures. Fourth, 12 of the 13 studies reinforced appropriate behaviors using primary reinforcers, token systems, or social praise.

Another similarity that existed among studies was the measurement of collateral behaviors. Four RIT, one structured-elicited, and the one in vivo study measured behaviors in addition to imitation. Spontaneous language or communicative behaviors were the most frequently measured (Ingersoll, 2010, 2012; Ingersoll & Schreibman, 2006; Ingersoll & Lalonde, 2010). Joint attention (JA) and appropriate or pretend play were the second most frequently measured behaviors (Ingersoll et al., 2003; Stephens, 2008). Other behaviors measured included positive affect with the experimenter, social initiations, object engagements and emotional cognition (Ingersoll, 2003; Ingersoll & Schreibman, 2006; Stephens, 2008).

2.2.2.3 Differences across imitation studies

Although similarities existed across studies in the outcomes, strategies and measurement of behaviors, there were also several differences. First, studies that investigated in vivo modeling and RIT both used adult and child directed strategies to teach imitation; however, the procedural sequence of these strategies differed. RIT used child-directed strategies first to motivate the child to attend and engage with the instructor, and then adult-directed strategies were introduced to teach new skills and fade prompts. No instructional cue specific to the imitative behavior was provided throughout the treatment. Conversely, Stephens (2008) used a child-directed strategy to motivate the child (e.g., choice of instrument) but paired this with an instructional cue (e.g., “do this” or “do like me”). Second, the function of imitation addressed in studies varied. Metz (1965), Kleeberger and Mirenda (2010), and the video modeling group in Cardon and Wilcox (2011) targeted the learning function of imitation. All RIT studies and Stephens (2008) addressed the social function of imitation. Third, while the majority of studies focused on therapist-delivered imitation interventions, two studies investigated training other intervention agents (e.g., parents, undergraduate students).

2.3 TRAINING PARENTS OF CHILDREN WITH DEVELOPMENTAL DISABILITIES

As discussed in the imitation studies presented in the previous section, trained therapists have been the predominant agent delivering the requisite services to child children with ASD. Parent-implemented intervention has been identified as cost-effective, feasible option to supplement services delivered by professionals (Kaiser & Roberts, 2011; Nefdt, Koegel, Singer, & Gerber, 2010). This section will cover the benefits and limitations of training parents of children with disabilities to implement interventions. Second, studies conducted on parent training programs for children with ASD and related disabilities will be discussed. Third, training programs that taught parents to implement imitation interventions for children with ASD will be examined. Finally, a rationale will be provided for future research pertaining to programs focused on teaching parents to implement RIT.

Training programs for parents of children with challenging behaviors and disabilities now have a strong literature supporting their efficacy and effectiveness. Therapist delivered training programs have demonstrated that parents can learn to reach high intervention fidelity in the use intervention techniques with their child, and that positive child outcomes are associated with implementation. Several programs have stronger evidence supporting them including Stepping Stones Triple P, Positive Parenting Program (Whittingham, Sofronoff, & Sheffield, 2006; Whittingham, Sofronoff, Sheffield, & Sanders, 2009), the Parent-Child Interaction Program (Eyberg, 1988), and the Incredible Years Program (Webster-Stratton, 2005). These three programs have been shown to teach parents the skills necessary to use applied behavior analytic strategies leading to decreases in their children's behaviors. Furthermore, parents involved in these programs gained self-confidence, reduced stress levels, and learned to communicate more

effectively with their significant other. Some have suggested that the most promising way to promote positive experiences for children with disabilities is to address the needs of the parents (Murphy, 2011).

2.3.1 Benefits of parent-implemented interventions for children with disabilities

Studies training parents of children with disabilities been shown to decrease stress and anxiety levels (Moes, 1995). Others have demonstrated improved parental self-satisfaction ratings (Smith, Buch, & Gamby, 2000; Tonge et al., 2006). Specific to ASD, parents have been taught to implement interventions reducing problem behaviors (Johnson et al., 2007) and improving adaptive functioning (Anan, Warner, McGillivary, Chong, & Hines, 2008), play skills (Reagon & Higbee, 2009), joint attention (Kasari, Gulsrud, Wong, Kwon, & Locke, 2010), language, communication (Coolican, Smith, & Bryson, 2010; Gillett & LeBlanc, 2007; Green et al., 2010; Koegel, Symon, & Koegel, 2002), and appropriate interactions between peers (Laugeson, Frankel, Mogil, & Dillon, 2009). In addition, parent facilitated outcomes in children with ASD have successfully generalized to other environments, persons, and materials (Anan et al., 2008; Vismara, Colombi, & Rogers, 2009). Furthermore, parents have identified training programs as worthwhile, enjoyable experiences during which they developed a stronger parent-child bond (Kasari, Gulsrud, Wong, Kwon, & Locke, 2010).

In addition to these core benefits, there are other good reasons to engage parents of children with ASD as change agents. Shortly after diagnosis, many parents search for appropriate interventions for their children. Parent training provides them with immediate access to treatments. Knowing how to deliver the interventions allows parents to teach strategies to other professionals or caregivers. In addition, many training programs involve group sessions;

therefore, parents may find a support system of individuals dealing with similar issues. Also, training parents may also reduce the public and familial costs of intensive behavioral treatments. Currently, the estimated cost for treating an individual with ASD up to the age of five is 250,000 dollars (Ganz, 2007).

2.3.2 Disadvantages of parent-implemented interventions for children with disabilities

Although there are significant benefits to parent-implemented interventions for children with disabilities there are also disadvantages. Family dynamics, such as the amount of time parents have to spend with other children or family members, may be disrupted because of the time and energy training requires. Changes in parenting style, the environment, or daily schedule inherent to the intervention approaches may temporarily increase a child's challenging behaviors with a concomitant increase in stress within the family. Some parent-implemented approaches may require the parents to transition from the "caregiver" to the "therapist," a role that some parents may prefer not to take on. In addition, delivering interventions with high treatment fidelity may be difficult for parents to learn and ultimately a child may progress more rapidly with professionally trained interventionists. Finally, if children learn primarily from their parents, generalization of skills and behaviors to other individuals or environments may be limited.

2.3.3 Training methods for parents of children with ASD

Training for parents of children with ASD has been delivered through several different methods including individual and group in vivo and distance-based. This section will describe each method in detail and examine the various strategies included within each approach. Then,

benefits and limitations of each method will be discussed. Finally, the existing research supporting each training method will be presented.

2.3.3.1 Individual in vivo training for parents of children with ASD

Parents have been trained through individualized, in vivo instruction sessions (Drew et al., 2002; Whittingham et al., 2009). Training has occurred in the clinic (Johnson et al., 2007), school (Ingersoll & Dvortcsak, 2006), and the home (Schertz & Odom, 2007). Strategies, including didactic instruction, has been used to inform the individual of factual information, intervention components, and assessment procedures in live instruction training (Schaefer & Briesmeister, 1989). Other strategies used during live training include modeling of proper techniques (Ingersoll & Gergans, 2007), video review of past sessions (Phaneuf & McIntyre, 2007), observation of individual skill practice, coaching during the session, positive or corrective feedback, and questions answer sessions (Ingersoll & Gergans, 2007; Kazdin, 1997; Phaneuf & McIntyre, 2007).

Individual in vivo training delivered in the clinic and home for parents of young children with ASD has been well established in the literature. For example, Kaiser, Hancock, and Niefeld (2000) taught parents of six children under the age of five to implement Enhanced Milieu Training (EMT). EMT was considered a naturalistic method that used environmental arrangements, Responsive Interaction strategies, and other milieu teaching methods. Training strategies used were: (a) didactic instruction, (b) handouts, (c) parent observation of video, (d) trainer feedback, (e) role-play, and (f) demonstrations/examples. During the last 15 minutes of each session, the trainer used prompts and verbal/non-verbal instruction to coach the parent. A procedural fidelity checklist was completed for each session. For homework, the parent was asked to implement EMT strategies in their home. Social validity was assessed through a

satisfaction questionnaire completed by the parent post-intervention. The results indicated five of the six parents reached fidelity mastery criteria of the EMT intervention during the 24 training sessions (averaged 82.7% over the last five sessions) and maintained a higher competency rate in the follow-up period. Parents reported high levels of satisfaction with the treatment. Two 30-minute language samples were collected during each intervention session. For each child, samples were coded for the frequency of spontaneous utterances, mean length of utterance (MLU), and diversity of word vocabulary. Children showed the most improvement in spontaneous rates of targets during the follow-up period. Changes in diversity and MLU were observed for three children and all the children showed improvements during the follow-up period. A limitation existed in this study was the variability of language improvement across subjects.

In another study, Schertz and Odom (2007) trained parents to use another naturalistic intervention improving joint attention in three young children with ASD using a multiple-baseline design. Treatment sessions were conducted in the parents' home environment. Trainers provided didactic instruction and a written description of all strategies. The parents were asked to practice the strategies for one hour per day in the home setting and take anecdotal notes on their experience. Parent notes were reviewed during each weekly session. Qualitative information was logged from the interviews, sessions, parent notes, and audio recordings. Child outcome measures included: (a) looks to face of his or her parent, (b) turn taking, and (c) joint attention skills. Parent measures included procedural fidelity and a social validity questionnaire. Joint attention improvements were demonstrated in the children. However, one limitation of this study was the lack of quantitative data.

Another group of researchers (Chaabane, Alber-Morgan, & DeBar, 2009) used a single-subject multiple-baseline design to examine the effects of training parents to implement the Picture Exchange Communication System (PECS) in the clinic setting. The initial phases of PECS involved teaching the child to locate and exchange a picture icon for access to a desired item or activity. The parents were taught through written explanations, didactic instruction, modeling, practice, and feedback the procedures. Outcome data was collected on fidelity of implementation and the correct and incorrect responses of each child were scored for each trial. All parents met fidelity criteria during the treatment phase and children improved in communication through picture exchange.

Reagon and Higbee (2009) investigated the effect of an intervention training three parents to implement a script fading intervention during play routines. The children were younger than six years of age. The parents were trained to fade prompts to promote the use of independent vocalizations during play with toy sets. Training was delivered to parents through modeling, prompts, and feedback. Parents recorded the frequency of unscripted and scripted initiations of the child. Procedural fidelity of implementation was recorded during sessions and through video. Results indicated all children mastered the scripts during the treatment sessions and all three parents reached fidelity. However, only two of the three children maintained scripts during follow-up.

(a) Benefits of individual in vivo training for parents of children with ASD

There are many reasons why in vivo individualized training is beneficial. Trainers are likely to develop strong relationships with the parent because opportunities are provided for observation of non-verbal communication (e.g., eye contact, gestures sessions, facial expressions), reinforcement of accurate implementation or responses (Duncan Jr, 1969; Haase & Tepper,

1972; Harwood et al., 2011), and generalization of skills. Parents have reported feeling more comfortable during home-based, in vivo sessions (Kahle & Kelley, 1994).

(b) Disadvantages of individual in vivo training for parents of children with ASD

There are several limitations to in vivo parent training. Clinic-based sessions require that the parent travel to and from visits taking time out of their day, thereby, reducing the time available to implement the strategies learned (Kazdin, 1997). The parent may fail to generalize skills because the trainer does not observe, coach, and provide feedback as strategies are implemented in his or her natural environment (Harris, 1984). Home-based sessions may include distractions such as a sibling engaging in problem behavior, a neighbor arriving for an unexpected visit, or a crowded room making learning difficult for some parents.

(c) Summary of in vivo training for parents of children with ASD

Parents have been trained through in vivo sessions to implement effective interventions to improve joint attention, communication, and social skills. It is clear that individual in vivo parent training has many benefits including immediate reinforcement of appropriate behaviors, and an increase in comfort between parents and trainers. There are also limitations to in vivo parent training such as travel time to attend clinic sessions and distractions included in home visits.

2.3.3.2 Group in vivo parent training for parents of children with ASD

Group in vivo training has emerged as another option to deliver training sessions to parents of children with ASD. However, little research has been conducted regarding the effectiveness of training parents in a group format (Anan et al., 2008). Stahmer and Gist (2001) investigated the

use of pivotal response training (PRT) to train 22 parents of children with ASD under the age of five. Participants were placed in two groups (i.e., PRT group v. PRT group and parent support group). Stahmer and Gist, reported the use of the PRT manual, but did not specify other treatment strategies used. Parents were recorded for five minutes before and after the session interacting with their child. Parent outcome measures included treatment fidelity of implementation. Child outcomes were collected through standardized developmental measures (i.e., Bayley, MacArthur Child Development Inventory) and a total frequency count of words. Stahmer and Gist (2001) found treatment group effects to be statistically significant. Parents in the group that received PRT and a parent support group showed more promising results although the children in both groups made gains. Limitations to this study included small sample size and non-randomized design.

In another group training study, Ingersoll and Dvortcsak (2006) investigated the effects of teaching parents to implement a social-communication intervention (through an Oregon Statewide Regional Program Autism Training Sites) with nine families of children with ASD under the age of four. Intervention sessions that were conducted in the school were comprised of individual and group sessions and took place one time per week over nine weeks. Six group sessions were one hour in duration and three individual sessions were 45 minutes. During the group sessions the parent received didactic instruction, video demonstration, therapist modeling and group discussion. Individual sessions included parent observation of trainer modeling, parent practice of strategies with a child, and feedback and constructive critique. Homework sheets were provided each week. Ingersoll and Dvortcsak (2006) evaluated acquisition of skills through a post-quiz regarding intervention techniques and satisfaction survey. Prior to the intervention, the parents received an average score of 75% of post-quiz correct responses. Parents indicated

that they enjoyed the training and that their child improved; however, no direct measurement of child or parent behavior occurred during the treatment sessions. The authors indicated that they intended to demonstrate if the intervention could be implemented easily in a group. Furthermore, in the discussion section, they indicated that the individual training in combination with group sessions were necessary for parental skills acquisition.

(a) Benefits of group in vivo training for parents of children with ASD

There are many reasons why group in vivo training is beneficial to parent learning. Group training allows parents the opportunity to establish relationships and network with others that have similar interests. Specifically, parents of children with ASD may locate new resources, discuss similar problems, or develop friendships with peers. Additionally, as the evidence supporting parent-implemented interventions increases, so does the need for professionals to provide trainings. Therefore, group in vivo training allows for large-scale dissemination of an intervention delivered by one or two trainers.

(b) Disadvantages of group in vivo training for parents of children with ASD

There are also limitations to in vivo group training. When parents are trained in a group they may not have the opportunity to have individualized training or attention, observation of skills, feedback, or question/answer sessions. Group trainings may make it more difficult for all parents to hear and see the presentation (depending on the format), thereby interfering with learning rate. Also, it may be difficult for trainers to conduct reliable treatment fidelity on all participants in a group; therefore, it is difficult to insure the trainees are able to implement strategies accurately and consistently.

(c) Summary of group in vivo training for parents of children with ASD

Although the existing research on in vivo group training for parents of children with ASD is limited, several studies (Ingersoll & Dvortcsak, 2006; Stahmer & Gist, 2001) have been conducted to support this method of instruction. The benefits of group instruction are clear including the ability to disseminate large-scale interventions and a possible support system for parents. However, there are some reasons why group training is limited including the inability for trainers to individualize treatment and gather reliable treatment fidelity data.

2.3.3.3 Distance-based parent training

Another method of training that has emerged as technology has improved is the use of distance-based instruction. Discussion of distance-based instruction is limited in the autism literature; however, professionals in the medical and psychology fields have written extensively on the dissemination of evidence-based practices via these types of methods. Therefore, this section will first discuss distance-based training methods used in other fields, then, the distance-based methods used by parents of children with ASD. Finally, the general benefits and disadvantages to parent training will be explored.

In the medical field, distance-based training methods have included web-based activities, computer-based activities, teleconferences, phone calls, written exercises, and smart phone technology. Web-based activities including face-to-face communications with discussion, coaching, feedback (Baharav & Reiser, 2010; Bert, Farris, & Borkowski, 2008; Wade, Oberjohn, Conaway, Osinska, & Bangert, 2011), online interactive modules (Tate, Wing, & Winett, 2001), email (Burgess, Jackson, & Edwards, 2005), webinars (Ludlow & Duff, 2003), and podcasts (Agrawal, 2007) have all been shown to improve the skills of trainees in the medical field. Additionally, computer-based activities used include downloadable interactive modules (Issa et

al., 2011; Subramanian, Timberlake, Mittakanti, Lara, & Brandt, 2012), video presentations (Donkor, 2010), and online applications (Gould, Boies, & Lewis, 1991). Delivery of teleconferences have been accomplished through video conferencing between trainer and trainee or groups of trainees (Stamm, 1998). To augment web-based, computer based, or telehealth training formats, trainers have called trainees on the phone to provide information, provide feedback, or answer questions (Davis, Burgio, Buckwalter, & Weaver, 2004) Also, written exercises have included workbooks or handbooks that provided intervention-specific information, required feedback on implementation of techniques, or asked the trainee to answer questions addressing previously learned techniques (Brooks, Rose, Attree, & Elliot-Square, 2002). Finally, due to improvements in technology, smart phone applications have been used to disseminate interventions (Holopainen, Galbiati, & Voutilainen, 2007).

Distance-based trainings have been identified in the literature as either self-directed or supported. In self-directed trainings, the trainee is provided with a set of materials to complete these independently. Supported distance-based methods include a combination of self-directed activities and face-to-face contact with another individual (Mamary & Charles, 2003). For example, a parent may be asked to complete a training module independently on the computer in their home followed by a live coaching session observed by the trainer through Skype™ on the Internet, other times a clinic session may be followed by trainee in-home training sessions. Distance-based methods such as telemedicine (Barahav & Reiser, 2010), web-based tutorials (Kobak et al., 2011), and DVD instruction (Nefdt et al., 2010) have been used to effectively train parents of children with ASD.

2.3.3.4 Distance-based training for parents of children with ASD

Baharav and Reiser (2010) compared traditional two week speech language pathology sessions with one time per week in-person clinic sessions followed by a home-based, parent-led, therapist coaching session using a web camera with two children with ASD. The intervention focused on increasing the child's turn taking abilities, initiations, and joint attention using motivation techniques. The parent wore a headset while implementing procedures and the therapist coached and provided feedback. The results of this study showed that the two participants made similar gains in both conditions with the time spent in reciprocal social interactions increasing from 8.8 to 70 percent.

In another study, Kobak et al. (2011) demonstrated the use of a parent tutorial, *Enhancing Interactions*, delivered over the Internet with 23 parents of children under the age of 6. Parents were taught to incorporate communication interventions into the daily interactions of their child. Results were limited to a pre and post test of parent knowledge. All parents demonstrated acquisition of knowledge after module completion; however data were not taken on child communication improvements.

In another study, Nedft and colleagues (2009) examined an intervention self-directed by the parent. Twenty-seven parents were randomly assigned to the pivotal response training (PRT) or control group. The parents progressed though a DVD at their own pace using the PRT manual as a guide. Results indicated parents in the treatment group had high rates of treatment fidelity, rapidly acquired skills, and improved confidence levels post-DVD. Parents reported the program changed the way they interacted with their child and they believed their child tried to communicate more frequently. Additionally, a significant difference was noted between the treatment group and control group in functional verbal utterances.

(a) Benefits of distance-based training

There are many benefits associated with distance-based learning. Web-based activities such as face-to-face chat use interactive teaching techniques similar to traditional clinic-based instruction. Face-to-face chat often includes didactic instruction, video observation, positive or corrective feedback, coaching, or question-answer sessions with the trainer (Wade et al., 2011). Some web-based-based instructional methods automatically track a trainee's behavior providing the trainer immediate feedback on performance and allowing them to address concerns and questions (Learning, 2009; Tate et al., 2001). Both web-based and computer based methods often provide trainees with flexibility to complete activities when they have free time (Khan, 2001). Some computer based methods such as iPod or iPad applications allowing trainees the flexibility to complete activities in distance-based locations other than their home (Brink, 2011). Furthermore, distance-based methods have been shown to overcome barriers in cost, feasibility (Butcher et al., 2011), and access to treatment (Vadheim et al., 2010).

Telehealth conferences can reach a large audience and simultaneously provide access to treatment in rural areas typically plagued by lack of providers (Jennett et al., 2003; Moffatt & Eley, 2010). Email or phone calls are can be used when the previously mentioned methods are unavailable (Sutton, 1995). Overall, distance-based methods reduce travel time and cost, allowing parents more time to implement the strategies they learned during the training and reduce financial constraints.

(b) Disadvantages of distance-based training

Distance-based learning also has limitations. Issues with connectivity can delay delivery or cause difficulty with completion of interventions when using the Web-based, computer, and telehealth conferencing. Trainers also give up the ability to provide immediate technical assistance when sessions are completed in the home environment without trainer support (Harwood et al., 2011). Participation in distance-based learning may require trainees to purchase specialized computer equipment, placing financial strain. Parents may lose motivation to complete activities because of the freedom they have to complete on their own time, increasing the potential for high dropout rates. The freedom to perform tasks during the trainees' own time may also allow for frequent interruptions while completing the activity, making it more difficult for the individual to comprehend the core concepts. Additionally, accountability may be low because the individuals are working more independently than during a typical clinic session. Computer or web-based based distance learning may be intimidating to trainees causing anxiety that detracts from learning opportunity (Tyler-Smith, 2006). Finally, non-verbal communication is eliminated when using email, telephone, workbooks, and handouts, thereby, limiting the trainer-parent bond and taking away the trainers ability to reinforce in vivo through verbal praise (Harwood et al., 2011).

2.3.4 Training parents to implement imitation interventions

The literature supporting the use of distance-based method to train parents of children with ASD is extremely limited; however, the literature that has trained parents to implement imitation interventions is even sparser. As discussed in the previous review of literature in this paper, four different approaches (i.e., structured-elicited, video modeling, in vivo modeling, naturalistic)

have been shown to teach and improve imitation to children with ASD. In the literature, only two studies have investigated parent-implemented imitation interventions (Ingersoll & Gergans, 2007; Wainer & Ingersoll, 2012) using a naturalistic approach. Furthermore, studies have not yet examined parent-implemented imitation interventions using a structured-elicited, video modeling, or in vivo modeling approach to teach imitation.

The two studies (Ingersoll & Gergans, 2007; Wainer & Ingersoll, 2012) reviewed in the previous section, trained three parents to implement RIT. Parents were trained through in vivo individual instruction (Ingersoll & Gergans, 2007) and an Internet-based training module (Wainer & Ingersoll, 2012). Both studies trained parents to use the same RIT techniques; however the sequence differed. Ingersoll and Gergans trained parents through three phases (i.e., reciprocal strategies, object imitation, gesture imitation) and Wainer and Ingersoll (2012) trained parents through five self-paced modules. Parents in Ingersoll and Gergans (2007) received verbal instruction of strategies, demonstration of techniques, practice opportunities and feedback. Conversely, Wainer and Ingersoll (2012) provided in vivo instruction only after a parent failed to reach fidelity. In both studies, a frequency count of child object and motor imitation was recorded. Parent measures differed across studies. Ingersoll and Gergans (2007) measured the frequency of modeling, prompting, reinforcement, contingent imitation, and linguistic mapping. Wainer and Ingersoll (2012) measured the frequency and duration of program utilization and assessed participant knowledge of techniques through a pre-post quiz. Results varied across studies. All parents in Ingersoll and Gergans (2007) reached high fidelity during treatment sessions; however, one parent in Wainer and Ingersoll (2012) required additional coaching in the home after completing the training modules.

2.3.5 Summary of parent training interventions

It is clear that parent-implemented interventions have emerged as a reliable, valid way to decrease challenging behaviors and improve skills in children with ASD. Several different methods have been used to deliver training to parents effectively including individualized in vivo, group in vivo, and distance-based instruction. The literature base strongly supports individualized in vivo instruction, with less literature available on group in vivo and distance-based instruction. In addition, only two studies have been conducted evaluating the effects of parent-implemented imitation interventions.

The aforementioned studies have demonstrated RIT is an effective way to teach children with autism to imitate. RIT was the most commonly studied approach reviewed in this paper; it has been investigated for eight years with 100 children. The majority of the results in RIT studies were favorable. However, only two studies (with a total of six subjects) investigated the effects of training parents to implement RIT. Only one study investigated training parents through distance-based methods; no studies investigated the delivery of parent training through a group format. Furthermore, the results of Ingersoll and Gergans (2007) and Wainer and Ingersoll (2012) suggested that some parents might require extensive in vivo coaching or in vivo coaching combined with the Internet-based instruction to acquire intervention techniques with high fidelity and see improvements in their child.

There are several reasons that warrant further research on the use of RIT. First and foremost, RIT is delivered in a naturalistic environment that promotes learning within situations that are similar to what might occur within the child's typical daily routine. Learning within this environment reportedly supports greater generalization of skills to novel toys, individuals, and locations. Second, the data has provided clear evidence that this type of instruction improves

spontaneous imitation of children with ASD, thereby leading to stronger social skills in the future. Third, although RIT has been rated as socially valid by parents in two studies, more research needs to be conducted on the most effective ways to deliver training. Therefore, this study will combine self-directed Internet-modules and home-based therapist coaching to train parents.

There are several rationales for training parents through a combination of these two methods. The duration of time allotted for early intervention therapy services for children with ASD is often limited because of extensive costs and lack of trained personnel (Hume, Bellini, & Pratt, 2005). Service providers have a brief period of time to train parents to implement interventions with fidelity. Through the combination of distance instruction and home-based coaching, parents will be able to complete informative, didactic portions of training programs independently so that home sessions can focus exclusively on the parent's active use of strategies and therapist coaching. Therefore, parents will have more exposure to training than they would if only in vivo instruction was used. Furthermore, this combination training may decrease the cost of services and provide parents with a way they can independently supplement their learning of evidence-based intervention strategies to use with their children

3.0 METHODS

This chapter will describe the methods used to conduct the present study. First, the purpose and research questions are presented. Second, the target population, selection of participants, and procedures implemented prior to the experiment are discussed. Third, a description of the research design, dependent and independent variables, and procedures used in this study are provided. Details on implementation fidelity, the methods used to measure inter-observer agreement, and social validity wrap up the section.

The purpose of this study was to expand on the existing literature by evaluating the efficacy of training parents using a combination of Internet-based instruction and in vivo coaching to implement an imitation intervention for children with ASD. Specifically, the purpose of this study was two-fold: first, to investigate the effectiveness of training parents through a combination of self-directed Internet-based learning and home-based in vivo coaching to implement RIT with their children, and second, to investigate the effectiveness of RIT to improve imitation and social-engagement in children with ASD. Permission to conduct this study was approved by the University of Pittsburgh Institutional Review Board (Appendix B).

The study addressed the following research questions:

1) What effect does learning RIT through Internet-based instruction and in vivo coaching have on the frequency of parental use of RIT strategies in play sessions with their children with ASD?

2) To what extent do parents maintain RIT strategies several weeks after implementation of the intervention?

3) To what extent do parents implement the RIT strategies with fidelity when they learn through a combination of Internet-based instruction and in vivo coaching?

4) What effect does parent-implemented RIT have on motor imitation and social engagement in children with ASD?

5) What effect does learning to implement RIT by combining Internet-based instruction with in vivo coaching have on the stress of parents of children with ASD?

3.1 TARGET POPULATION AND SELECTION

3.1.1 Recruitment Procedures

Participants were recruited from the clientele of a local infant/toddler service provider and local behavioral health agency. After securing permission from the director, professionals who work for the agency (e.g., speech language pathologists, occupational therapists, behavior consultants, etc.) contacted parents and asked if they would like to participate in the study. Parents that expressed interest provided permission to be called by the researcher. The researcher contacted them by telephone, provided the parents with details of the study (Appendix C), confirmed their participation, and scheduled a screening with the family.

Participants were included in the study if they met the following criteria: (a) the child was diagnosed with ASD according to the DSM-IV (American Psychiatric Association, 2000) or DSM-V (American Psychiatric Association, 2000), (b) the child was less than five years of age, and (c) the parent had not received structured parent training in the past. Children were excluded

from the study if: (a) the parent was currently receiving a structured parent training program to implement RIT or evidence that the parent has participated in a structured parent training program of any kind in the past year, and/or (b) the child's treatment team members had implemented RIT in a past treatment in the home, community, and/or school.

3.1.2 Screening procedures

Four boys and their parents were recruited for participation in the study. Screening procedures were conducted to determine eligibility.

3.1.2.1 Parent questionnaire

Parents were asked to complete a questionnaire (Appendix D). The questionnaire included the parent's name, gender, age, ethnicity, education level, and employment position. Parents were asked to identify: (a) past participation in a structured training program or distance-based instruction, (b) types of interventions used in their children's past treatment, (c) medication their children were given, (d) their children's medical problems/conditions, and (e) accessibility to Internet and computer access.

3.1.2.2 Diagnostic assessment report

The parent provided a copy of the child's diagnostic assessment report. This report included a summary of the child and parent history, the diagnosticians' observations of ASD symptoms and behaviors, and a DSM-IV diagnosis.

3.1.3 Pre-treatment measures

The four parent-child dyads, all boys and mothers, met eligibility criteria. After consent to participate and to videotape were obtained from the parents (Appendix E), pre-treatment measures were conducted. Five measures were conducted to assess the following: (a) child gross/fine motor, language, and social-communication skills, (b) elicited motor imitation ability, (c) autism severity, and (d) parent stress levels related to parenting a child with autism.

3.1.3.1 Communication and Symbolic Behavior Scales, Developmental Profile: Behavior Sample

The Communication and Symbolic Behavior Scales (CSBS; Wetherby & Prizant, 2002) Developmental Profile: Behavior Sample is a standardized play-based assessment designed to measure spontaneous social-communication and play behaviors in children whose chronological ages are between 9 months and 6 years of age. The CSBS Behavior Sample provides both quantitative and qualitative information about a child's communication, social, and symbolic play abilities. The sample does not provide an age equivalency, but yields a weighted raw score converted to percentile rank indicating the child is either performing at the same level as other peers the same age, or lower than same age peers. The CSBS Behavior Scales were normed on a sample of 337 children ranging in age from 12 to 24 months known to have developmental delays or were eligible for Part C early intervention services. Internal consistency ranged from .86 to .93 for composite scores and test-retest reliability demonstrated stronger reliability with short test intervals (less than two months) than longer test intervals of more than two months.

3.1.3.2 Developmental Observation Checklist System (DOCS): Developmental Checklist Profile/Record form

The Developmental Checklist Profile/Record form from the DOCS (Hresko, Miguel, Sherbenou, & Burton, 1994) is parent-report questionnaire used to assess the cognition, language, social and motor development of children under the age of six. The parent places a number "1" for yes or "0" for no under the domains indicated in the columns to the right of each test item. Raw scores are converted into percentiles and standard scores to determine the child's overall development level and level in each developmental area. Standardized on a sample of 1,094 children under the age of six from 30 states. Chronbach alphas for children under the age of three ranged from .80 to mid to high .90s in internal consistency. The range for inter-rater reliability was .91 to .94 and test-retest reliability was .85 to .94 in a 14 – 21 day interval of children ages 2 to 3 years old.

3.1.3.3 Motor Imitation Scale

The Motor Imitation Scale (MIS; Stone, 1997; Appendix G) was conducted to gather a baseline of the child's elicited imitation of motor movements. In this assessment, the researcher modeled eight object and eight gestural imitation tasks in a playful manner up to three times. The imitation tasks are based on Piaget's developmental sequence (Dunst, 1980; Uzgiris & Hunt, 1975). The researcher provided the discriminative stimulus "you do it" while modeling each behavior. Imitation was scored as "0" for no imitation, "1" for partial imitation, and "2" for complete imitation. Credit was given for the child's best score on each task. Delayed imitation was not scored. Total scores on the scale range from 0 to 32 with higher scores indicating higher levels of imitation. Psychometric properties for the MIS demonstrate strong internal consistency for the total MIS score and sub-areas (Stone, 1997). Stone (1997) calculated test-retest reliability

for 30 children with diagnoses of autism and other developmental disorders (mean age of 29.8 months) and found .80 for the total MIS score.

3.1.3.4 Childhood Autism Rating Scale-Parent version

The Childhood Autism Rating Scale-Parent version (CARS-P; Schopler, Reichler, DeVeliis, & Daly, 1980) was used to provide a level of autism severity for each child. The CARS-P parental report covers 14 domains, including: relating to people, body use, adaption to change, listening response, and verbal communication. A rating of 1 to 4 is provided for each one of the 15 behavioral areas. A total score is gathered by summing the 14 ratings (range of 15 to 60). The summed scores place the child in diagnostic categories ranging from one (normal for chronological age) to four (severely abnormal for chronological age). The psychometrics of this tool has been well documented for autistic disorder (Schopler et al., 1988; Nordin et al., 1998; Tachimori et al., 2003) and is reportedly a highly sensitive measure (Lord, 1995).

3.1.3.5 Autism Parenting Stress Index

The Autism Parenting Stress Index (APSI; Silva & Schalock, 2012), a self-report measure, is used to assess stress in parents of children with autism less than six years of age. Parents complete this measure rating their stress level of 0, 1, 2, 3 or 5. A rating of four is absent on the scale. Total scores range from 0 (not stressful) to 52 (so stressful sometimes we feel like we can't cope). Thirteen items are assessed relating to parenting a child with autism including a child's social development, communication, tantrums/meltdowns, aggressive behavior, and potty training (Appendix F). Initial psychometric evidence validates the use of this tool for parents of children with autism (Silva & Schalock, 2012). This psychometric study presented the index to

274 parents of children under the age of six; it demonstrated that the parents of children with autism had stress levels four times that of parents of typically developing children.

3.1.4 Participants

3.1.4.1 Dion

Dion, a Multiracial Caucasian and African American male, was 4-years, 4-months old at the beginning of the study. According to his diagnostic report he received the diagnosis of Autism and Receptive/Expressive Language Disorder (DSM-IV). According to the CARS, he met the criteria for Severe Symptoms of Autism Spectrum Disorder (score of 37 and higher) with a total score of 43. His mother reported he was not taking medications and did not have any significant medical conditions. He had received one hour of early intervention, speech language therapy, and occupational therapy per week when he was under three years of age. During the study, his mother reported he was attending a classroom program that used interventions grounded in ABA and received listening therapy through headphones two times per week for 20-minutes. The auditory intervention had been implemented for approximately one month when the study began. He was receiving no other services in the home during participation in the study.

The results of the DOCS assessment indicated that developmentally Dion was below average in all developmental areas (see Table 1). On the MIS, Dion received an object imitation score of 81% and a gesture imitation score of 93%. The results of the CSBS showed that Dion functioned below developmental level for his age in sounds, social interaction, gestures, words and language comprehension (see Table 2). Dion said seven single-words during the assessment to request items he desired. His use of gestures was limited, but he gazed in the direction of the researcher's finger point two times. He demonstrated comprehension of object names "cup,

spoon, fork, bowl"; person name "mommy"; and body parts "mouth, eyes, ears, feet." He engaged in seven actions with objects (e.g., put in, feed with utensil, stir) and stacked five blocks after the researcher modeled this behavior.

Dion's mother, Jennifer was a 41-year-old African American with a graduate degree in interpersonal communication. She was the co-owner and president of a contracting company. She reported that she had not participated in parent training or distance-based instruction prior to the start of the study. She had a moderately high stress rating of 30 on the APSI. The most intense stressors included her child's ability to communicate and concern for her child's future. Dion lived with his mother, father, sister, and half sister in a rural area in a neighboring state. The school psychologist had recently provided his older sister with a diagnosis of Asperger's Disorder.

3.1.4.2 Joshua

Joshua, a Caucasian male, was 2-years, 8-months old at the start of the study. According to his diagnostic report he received the diagnosis of Pervasive Developmental Disorder, Not Otherwise Specified (DSM-IV). According to the CARS, he met the criteria for Severe Symptoms of Autism Spectrum Disorder (score of 37 and higher) with a total score of 48.5. His mother reported he was not taking medications and did not have any significant medical conditions. He had received one hour of early intervention, speech language therapy, and occupational therapy per week for the six months prior to the study. During the study, early intervention and speech language therapy occurred one time per week in the home. Additionally, he was receiving 10 hours per week of Behavioral Health Rehabilitative Services (BHRS) direct therapy. His mother indicated that BHRS was using "repetition and modeling" to teach him skills.

The results of the DOCS assessment indicated that developmentally, Joshua was well below average in all areas (see Table 1). On the MIS, Joshua received an object imitation score of 6% and a gesture imitation score of 6%. The results of the CSBS showed that Joshua functioned well below developmental level for his age in sounds, social interaction, gestures, words, and language comprehension (see Table 2). Joshua said one sound (i.e., /m/) during the assessment to request an item he desired. To communicate his desire for items he reached out his hand towards the object. He did respond to the gaze/point following task when presented two times. The assessment showed significant deficits in comprehension of object names, play actions with objects and stacking blocks after the researcher modeled this behavior.

Joshua's mother, Sarah, was a Caucasian 41-year-old who was working on her Bachelor's degree in communication disorders. She was a single parent and homemaker. Sarah reported that she had not participated in parent training or distance-based instruction prior to the start of the study. She had a moderately low stress rating of 14 on the APSI. Specific stressors included her child's social-communication development and concern for his future. Joshua lived at home in a suburban medium size Mid-Atlantic city with his mother and two brothers; both brothers were also diagnosed with ASD.

3.1.4.3 Nikhil

Nikhil, an Indian-American male, was 2-years, 5-months old at the start of the study. According to his diagnostic report he received the diagnosis of Pervasive Developmental Disorder, Not Otherwise Specified (DSM-V). According to the CARS, he met the criteria for Mild to Moderate Symptoms of Autism Spectrum Disorder (score between 30 – 36) with a total score of 34.5. His mother reported he was not taking medications and did not have any significant medical conditions. He had received one hour of speech language therapy, occupational therapy, and

physical therapy per week for one year prior to the study. Speech language therapy occurred one time per week during the study in the home.

The results of the DOCS assessment indicated that developmentally, Nikhil was slightly below average in cognition and language, average in social and above average in motor development (see Table 1). On the MIS, Nikhil received an object imitation score of 63% and a gesture imitation score of 69%. The results of the CSBS showed that Nikhil functioned below developmental level for his age in social interaction, and symbolic play and above developmental level in speech (see Table 2). Nikhil used over sixteen words and over eight combinations of words to request items he desired and communicate during the assessment. His use of gestures was limited (pointed only), but he responded to the gaze/point following task when presented two times. He demonstrated comprehension of object names “cup, spoon, fork, bottle”; person names “mommy, nanny, monkey”; and body parts “toes, hands, mouth.” He engaged in two actions with objects (i.e., put in, feed monkey with utensils) and quickly stacked five blocks after the researcher modeled this behavior.

Nikhil’s mother, Asha, was a 34-year-old Indian American medical doctor. She was four months pregnant when the pre-treatment measures were collected. Asha reported that she had not participated in parent training or distance-based instruction prior to the start of the study. She had a moderate stress rating of 23 on the APSI. Specific stressors included her child’s social-communication development and her lack of feeling close to her child. Nikhil lived at home in a Mid-Atlantic city with his mother and father.

3.1.4.4 Ryan

Ryan, a Caucasian male, was 3-years, 6-months old at the start of the study. According to his diagnostic report he received the diagnosis of Autistic Disorder (DSM-IV). The results of the

CARS indicated that he met the criteria for Severe Symptoms of Autism Spectrum Disorder (score of 37 and higher) with a total score of 41. His mother reported he was not taking medications and did not have any significant medical conditions. He had received one hour of speech language therapy and occupational therapy per week from the age of two to three. Speech language therapy occurred one time per week during the study in a outpatient setting. Ryan also received 15 hours per week of BHRS direct therapy service while participating in the study.

The results of the DOCS assessment indicated that developmentally, Ryan was below average in all areas of development (see Table 1). On the MIS, Ryan received an object imitation score of 6% and a gesture imitation score of 0%. The results of the CSBS showed that Ryan functioned below developmental level for his age in social interaction, speech, and symbolic play (see Table 2). Ryan used fifteen single-words to request items he desired and communicate during the assessment. He used three different conventional gestures (i.e., gives, pushes/pulls away) and responded once to the gaze/point following task. He demonstrated comprehension of object name “bowl”; person names “mommy, monkey.” He engaged in one action with objects (i.e., put in) and quickly stacked five blocks after the researcher modeled this behavior. It is important to note that Ryan engaged in challenging behaviors while the assessment was being conducted (e.g., crying, saying “no”); it is the opinion of the researcher that his scores may have improved if behaviors were absent.

Ryan’s mother, Susan was a 37-year-old Caucasian homemaker with an associate’s degree. Susan reported that she had not participated in parent training or distance-based instruction prior to the start of the study. She had a high stress rating of 38 on the APSI. Specific stressors included her child’s ability to communicate, self-injurious behavior, and concern for his future. Ryan lived at home in a Mid-Atlantic city with his mother and father.

Table 1. Pre-Treatment results: DOCS-Developmental checklist profile developmental age equivalent scores

Child	Chronological age (months)	Cognition age (months)	Language age (months)	Social (months)	Motor (months)
Dion	52	22	22	23	24
Joshua	32	13	16	16	16
Nikhil	29	25	25	26	35
Ryan	42	17	22	17	19

Table 2. Pre-Treatment results: Composite and total CSBS behavior sample percentile ranks

Child	Social	Speech	Symbolic	Total
Dion	2	37	50	10
Joshua	1	2	1	1
Nikhil	2	91	63	50
Ryan	2	63	2	5

3.2 PROCEDURES

3.2.1 Settings and staff

All aspects of the study occured in the participants' homes, including the completion of the Internet-based training modules on home computers. During the first in vivo coaching session, the parent and trainer identifed a specific, defined location where the sessions would be conducted. This location was dependent on the avaliability of space in the playroom, bedroom, basement, or other area in the home. In some cases, options for generalization in a new environment were limited because of the home's layout. Dion's treatment sessions were conducted in the middle of the floor in their large basement. Generalization sessions were

conducted in his upstairs bedroom. Joshua's treatment sessions were conducted in an upstairs bedroom; generalization was conducted in an open area in the living room. Nikhil's core sessions were conducted in an enclosed playroom; generalization sessions were conducted in the same environment. Ryan's family had a small home; therefore, it was determined that sessions would be conducted throughout the entire living area (i.e., dining area, small play area, and area with a couch and lounge chair). Ryan and his mother moved back and forth between all areas during sessions.

The researcher performed the procedures, collected target behavior data, and rated treatment fidelity in baseline, in vivo module coaching, generalization, post-treatment, and follow-up. A graduate student videotaped five of the sessions for Dion. Unfortunately, the graduate student was unable to help with the remainder of the sessions; therefore, the researcher set up a camera in the corner of the room to videotape the remainder of the sessions for all participants. The researcher and parents prepared for and cleaned up toys after sessions together.

3.2.2 Materials

3.2.2.1 Internet-based modules

The Internet-based modules, developed by Allison Wainer at Michigan State University, focused on teaching parents to implement RIT; they are similar to the modules used to train three parents and three undergraduate students in Wainer & Ingersoll (2012). Parents accessed the modules using a password-protected secure Internet service (http://psychology.msu.edu/autismlab/onlinerit/intro.aspx).

Parents were assigned a login username and password to access the modules. The first module, *Introduction to RIT*, provided a description of naturalistic behavioral interventions, the

rationale for their use, and how to set up their home for intervention success (e.g., limiting stimuli in the child's environment to eliminate and reduce distractions during sessions). The final three modules taught strategies including, *Imitate Your Child*, *Describing Your Child's Play*, and *Teaching Object Imitation*.

The instruction in each module was displayed through slide show presentations, video clips of RIT intervention strategies, prominent text shown on the screen, and audio lectures. The modules showed three to five longer video segments of strategies used in the module. Five 5-minute videos of entire RIT sessions were shown at the end of the fourth module. The modules also included short online quizzes to evaluate understanding of the material. Viewing time for each module varied based on the parents' learning abilities. A detailed description of the content in each module is shown in Table 3.

3.2.2.2 In vivo coaching sessions

In home coaching sessions were used to train parents to use RIT strategies following the completion of each Internet module. During these sessions, the researcher used a laptop to show parents a two to three minute video segment of their use of strategies (not used in session 1) from the last play session and provided feedback. The viewing occurred at a table or couch in the parents' homes. The parents were provided with laminated checklists detailing the strategies presented in the target modules. The in vivo coaching sessions included a short didactic, question/answer opportunities, demonstration of strategies, practice, feedback, and discussion. The parents practiced implementing strategies in the area identified with four to six sets of toys identified during the first session. This area was void of any unnecessary items (e.g., extra chairs, coffee tables, etc.).

Table 3. Reciprocal Imitation Training modules: Topics and descriptions

Modules	Descriptions
1) Introduction to RIT	Parent is provided with an overview of Reciprocal Imitation Training components. Parent is taught to set up the environment for successful use of RIT strategies.
2) Imitate Your Child	Parent is taught to engage in the same/similar behaviors as her child with same/similar objects or movements. Parent is taught to use affect and waiting with anticipation to engage child.
3) Describing Your Child's Play	Parent is taught to describe her play and her child's play actions with toys. Parent is taught to expand the child's language.
4) Teaching Object Imitation	Parent is taught to use RIT teaching techniques including: 1) presenting a model, 2) waiting for response, 3) presenting the model up to 2 more times, 3) prompting child to respond, 4) providing verbal praise for the child's imitation.

3.2.3 Research design

A single-subject, concurrent multiple-probe design (MPD) across participants was used to demonstrate a functional relationship between the dependent and independent variables. The MPD offered the ability to evaluate experimental control by replicating the effects of the interventions across participants, behaviors, and time. Further, varying the length of the baseline controls for history effects and maturation. The design included (a) baseline, (b) parent training (consisting of the completion of four Internet-based modules, the last three of which were followed by in vivo home-based coaching, and generalization training sessions designed to extend the intervention to novel settings and toys in the home) and (c) follow-up at least two weeks after the intervention was completed.

All participants started baseline probes on the same day with the exception of Nikhil due to late entry into the study; Nikhil's first baseline session was 12 days after the first baseline session for the other participants. A probe procedure was used in this study. Probes were designed to be as non-reactive as possible to conduct the minimum amount of data points to reach a stable baseline (Horner & Baer, 1978). Each parent-child dyad completed one baseline probe during the first week of the study with the exception of Dion. Dion's mother completed two baseline sessions per week for the first two weeks until stability was reached with parent behaviors (i.e., linguistic mapping, contingent imitation, demands, see definitions in Table 4). Then, she entered the parent training condition. The second parent-child dyad continued in baseline until the first parent reached 80% fidelity on the strategies in the first two modules, then baseline sessions were increased to two times per week. Once a stable baseline was demonstrated by the second parent on parent behaviors, the second dyad entered into the parent training condition. The same process was repeated for all remaining participants. After each participant reached fidelity criterion on the strategies used in modules 1 through 4, then, they completed generalization sessions. Once participants reached fidelity criterion in the generalization sessions using the strategies with novel toys, the parent training condition ended. Two follow-up sessions were conducted for each participant. Follow up sessions for Joshua and Nikhil occurred two and three weeks after generalization sessions concluded. Follow up sessions for Dion and Ryan occurred at three and four weeks and three and six weeks, respectively.

3.2.4 Dependent variables

3.2.4.1 Parent behaviors

The following dependent variables were collected for parent behaviors: (a) contingent imitation, (b) linguistic mapping, (c) demands/questions and (c) imitation training.

Table 4. Parent dependent variables definitions and scoring

Dependent variables	Definitions	Scoring
Linguistic mapping	The parent describes what the child is attending to or doing using simple language (e.g., ‘‘you built a tower) with or without sound effects.	Frequency count
Contingent imitation	The parent imitates the child’s behaviors (i.e., actions with toys, gestures/body movements, and vocalizations) at the same time as the child engages in them, or within one to two seconds of the occurrence of the behavior.	Frequency count
Demands/Questions	Parent asks the child a question or places a demand on the child.	Frequency count
Imitation training	Combination of (up to three) parent model(s), prompt, and reinforcement together or combination of (up to three) parent model(s) followed by reinforcement (used when child imitates model spontaneously).	Frequency count

3.2.4.2 Child behaviors

Primary dependent variables collected for each child were prompted and spontaneous motor imitation. Social engagement was collected as a secondary dependent variable. See Table 5 and Appendix H for operational definitions and scoring information.

Table 5. Child dependent variables definitions and scoring

Dependent variables	Definitions	Scoring
Prompted imitation	Child imitates the parent's action (with or without a toy) with a physical/gestural prompt or verbal command within 10 seconds of the modeled behavior.	Rate per minute
Spontaneous imitation	Child imitates the parent's action (with or without a toy) without a physical/gestural prompt or verbal command within 10 seconds of the modeled behavior.	Rate per minute
Social-engagement	Combined total of five behaviors: 1) social gaze 2) mutual gaze 3) responding to joint attention, 4) initiating joint attention and 5) initiating behavior requests.	Total duration in seconds

3.2.4.3 Parent intervention fidelity

Intervention fidelity data were collected during the 10-minute parent-child play sessions that occurred in baseline, at the end of training sessions during the parent training condition, and at follow-up (see Appendix I for example of intervention fidelity calculation). Parents were taught specific strategies in each module that built upon one another to form a comprehensive intervention program; therefore, two measures of intervention fidelity were calculated for each 10-minute parent-child play session: (1) *module fidelity* and (2) *overall fidelity*. Module fidelity was the fidelity rating for the techniques in the individual modules. Overall fidelity was an average of the fidelity rating for all four modules.

Parents were rated on a 0 to 5 scale for each module with a "0" for parent never uses RIT techniques and misses all opportunities and a "5" for parent uses RIT techniques throughout. Although the range was the same for each module (i.e., 0 to 5), calculation for each module was contingent on the type of techniques being taught to the parent.

The scale for module 1 (introduction to imitation training) included seven fidelity items (i.e., reduces physical area/creates defined space, de-clutters room, removes of distractions, identifies 4-6 sets of toys and places them on the floor, selects appropriate toys, removes overly absorbing toys). Each fidelity item included a detailed description of what signified a 0 – 5 rating. For example, in the fidelity item *"reduces physical area/creates a defined space for intervention,"* a "0" signified that an area has not been defined and the child may leave the play area more than 8 times during the session, engaging in challenging behaviors throughout and a "5" signified that a designated space is created by the parent using physical barriers such as furniture or a section of the room and the child never leaves the area.

The scale for module 2 (imitate your child) used a 30-second partial interval recording system to rate seven indicators that the technique "imitate your child" was performed correctly. Each interval for each indicator was coded as a "1" for the occurrence of the behavior, a "0" for the non-occurrence of the behavior, or a shaded cell for no opportunity to display the behavior. A sum was calculated for each indicator, converted into a percentage, and then converted into a 0 to 5 rating for each indicator based on a table that associated percentages with specific ratings. The seven ratings were then averaged to obtain an intervention fidelity rating session score for the targeted technique.

The mean score for module 3 (describing your child's play) was calculated in the same manner as module 2, except only six techniques were coded. The scale for module 4 (imitation training) included one fidelity item describing how well and often the parent used imitation training techniques (i.e., 0 = never used the techniques, 5 = used a combination of the techniques five times across 3-one minute intervals). This variation in data collection across the four modules was used because the accuracy of the parents' use of the techniques in the first and

fourth modules were better reflected through the use of a rating scale, whereas those used in the second and third module were evaluated more appropriately with an interval recording system that was then converted into a point on the 5 point rating scale. For example, module 1 taught the parent to set up the environment. The parent could only complete this task one time; therefore, it would not have been accurate to measure this behavior using a partial interval system. Conversely, module 2 taught the parent to imitate the child; therefore, the parent had the opportunity to engage in this behavior at least one time every 30-seconds. An example of calculations for the fidelity rating is shown in Appendix I.

3.2.5 Independent variables

The independent variables included training the parent through a combination of self-directed Internet-based instruction interspersed with home-based in vivo coaching sessions. The key strategies included in this intervention were first presented in one of the four Internet-based modules. Therapist coaching during the home-based sessions reinforced the material presented in each Internet-based module and provided the parents with opportunities to implement the strategies with their children followed by feedback on strategy use from the researcher.

3.2.6 Treatment procedures

3.2.6.1 Baseline condition

In the baseline condition, the researcher instructed the parent to play with the child as she typically would. Parents were not provided with specific information on toy use during the baseline; therefore, in several sessions parent did not use toys. The parent played with his or her

child for 10-minutes while the researcher observed the session from the side of the room. No instruction, coaching, or feedback was provided to the parent during this session.

3.2.6.2 Parent training condition

(a) Distance learning instruction

After the last baseline session, parents were provided with verbal and written instructions regarding how (i.e., website, login, password, procedures to use) and when (i.e., within 24 hours before the first in vivo coaching session) to access the RIT Internet modules. Before starting the modules, parents completed a pre-quiz for the Internet modules. The quiz evaluated their knowledge of RIT pre-treatment. Then, parents independently logged into the website, accessed the modules, and completed Internet modules 1 and 2 (i.e., Introduction to Reciprocal Imitation Training and Imitate Your Child, respectively). In order for the parents to transition to Module 3, they had to reach 80% intervention fidelity on the RIT strategies discussed in module 1 and 2 during the in vivo coaching sessions. After they met 80% fidelity, module 3 was assigned. The same process and criteria was applied for module 4. Participants were provided with three opportunities/sessions to reach fidelity criteria. If the participant did not reach fidelity by the third in vivo practice session for each module then the parent was told to complete the next module. After the modules were concluded, parents were asked to complete a post-quiz. The quiz evaluated their knowledge of RIT post-modules. See Appendix J for an example participant schedule.

(b) In vivo coaching

Within the next week, the researcher arrived at the home to conduct the first in vivo coaching session. During all coaching sessions, except for the first coaching session, the researcher reviewed a two to three minute portion of this video clip, from the previous play session, with the parent upon arrival, providing positive and corrective feedback and responding to parent's questions. Homework was reviewed if the parent had completed a module directly before the the coaching session. The researcher briefly discussed the concepts in the module (for approximately 5 minutes), provided the parent with a laminated checklist of the strategies, asked if the parent had any initial questions, and demonstrated steps/techniques with the child discussing the strategies used as the parent observed. If the session was the second or third in vivo training session for a module, the laminated checklists from the prior session were used for review. Then, the parent was provided with approximately 10-minutes to practice the steps with the children as the researcher provided suggestions and positive or constructive feedback. The researcher responded to any parent questions. Finally, the parent used the strategies with the child for 10-minutes. The researcher did not provide feedback during this final play session because this was a probe of the parent's ability to implement the intervention independently. Parents were asked to practice using RIT techniques with their child for 20-minutes each day during the study. They were provided with a data sheet to collect information about issues and successes they experienced while practicing.

In the first in vivo coaching session, the therapist helped the parents set up their home for success by identifying: 1) a defined area to be used to practice RIT strategies, 2) a 20-minute time period during the day for the parent to practice strategies, and 3) motivating toys that would be used in the play sessions. To identify motivating toys, the researcher brought approximately

12 - 15 novel sets of toys from outside the home and the parent gathered sets of toys that the parent reported the child played with in the home. The parent and researcher observed the child playing with the toys, then together they identified a combination of toys that appeared to be the most motivating to use during sessions based on the duration the child spent with each toy. The parents choose four to six sets of toys to use during training sessions; these toys were chosen from the larger group of motivating toys identified previously. Then the researcher briefly discussed the components in module 2, provided the parent with a laminated checklist of the strategies, asked if the parent had any initial questions, and demonstrated steps/techniques with the child discussing the strategies used as the parent observed. Next, the parent was provided with approximately 10-minutes to practice the steps with the children as the researcher provided suggestions and positive or constructive feedback. The researcher responded to any parent questions. Finally, the parent used the strategies with the child for 10-minutes. The researcher did not provide feedback during this final play session.

(c) Generalization sessions

After the parent reached treatment fidelity criteria in each of the four modules, then, generalization sessions were conducted. The purpose of the generalization sessions was to focus on teaching the parent to generalize strategies use with novel toys. Generalization sessions were conducted two times per week. For Dion and Joshua, generalization sessions occurred in a different location than the module training sessions. Nikhil and Ryan's parents did not have access to a different area to play due to the size and layout of their homes; consequently the same area was used for both module training and generalization sessions.

During generalization sessions, the researcher arrived at the home and reviewed a two to

three minute video clip with the parent from the past session, providing positive and corrective feedback and responding to parent questions. The first generalization session was different from the second in that the researcher provided a review of the strategies and rationale for generalizing to novel toys. Together, the parent and researcher identified novel toys that had not been used in any of the training sessions. Then, the parent interacted with her child using the strategies and novel toys while the researcher observed, provided positive/corrective feedback statements, and responded to parent's questions. Finally, the parent used the strategies with the child for 10-minutes. The researcher did not provide feedback during this brief play session. Generalization sessions continued until the parent reached 80% fidelity in the 10-minute play sessions or she met the three session limit.

3.2.6.3 Follow-up condition

Two follow-up sessions were conducted at least two weeks after the last parent generalization session. During these sessions the parent completed one, 10-minute play session with the child using any of the toys from training or generalization sessions. The parent was told to play with the child using the strategies learned during the parent training sessions.

3.2.6.4 Post-treatment assessment

When the follow-up condition ended, post-treatment assessments were completed to evaluate post-treatment changes in: (a) child gross and fine motor, expressive language, receptive, social-communication skills development and (b) parent stress level related to raising a child with autism, and (c) the child's elicited imitation. Additionally parents were asked to complete a measure evaluating treatment acceptability/social validity. Child developmental age, parent stress, and elicited motor imitation were evaluated with the same tools used in the pre-treatment

assessment: (a) DOCS: Developmental Checklist/Profile (Hresko, Miguel, Sherbenou, & Burton, 1994), (b) CSBS Developmental Profile: Behavior Profile (Wetherby & Prizant, 2002), (c) APSI (Silva & Schalock, 2012), and (d) MIS (Stone, 1997). In addition, parents completed the BIRS (see below for description of the modified version of Elliott & Trueting, 1991) to evaluate social validity.

3.2.6.5 Social validity

Parents were asked to complete a modified version of the Behavioral Intervention Rating Scale (BIRS; Elliott & Trueting, 1991) following the last generalization session. The original BIRS (Elliot & Trueting, 1991) was comprised of a 24 items scored on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree) that broadly addressed the social validity of any intervention program. The modified BIRS evaluated the parents' opinions of the feasibility, acceptability and effectiveness of the combination of distance-based instruction and in vivo methods of training to teach an imitation intervention. Parents were asked to answer 33 questions. Twenty questions from the BIRS were used (4 were not relevant). Three questions in the social validity assessment were developed by Wainer and Ingersoll (2012). Another 10 questions were developed by the researcher in this study (See Appendix K for BIRS).

3.2.7 Data collection procedures

All sessions were videotaped for data collection and reliability measurement.

3.2.7.1 Implementation fidelity

To identify whether training methods were delivered as intended, implementation fidelity checklists were designed for the parent training condition (Appendix L). A graduate student acted as an implementation fidelity observer and used the checklists to evaluate whether or not the researcher correctly implemented each step of the treatment during sessions. The reliability observer recorded "0" when the step was not implemented accurately and "1" when the step was implemented with accuracy. Implementation fidelity for each session was calculated by: summing the total number of steps completed accurately divided by the total number of steps completed accurately plus the total number of steps completed inaccurately/not completed multiplied by 100. Implementation fidelity was collected on 33 – 40% of sessions, depending on the number of sessions for each participant. To reach fidelity, the researcher must have completed 95% of the procedures correctly.

3.2.7.2 Observer training

Inter-rater reliability was established prior to scoring and maintained during treatment. Three graduate students assisted with reliability of implementation fidelity, intervention fidelity, and measurement of dependent variables. Two graduate students were in an Early Intervention Masters Program and the third was in a Library Science Masters Program. The two Early Intervention students were assigned to independently measure intervention fidelity and measurement of all other parent/child dependent variables. The Library Science student evaluated the implementation fidelity of the researcher. Students were provided with a scoring manual that provided detailed examples of the target behaviors and measurement procedures.

Initial training included the researcher and the graduate students discussing the definitions of parent and child behaviors or fidelity variables, and watching videos presenting

examples/non-examples. After reviewing the concepts, the researcher and graduate students independently coded intervention fidelity/other dependent variables or implementation fidelity in three 5-minute videos of child/parent play interactions (involving parents and children not included in the study). Then, they compared their respective codes to that of the researcher. For the dependent parent and child variables, the percentage of interobserver agreement was calculated by dividing the smaller frequency by the larger frequency and multiplying by 100. For intervention fidelity, an agreement was defined as the researcher and graduate student being within one point on the 5-point rating scale for the overall fidelity and for each of the four modules. For implementation fidelity, the two raters compared their ratings for each item on the checklist. An agreement was scored if they both indicated the occurrence of the item and a disagreement was scored if they differed. Interobserver agreement (IOA) was calculated by dividing the total number of agreements by the total number of agreements plus disagreements then multiplying by 100. For the observers to be considered trained on coding the dependent variables and implementation fidelity, they had to achieve 80% agreement with the researcher across three novel 5 – minute videos. For intervention fidelity, they had to be within one-point on the 5-point rating scale for the overall fidelity and for each of the four modules across three novel 5-minute videos. The researcher and graduate students reached agreement criteria for implementation, intervention, and all child and parent dependent variables after watching three videos.

3.2.7.3 Interobserver agreement

The graduate students coded the dependent variables, intervention fidelity and implementation fidelity variables from videos for 25% of the cumulative sessions for all participants. They were blind to the conditions in which the parent-child dyads were placed. Using the sample command

in STATA®, Data Analysis and Statistical Software, a random sample of 25% of the total number of sessions was generated. Reliability data were collected for Dion, Joshua, Nikhil, and Ryan in 16 to 50% percent of sessions within each condition (displayed in Table 6). After reliability was calculated, if the percentage was below 80%, the researcher and graduate student met to discuss differences in the data. This occurred with 3 sessions for Dion, 1 session for Joshua, 3 sessions for Nikhil, and 3 sessions for Ryan (bold text on Table 6). Differences were discussed and the researcher and graduate student independently coded the sessions again until they met a minimum of 80% agreement. Interobserver reliability data is presented in Table 6 and 7. Reliability data for session intervention fidelity and implementation fidelity for all four participants was 100%; therefore, this data is not represented in a table. The researcher's data was used in the results of the study.

3.2.7.4 Data analysis

The effect of the independent variable (i.e., in vivo coaching combined with Internet based modules) on the dependent variables (i.e., frequency of parent RIT strategies, parent fidelity rating, rate of child imitation and duration of social engagement) was determined through the visual inspection of the graphic representation of the data. Changes in variability, level, and trend of these variables were analyzed across conditions and participants.

Table 6. Frequency and percentage of sessions in which interobserver reliability data was collected for parent behaviors

Behaviors/ Conditions		Dion's mother		Joshua's mother		Nikhil's mother		Ryan's mother	
		Sessions	IOA	Sessions	IOA	Sessions	IOA	Sessions	IOA
Contingent Imitation	Baseline	1(25%)	**85%***	1(20%)	100%*	1(16%)	100%*	2(33%)	90% (80 – 100)
	Parent Training	3(50%)	97.5% (95 – 100)	1(16%)	80%*	2(33%)	90% (80 – 100)	1(20%)	**80%***
	Follow-up	1(50%)	90%*	1(50%)	100%*	1(50%)	**80%***	1(50%)	85%*
Linguistic Mapping	Baseline	1(25%)	**80%***	1(20%)	**80%***	1(16%)	80%*	2(33%)	86% (82 – 90)
	Parent Training	3(50%)	86.6% (80 – 100)	1(16%)	100%*	2(33%)	88.5% (80 – 97)	1(20%)	**80%***
	Follow-up	1(50%)	80%*	1(50%)	100%*	1(50%)	80%*	1(50%)	80%*
Demands/ Questions	Baseline	1(25%)	86%*	1(20%)	80%*	1(16%)	98%*	2(33%)	86% (82 – 90)
	Parent Training	3(50%)	**85% (80 – 95)**	1(16%)	95%*	2(33%)	87.5% (80 – 95)	1(20%)	85%*
	Follow-up	1(50%)	95%*	1(50%)	80%*	1(50%)	**80%**	1(50%)	80%*
Imitation Training	Baseline	1(25%)	100%*	1(16%)	85%*	1(16%)	100%*	2(33%)	100%*
	Parent Training	3(50%)	95% (85 – 100)	1(20%)	85%*	2(33%)	100%*	1(20%)	100%*
	Follow-up	1(50%)	100%*	1(50%)	100%*	1(50%)	85%*	1(50%)	100%*

Note: Bold text = In this condition, for this behavior, the graduate student and researcher met to discuss differences that were below IOA criterion (80%). After they compared and independently measured the behavior again, the agreement criterion was met; * = no range due to only one session calculated or same score in all reliability sessions.

Table 7. Interobserver reliability data for child imitation and social-engagement

Behaviors/ Conditions		Dion		Joshua		Nikhil		Ryan	
		Sessions	IOA	Sessions	IOA	Sessions	IOA	Sessions	IOA
Spontaneous imitation	Baseline	1(25%)	100%*	1(20%)	100%*	1(16%)	100%*	2(33%)	100%*
	Parent Training	3(50%)	100%*	1(16%)	100%*	2(33%)	100%*	1(20%)	100%*
	Follow-up	1(50%)	100%*	1(50%)	100%*	1(50%)	100%*	1(50%)	100%*
Prompted imitation	Baseline	1(25%)	100%*	1(20%)	80%*	1(16%)	100%*	2(33%)	97% (94 – 100)
	Parent Training	3(50%)	100%*	1(16%)	100%*	2(33%)	90% (80 – 100)	1(20%)	100%*
	Follow-up	1(50%)	100%*	1(50%)	100%*	1(50%)	100%	1(50%)	100%*
Social-engagement	Baseline	1(25%)	85%*	1(20%)	89%*	1(16%)	90%*	2(33%)	87.5% (88 – 87)
	Parent Training	3(50%)	90.7% (83 – 95)	1(16%)	86%*	2(33%)	88.5% (84 – 93)	1(20%)	94% (90 – 98)
	Follow-up	1(50%)	84%*	1(50%)	88%*	1(50%)	94%	1(50%)	91%*

Note: * = no range due to only one session calculated or same score in all reliability sessions

4.0 RESULTS

This chapter presents the effects of training parents of young children with autism to implement RIT through combined Internet-based modules and in vivo coaching. The first section reports treatment duration and adherence and changes in the frequency of parental use of RIT techniques (i.e., contingent imitation, linguistic mapping, demands/question, imitation training. The second section describes changes in parent intervention fidelity. The third section displays child changes in primary and secondary dependent variables (i.e., imitation, social engagement, respectively). The first three sections demonstrate the changes within and across conditions visually. The fourth section displays differences in pre and post treatment measures in child development, imitation, and parenting stress. The final section shows the results of a social validity rating scale responses to open-ended questions parents were answered regarding benefits of the intervention program and improvements they observed.

4.1 PARENTAL RIT STRATEGY USE

This section provides a description of changes in dependent variables across parent-child dyads and experimental conditions. Treatment duration and adherence will be presented, followed by a description of each parent's use of RIT techniques.

4.1.1 Treatment duration and adherence

Parent training sessions were conducted one or two times each week for the duration of the study. On average, parents completed the treatment condition in six sessions with a range of five to seven. Nikhil's mother completed the treatment in five sessions over 3.7 weeks, which was less than the other parents. The mother's of Dion and Ryan completed treatment in six sessions over 3.4 weeks and 4.9 weeks, respectively. Joshua's mother required seven treatment sessions over 4.7 weeks.

Two factors influenced how rapidly parents completed the treatment: (a) reaching fidelity criterion for techniques presented in assigned target modules that were evaluated during play sessions conducted at the end of each in vivo coaching session (see parent fidelity section below); and (b) the number of times parents cancelled sessions due to sickness or other factors. Dion's mother never cancelled a session. The mothers of Nikhil, Joshua and Ryan cancelled one, three and nine sessions, respectively. Furthermore, during the first in vivo session, parents were asked to practice strategies one time per day for 20-minutes during treatment. They were given a clipboard with a data sheet to record notes each time they played with their child. Dion's mother reported practicing 18 times and Nikhil's mother practiced 15 times. The mothers of Joshua and Ryan did not record any practice data; however, both anecdotally reported practicing daily.

Table 8. Mean and range for frequency of parent use of RIT techniques across conditions

	Condition	Contingent Imitation mean (range)	Linguistic Mapping mean (range)	Demands/ Questions mean (range)	Imitation Training mean (range)
Dion's Mother	Baseline	7.5 (3 – 16)	43.3 (30 – 59)	78 (32 – 103)	0 (0 – 0)
	Module 1 & 2	99*	48*	25*	0*
	Module 3	176*	163*	3*	0*
	Module 4	78 (36 – 120)	101.5 (141 – 62)	5 (3 – 7)	3.5 (1 – 6)
	Generalization	79.5 (62 – 97)	132 (80 – 184)	19 (19 – 19)	4.5 (3 – 6)
	Parent Training	98.3 (36 – 176)	113 (48 – 182)	13.3 (3 – 25)	5 (0 – 20)
	Follow-up	70 (28 – 112)	212.5 (182 - 243)	6.5 (4 – 9)	60 (35 – 85)
Joshua's Mother	Baseline	2 (0 – 6)	34.6 (15 – 60)	86.2 (68 – 111)	0 (0 – 0)
	Module 1 & 2	173*	47*	6*	0*
	Module 3	207*	87*	1*	0*
	Module 4	98 (37 – 159)	101 (89 – 113)	9.5 (0 – 19)	0.5 (0 – 1)
	Generalization	59 (40 – 78)	98.3 (70 – 125)	.3 (0 – 1)	9.3 (5 – 15)
	Parent Training	111.1 (40 – 207)	90.1 (47 – 125)	3.9 (0 – 19)	4.4 (0 – 15)
	Follow-up	89 (79 – 99)	103 (90 – 116)	1.5 (0 – 3)	5.5 (5 – 6)
Nikhil's Mother	Baseline	5.2 (1 – 9)	30 (21 – 36)	149.5 (65 – 178)	0.3 (0 – 1)
	Module 1 & 2	326*	22*	3*	0*
	Module 3	254*	138*	1*	0*
	Module 4	105*	81*	9*	7*
	Generalization	55.5 (51 – 60)	106 (102 – 110)	11 (5 – 17)	7 (7 – 7)
	Parent Training	159.2 (51 – 326)	90.6 (22 – 138)	7 (1 – 17)	4.2 (0 – 7)
	Follow-up	80 (65 – 95)	141.5(109 – 174)	11.5 (3 – 20)	9 (7 – 11)
Ryan's Mother	Baseline	5 (1 – 8)	21.2 (4 – 60)	50.5 (31 – 75)	0 (0 – 0)
	Module 1 & 2	269*	2*	0*	0
	Module 3	97.7 (63 – 117)	69.3 (40 – 99)	10.3 (4 – 21)	0.3 (0 – 1)
	Module 4	72*	92*	12*	4*
	Generalization	80*	88*	4*	3*
	Parent Training	119 (72 – 269)	65 (2 – 99)	7.8 (0 – 21)	1.3 (0 – 4)
	Follow-up	64.5 (52 – 77)	25 (21 – 29)	20.5 (12 – 29)	1 (0 – 2)

Note: *Parents completed only one training session for this module; Parent Training = cumulative mean and range for all four modules.

Figure 1. Parent frequency of RIT techniques: Contingent imitation

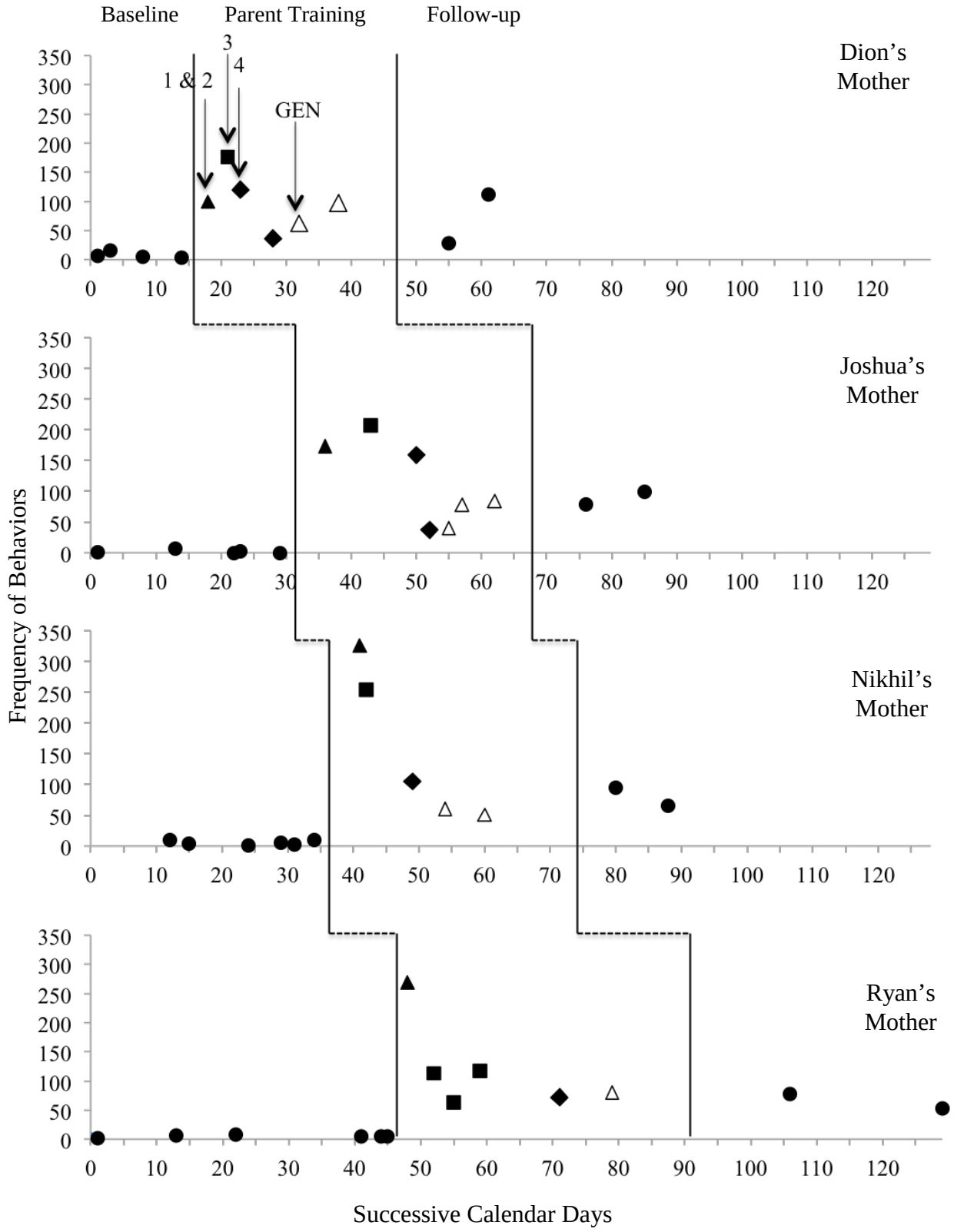


Figure 2. Parent frequency of RIT techniques: Linguistic mapping

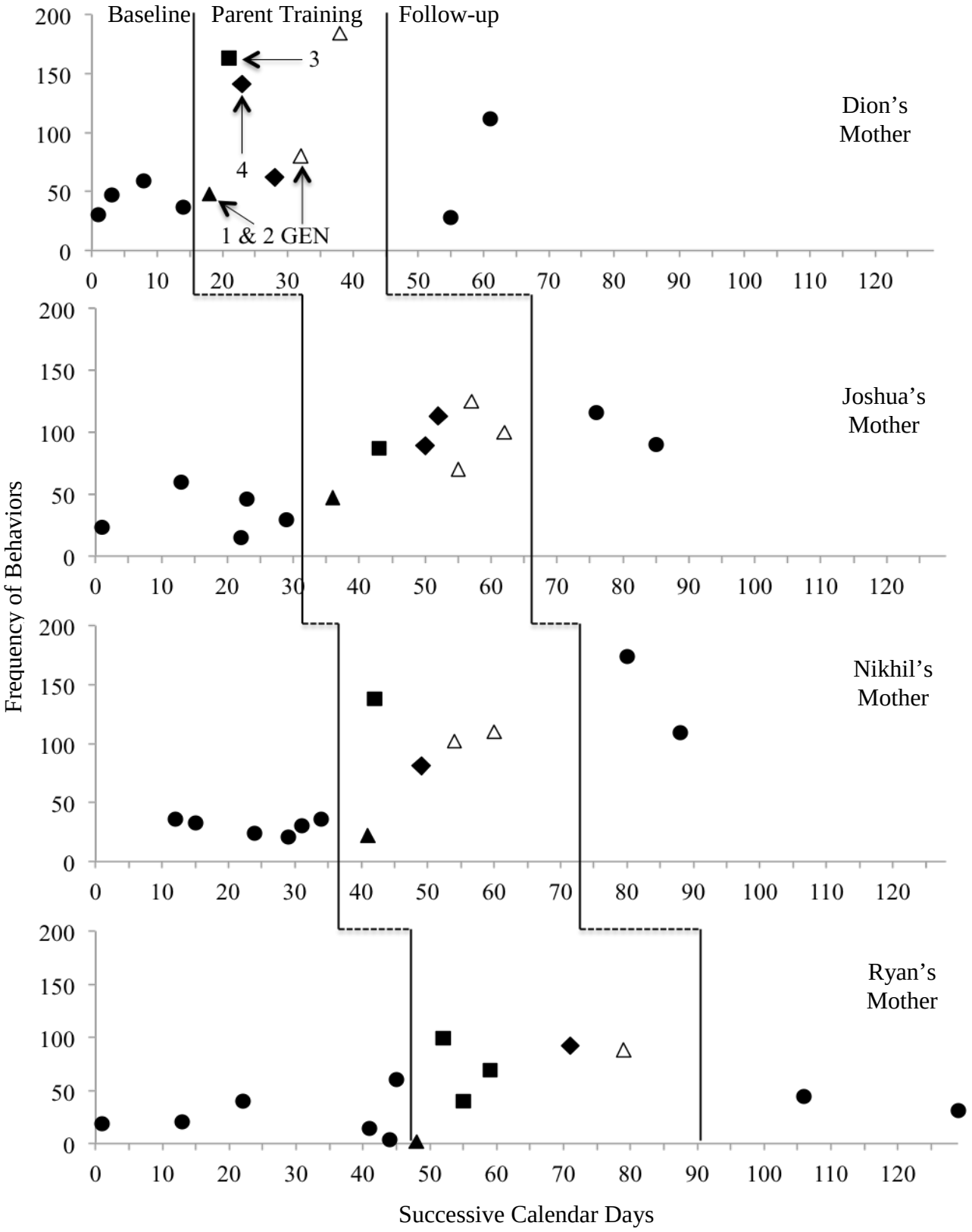


Figure 3. Parent frequency of RIT techniques: Demands and questions

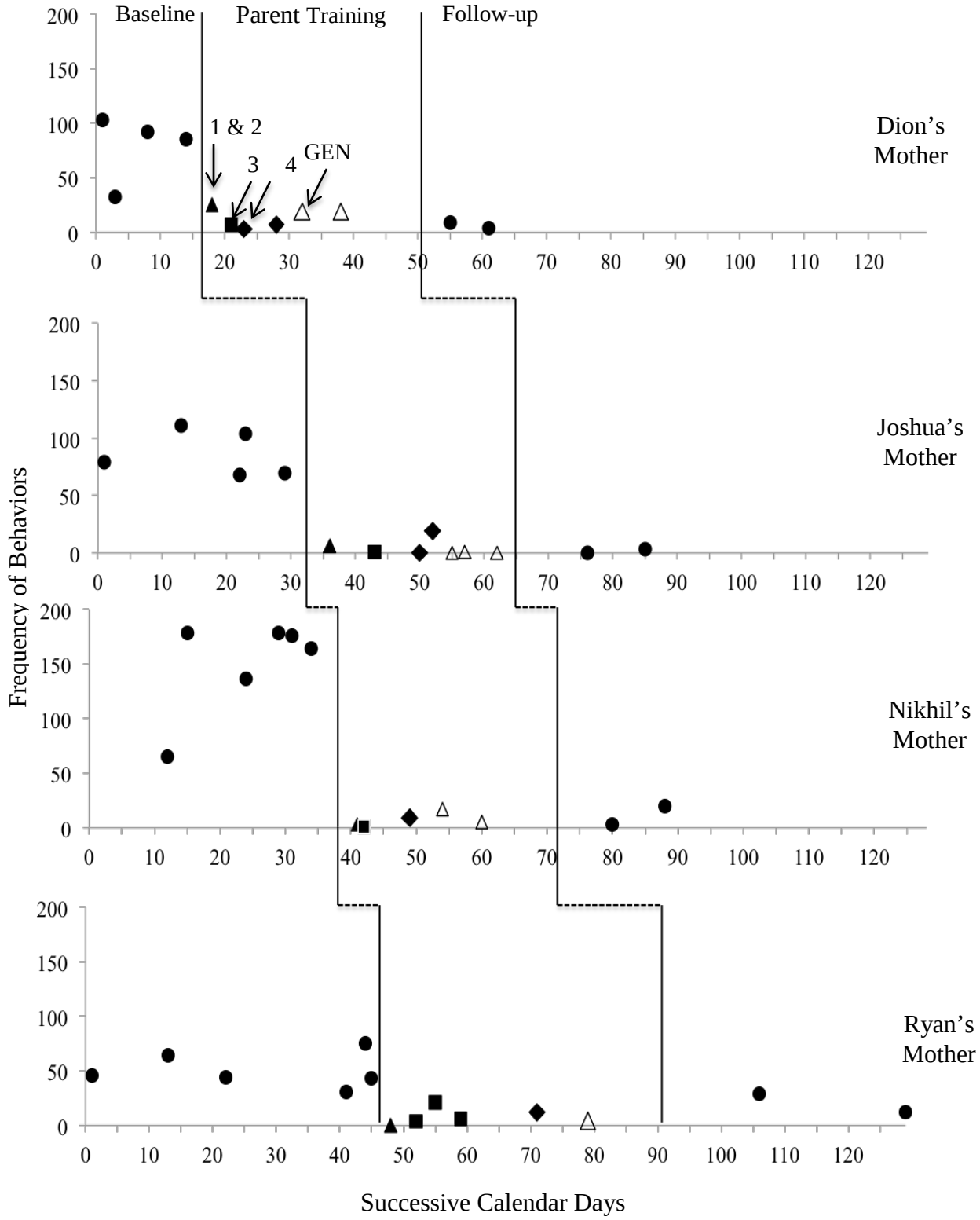
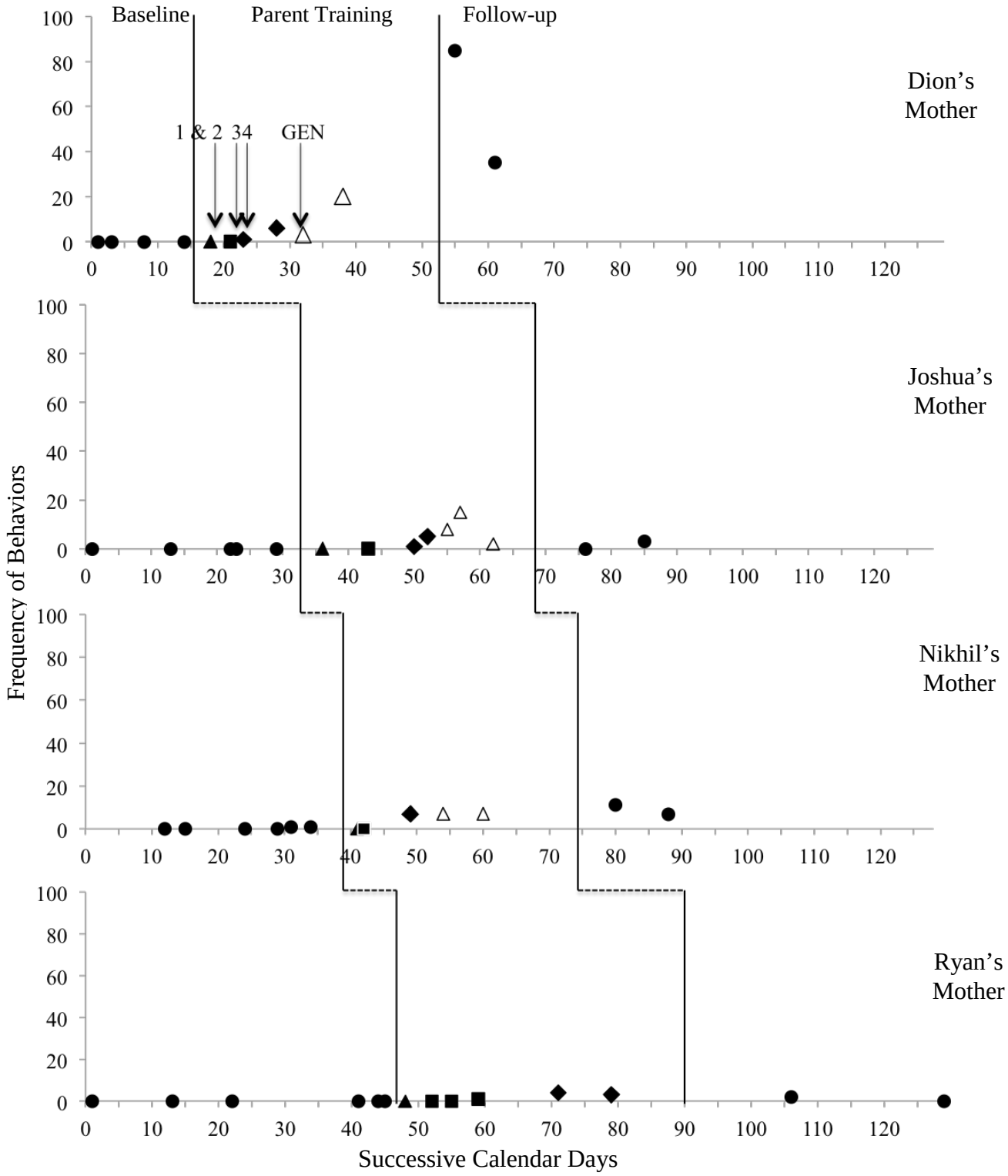


Figure 4. Parent frequency of RIT techniques: Imitation training



4.1.2 Parent dependent variables

Throughout the treatment condition, a phased approach was used – parents completed four modules, each followed by in vivo coaching sessions until fidelity was reached on the techniques in the target module or modules assigned. These techniques built upon one another until each parent had a collection of strategies to use together to teach their child imitation (see Table 8 for frequency mean and range of each condition and module for each parent).

4.1.2.1 Dion's mother

In the baseline condition, Dion's mother engaged in relatively low rates of contingent imitation, zero rates of imitation training, and moderate rates of linguistic mapping with minimal variability. She used demands and questions frequently throughout all baseline sessions. After Dion's mother entered treatment she was trained to set up her home environment for success (module 1) and imitate her child (module 2). Her subsequent use of contingent imitation increased. High rates of contingent imitation maintained throughout all parent training sessions with a slight "dip" when she was taught to use imitation training techniques (module 4) and generalize strategies. Dion's mother engaged in low rates of linguistic mapping until she was taught to describe her child's play (module 3); then, her rate increased to three times the occurrence in the first treatment session (module 1 and 2). Similar to contingent imitation, the rate of linguistic mapping decreased when she was taught to use imitation training techniques (module 4) and generalize strategies to novel toys. After she was instructed how to teach her child to imitate (module 4), imitation training techniques were observed. Then, her use of imitation training techniques gradually increased during the remainder of the treatment sessions,

including generalization. With the onset of the first treatment session where she was trained to set up her home environment for success (module 1) and imitate her child (module 2), her use of questions and demands decreased from a high to lower level with a downward trend observed. After Dion's mother was taught to describe her child's play (module 3), her demand/question use decreased and maintained at slightly variable, low rates through the generalization sessions.

In the follow-up condition, Dion's mother engaged in contingent imitation at a lower level in the first follow-up session and a much higher level in the second; both were still higher than in baseline. Dion's mother continued to engage in high rates of linguistic mapping; she used this strategy more in the first follow-up session than in any other treatment session. Her rates of questions and demands in the final follow-up sessions remained stable at a low level. Conversely, her rates of imitation training increased drastically; she used imitation training more in the follow-up sessions than in any other treatment sessions.

4.1.2.2 Joshua's mother

During baseline, Joshua's mother engaged in near zero rates of contingent imitation, zero rates of imitation training and low rates of linguistic mapping with some variability. Similar to Dion's mother, demands and questions were used frequently during baseline sessions.

With the onset of the first two training modules (introduction to RIT; imitate your child), Joshua's mother's use of contingent imitation gradually increased to a moderately-high rate; the rate maintained as she completed training sessions on describing her child's play (module 3). A slight dip was observed in the second training session of module 4 (imitation training) and the first generalization session. During modules 1 and 2, rates of linguistic mapping were similar to baseline. Linguistic mapping increased after the parent was taught to describe her child's play (module 3). An upward trend in linguistic mapping was observed throughout all treatment

sessions with the exception of the first generalization session where a slight dip was observed. With the onset of imitation training instruction (module 4), Joshua's mother began to use a combination of imitation training techniques and this continued with an upward trend. A slight decrease in imitation training techniques was observed in the last generalization training session. When Joshua's mother was taught modules 1 and 2, her use of questions and demands decreased substantially. A slight increase in question asking/demands was observed when she was taught imitation training techniques (module 4), but then these behaviors decreased to near zero rates when she was taught to generalize the techniques.

During the follow-up condition, Joshua's mother used contingent imitation at relatively high rates with a slightly lower average than in the treatment condition. The upward trend in linguistic mapping continued into follow-up with a higher average than in the treatment condition. She maintained imitation training at a moderate level, slightly lower than observed in the treatment condition. Joshua's mother engaged in near zero rates of demands and questions in the final condition than during the baseline and treatment conditions.

4.1.2.3 Nikhil's mother

In baseline, Nikhil's mother engaged in low levels of contingent imitation and linguistic mapping; both behaviors were relatively stable. She engaged in near zero rates of imitation training. Conversely, she gave demands and asked questions frequently. With the exception of the first baseline session, she engaged in over 100 demands/questions during each of the 10-minute play session.

With the onset of treatment, Nikhil's mother was taught to set up her environment for success and imitate her child (module 1 and 2); she began to use contingent imitation at substantially high rates, but linguistic mapping was used minimally. Contingent imitation use

gradually decreased as the treatment sessions progressed, but was still much higher than the average during baseline. After Nikhil's mother was taught to describe her child's play (module 3), a steep increase was observed in her use of linguistic mapping; the frequency maintained at slightly over 100 during the generalization sessions. Nikhil's mother began to use imitation training techniques when she was taught to teach her child to imitate (module 4). With the exception of a slight increase in the first generalization session, she minimally used demands and asked questions during any of the parent training sessions.

In the follow-up condition, Nikhil's mother maintained higher levels of contingent imitation than in baseline; however, they were much lower than exhibited during the parent training condition. She engaged in higher rates of linguistic mapping in the first follow-up session than in any other sessions, and maintained a relatively high level in the second follow-up session. She also used imitation training more frequently in the first follow-up session than in any other sessions during baseline and treatment. In the first follow-up session, she engaged in near zero rates of demands/question with a slight increasing trend still much lower than in baseline, was observed in the last session.

4.1.2.4 Ryan's mother

The final participant, Ryan's mother demonstrated low, stable levels of contingent imitation during baseline. Her use of the linguistic mapping technique was higher, at a moderate level, with some variability. She did not use imitation training techniques during baseline. Ryan's mother presented demands and asked her child questions frequently, but less than the other participants in baseline. Some variability was observed in demands/questions; however, neither an upward nor downward trend was observed.

With the onset of the first training session in which Ryan's mother was taught to set up the environment and imitate her child, she engaged in a much higher level of contingent imitation than in baseline. After the first session, rates leveled off and maintained at relatively stable rates during the remainder of the treatment sessions. Use of linguistic mapping also increased after Ryan's mother was taught to describe her child's play (module 3) and maintained stable throughout treatment; however, the frequency was not as high as with contingent imitation. Ryan's mother began to use imitation training during the third in vivo session focusing on describing her child's play (module 3), although the techniques had not yet been taught. Her use of imitation training increased as she was taught to imitate her child in the fourth module; but decreased slightly as she completed the generalization session. Regarding demands and questions, she engaged in a much lower level during parent training with a steep decline after she was taught to set up the environment and imitate her child (module 1 and 2). A slight increase was observed in the second in vivo session focusing on teaching her to describe her child's play (module 3) but a declining trend was seen towards the end of treatment.

In the follow-up condition, a slight downward trend in contingent imitation use by Ryan's mother was observed although the frequency was much higher than in baseline. A decrease was seen in the use of linguistic mapping from treatment, with stable responding across both follow-up sessions. Similarly, a decreasing trend in imitation training was observed in the follow-up sessions. She implemented imitation training twice in the first session and zero times in the second. A slight increase was observed in questions/demands during the follow-up sessions; however, frequency of use maintained at lower rates than seen in baseline.

4.2 PARENT INTERVENTION FIDELITY

This section describes the results of intervention fidelity ratings across the four parents in this study. The results will be presented on parent fidelity ratings across conditions. Table 9 displays fidelity for each individual module and overall fidelity for each parent in each session across conditions in the study. The number of sessions required before parents reached fidelity in the techniques during parent training will be presented to conclude this section.

4.2.1 Dion's mother

During baseline condition, Dion's mother's overall intervention fidelity rating was relatively stable at a medium level, but lower than the study criterion for high fidelity with zero trend observed in the data. She was using slightly below half of the RIT techniques presented in the four modules. With the onset of training, Dion's mother was taught to arrange the environment for success and imitate her child (module 1 and 2); in the first session she met the fidelity for the techniques related to setting up her home environment for success and imitating her child (module 1 and 2). She also met the overall fidelity criterion (an average rating of 4 out of 5 or higher, i.e., 80%); however, fidelity for describing her child's play and imitation training were below criterion. With the onset of training for describing the child's play, Dion's mother met fidelity on the techniques in modules 1, 2, and 3 and was above criterion on overall fidelity.

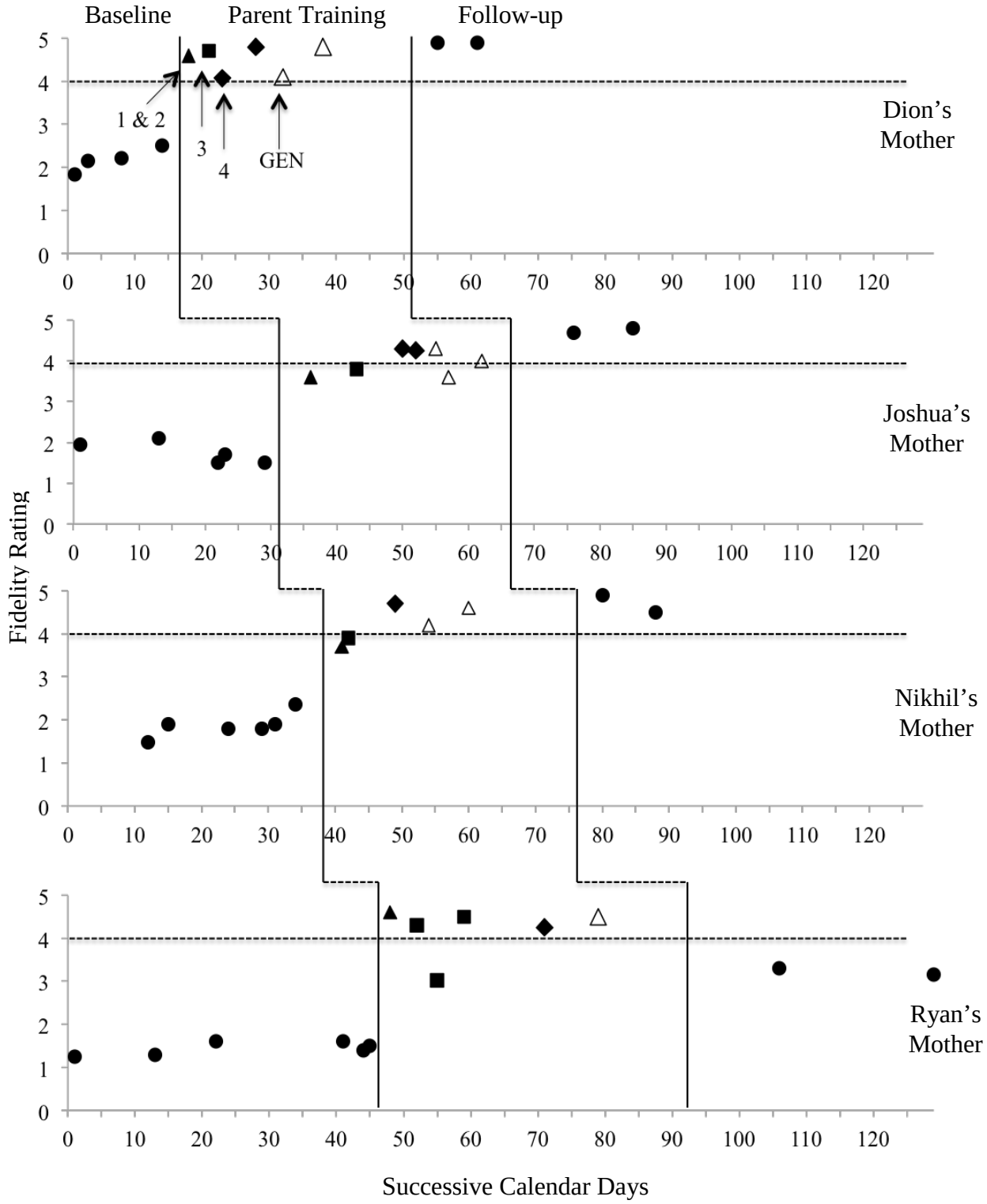
She required two sessions to reach fidelity when taught imitation training techniques (module 4) and two sessions to generalize techniques accurately with novel toys. She maintained a stable overall fidelity that met criterion throughout the parent training condition. At follow-up, fidelity remained stable, at a high level and she maintained the overall fidelity criterion.

Table 9. Parental fidelity ratings for Module 1 - 4 across all conditions and sessions

	Sessions	Baseline 1	Baseline 2	Baseline 3	Baseline 4	Baseline 5	Baseline 6	Module 1 & 2	Module 3	Module 3	Module 3	Module 4	Module 4	Generalization 1	Generalization 2	Generalization 3	Follow-up 1	Follow-up 2
Dion's Mother	M 1	2.3	2	3.8	3.5			4.3	4.8			5	5	5	5		5	5
	M 2	1.5	2.3	1.6	1.6			4.6	4.7			4.6	4.6	4.2	4.4		5	4.8
	M 3	1.6	2.3	2.4	1.8			3.4	4.6			4.6	4.7	4.3	4.9		4.8	4.8
	M 4	2	2	1	3			1	2			2	5	3	5		5	5
	OA	1.8	2.2	2.2	2.5			4.5	4			4.1	4.8	4.1	4.8		5	4.9
Joshua's Mother	M 1	2	2	2	2	2		4.7	4.7			4.3	4.5	4.5	4.5	4.8	4.2	4.5
	M 2	1.7	2.5	1	1.7	0.3		4.4	4.6			4.7	4.1	3.8	3.8	4.1	4.7	5
	M 3	2.1	2	1	1.2	1.8		4.6	4.9			5	4.6	4.1	5	4.7	5	4.7
	M 4	2	2	2	2	2		1	1			3	4	5	5	3	5	5
	OA	2	2.1	1.5	1.7	1.5		3.7	3.8			4.3	4.3	4.4	4.6	4.2	4.7	4.8
Nikhil's Mother	M 1	2.5	2.7	3	2.3	3.2	3.5	4.5	5			5		4.5	4.8		5	4.8
	M 2	1.4	1.1	0.8	1.2	0.8	0.8	5	5			4.5		3.6	4.3		4.9	4
	M 3	1	2	1.7	1.3	1.8	2.2	4.4	5			4.4		3.8	4.5		4.9	4
	M 4	1	2	2	2	2	3	1	1			5		5	5		5	5
	OA	1.5	2	1.9	1.7	2	2.4	3.7	4			4.7		4.2	4.7		5	4.5
Ryan's Mother	M 1	2	2	2.2	2.7	2.2	1.7	4.3	3.8	3.8	4.3	4		4			2.3	2.2
	M 2	1.4	1	1.3	1.5	0.8	1.6	5	4.8	2.7	4.8	4.7		5			4.3	4.7
	M 3	0.7	1.2	2	1.3	0.5	1.9	1	4.3	2.6	4.4	4.3		5			3.4	3.8
	M4	1	1	1	1	2	1	1	1	1	3	4		4			3	2
	OA	1.3	1.3	1.6	1.6	1.4	1.6	2.8	3.5	2.5	4.1	4.3		4.5			3.3	3.3

Note: M = Module; shaded = parent reached fidelity criteria before this session; therefore, this session was not part of the parent's training; OA = Overall fidelity (cumulative average of the four modules)

Figure 5. Parent intervention fidelity ratings



4.2.2 Joshua's mother

During baseline condition, the overall intervention fidelity rating of Joshua's mother was relatively stable at a medium level, but lower than the study criterion for high fidelity; zero trend was observed in the data. She implemented less than half of the RIT techniques with fidelity in all baseline sessions. After Joshua's mother was taught to set up the home environment for the intervention and imitate her child (module 1 & 2), like Dion's mother, she met overall fidelity criterion. She also met module fidelity criterion for setting up her home, imitating her child, and describing her child's play (module 1, 2, and 3, respectively) although she had not yet completed module 3. She required two training sessions to meet fidelity for imitation training (module 4). A slight dip in overall fidelity was observed in the generalization session. Joshua's mother never met target fidelity for all four modules during her first, second, and third generalization session due to a low rating in module 2, 2, and 4, respectively. In general, she met criterion for overall fidelity; ratings maintained stability at a high level with a gradual upward trend throughout the parent training condition. An increase in level was observed during the follow-up sessions; she met the overall fidelity in both sessions at a higher rating than any other sessions during treatment with the exception of one. Her overall fidelity rating was at a higher level than in all other sessions, with zero trend observed.

4.2.3 Nikhil's mother

During baseline condition, the overall fidelity rating of Nikhil's mother was relatively stable at a medium level, but lower than the study criterion for high fidelity; a slight upward trend was

observed in the sixth and final baseline session. With the onset of treatment (after the she was taught to set up her home for success and imitate her child), a change from low to high was observed in the level; Nikhil's mother met module fidelity criterion for the techniques used in modules 1 – 4 in three sessions. Her overall fidelity was relatively stable, at a high level, with zero trend across the remainder of treatment sessions with one exception; a slight dip (was below fidelity on techniques in module 2 and 3) was observed in the generalization session. She required two in vivo coaching sessions to meet module fidelity in the strategies in all four modules during generalization. This increasing trend continued in the first follow-up session; however a slight decrease the overall fidelity rating was observed in the second.

4.2.4 Ryan's mother

During the baseline condition, Ryan's mother's average intervention fidelity rating was relatively stable at a low level; no trend was observed. As she was trained to set up her home and imitate her child (module 1 and 2), a much higher level in the overall fidelity was observed followed by a descent to below criterion when she was taught to describe her child's play (module 3). Ryan's mother's overall fidelity during the treatment sessions was more variable than the other participants, at a moderate to high level. Like the other parents, she met the overall fidelity criteria immediately after she was taught to set up her home and imitate her child (modules 1 and 2). A slight dip was observed when she was taught to describe her child's play (module 3); three sessions were required before she met module fidelity criteria. She quickly met criteria for imitation training (module 4) and generalization with only one training session for each. A decrease in level was observed during follow-up. She was the only parent that did not meet overall fidelity criteria in the follow-up sessions.

4.2.5 Summary of parent fidelity

The four parents met fidelity rapidly through the combination of Internet-based instruction and in vivo coaching. All parents met fidelity on module 1 and 2 techniques after they were taught to set up their homes and imitate their children in one training session. Similarly, with the exception of Ryan's mother, all parents met fidelity on module 3 (describe your child's play) in one training session while maintaining fidelity on modules 1 and 2. Two parents required two sessions to reach fidelity on imitation training techniques and two required only one session. To reach module fidelity criteria in all four modules during generalization, one parent required one in vivo training session, one parent required two, and one parent required three.

4.3 CHILD IMITATION

This section describes changes in children's spontaneous and prompted imitation across three conditions: baseline, treatment and follow-up.

4.3.1 Dion

During the baseline condition, Dion engaged in stable, near zero rates of prompted and spontaneous imitation. Low rates of imitation were observed when his mother was taught to set up the environment, imitate her child, and describe her child's play (module 1, 2, and 3, respectively). Rates increased slightly after Dion's mother was provided with instruction on how to teach her child to imitate (module 4); an upward trend was observed with minimal variability

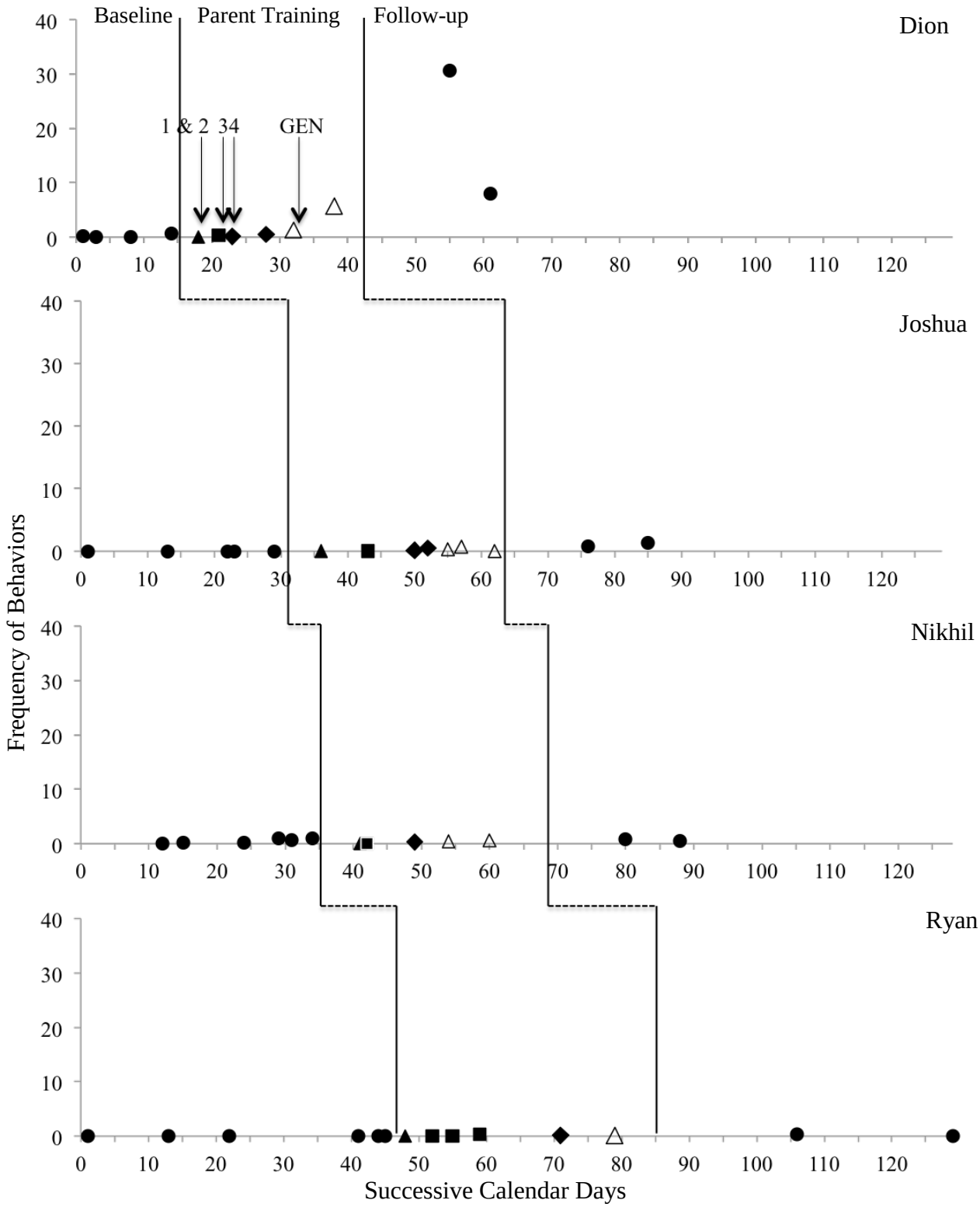
in spontaneous and prompted imitation through the second session for imitation training. When Dion's mother completed generalization sessions, Dion spontaneous imitation was more variable but occurred at a slightly higher level than during the imitation training sessions (module 4) with an upward trend. Prompted imitation maintained stability with no observable trend, but was also at a higher level during generalization than during imitation training (module 4) sessions. Dion engaged in rates of spontaneous imitation in both follow-up sessions that were much higher than during treatment. A steep and gradual increasing trend was observed during the first follow-up.

Table 10. Child rate of spontaneous and prompted imitation per 10-minute session across conditions

	Dion		Joshua		Nikhil		Ryan	
Sessions	S	P	S	P	S	P	S	P
Baseline 1	0.2	0	0	0	0	0	0	0.1
Baseline 2	0	0	0	0	0.1	2.5	0	0
Baseline 3	0	0	0	0	0.1	0.8	0	0
Baseline 4	0.6	0	0	0	1	1.7	0	0
Baseline 5			0	0	0.7	0.2	0	0.2
Baseline 6					0.8	0.3	0	0
Module 1 & 2	0	0	0	0	0	0	0	0
Module 3	0.3	0	0	0	0	0	0	0
Module 3							0	0
Module 3							0.3	0.2
Module 4	0.1	0	0.1	0.5	0.3	0.5	0.1	0.2
Module 4	0.5	0.6	0.5	0.5				
Generalization 1	1.3	0.3	0.3	0.5	0.4	0.4	0.1	0.3
Generalization 2	5.7	0.3	0.7	1.3	0.5	0.5		
Generalization 3			0	0.2				
Follow-up 1	30.6	0.9	0.8	0.5	0.1	0.5	0.4	0.2
Follow-up 1	8	0	1.3	0.4	0.2	0.4	0	0

Note: S = spontaneous imitation; P = prompted imitation; shaded = parent reached fidelity criteria before this session; therefore, this session was not part of the parent's training

Figure 6. Child rate of spontaneous imitation in 10-minute play sessions across conditions



session (three weeks after treatment was completed) for spontaneous and prompted imitation, respectively. Rates of spontaneous imitation continued to be high in the second session, prompted imitation rates dropped to zero, both lower than in the first follow-up session.

4.3.2 Joshua

During the baseline sessions, Joshua had zero rates of prompted and spontaneous imitation. Similar to Dion, after Joshua's mother was taught imitation training techniques (module 4) his rate of spontaneous and prompted imitation increased. Stable rates of both spontaneous and prompted imitation were observed throughout the remainder of the imitation training and generalization training sessions with a slight upward trend in spontaneous imitation. One exception was observed; a "dip" to zero in spontaneous imitation was seen in the third generalization training session. The overall mean for treatment sessions was 0.2 with a range of 0 to 0.7. In the two follow-up sessions, Joshua engaged in spontaneous imitation more than in any other baseline or treatment session.

4.3.3 Nikhil

During baseline, Nikhil engaged in relatively variable rates of prompted and spontaneous imitation, at a moderate level with a slight upward trend. With the onset of treatment, imitation decreased substantially when Nikhil's mother was taught to set up the environment, imitate her child, and describe her child's play (module 1, 2, and 3, respectively). As imitation training was introduced in treatment, spontaneous and prompted imitation rates increased slightly. Spontaneous imitation continued to increase with slight variability as generalization sessions

were conducted; prompted imitation maintained at a stable rate. During the first follow-up sessions (conducted two and three weeks after treatment concluded), Nikhil engaged in an upward trend of spontaneous imitation from treatment, but in the second session the rate decreased slightly.

4.3.4 Ryan

Ryan engaged in near zero rates of spontaneous and prompted imitation with no variability or trend during the six baseline sessions. No trend continued to be observed with the onset of treatment in spontaneous and prompted imitation. A slight increase in both types of imitation was observed in the third training session for module 3. During this session, a slight decreasing trend was observed in spontaneous imitation while rates of prompted imitation continued to maintain at a similar level. Ryan engaged in an average of imitation of 0.08 with a range of 0.0 – 0.3 times per minute. The highest rate of spontaneous imitation was observed in the first follow-up session, but this decreased to zero rates during the second follow-up session.

4.3.5 Summary of child imitation

Indeed, children were taught to imitate through parent-implemented RIT in this study. Overall, three children (Dion, Joshua, and Ryan) engaged in higher rates in the treatment condition than in baseline, specifically, the children began to engage in higher rates of imitation when the parents were taught to teach their children to imitate (module 4). Dion and Joshua's spontaneous imitation maintained at higher rates than in baseline at follow-up. Conversely, Ryan's imitation decreased to near zero; this is likely due to the fact that Ryan's mother did not use imitation

training techniques to elicit imitation. Nikhil engaged in higher rates of imitation during baseline; however, rate of spontaneous imitation did gradually improve during treatment, contingent upon the parental use of techniques that elicited imitation.

4.4 CHILD SOCIAL-ENGAGEMENT

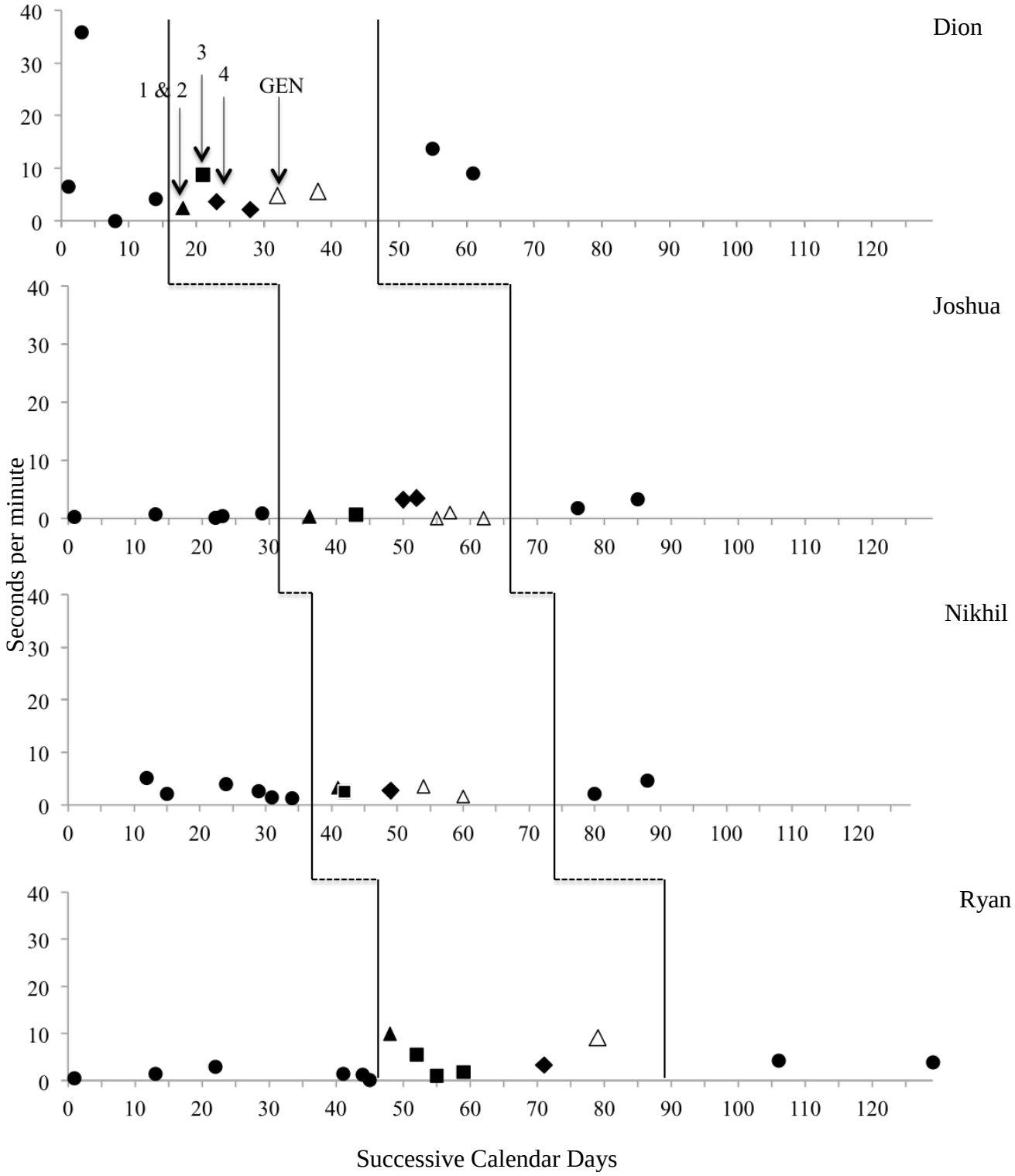
This section describes changes in children's social engagement (measured in seconds and seconds per minute across the 10-minute play sessions) across three conditions: baseline, treatment and follow-up. Social-engagement was a cumulative duration of the occurrence of mutual gaze, social gaze, and three types of joint attention.

Table 11. Child duration in seconds and rate of social-engagement per 10-minute session across conditions

	Dion		Joshua		Nikhil		Ryan	
Sessions	Seconds	Rate	Seconds	Rate	Seconds	Rate	Seconds	Rate
Baseline 1	63.8	6.4	1.9	.2	51.1	5.1	4.3	.4
Baseline 2	358.6	35.9	6.8	.7	21.1	2.1	14.3	1.4
Baseline 3	0	0	.5	.05	40.1	4.0	29.5	3.0
Baseline 4	41.4	4.1	3.5	.35	26.2	2.6	14.5	1.5
Baseline 5			7.7	.77	14.9	1.5	11.7	1.2
Baseline 6					12.8	1.3	.5	.05
Module 1 & 2	24.4	2.4	2.9	.29	32.5	3.3	99	9.9
Module 3	87.2	8.7	6.2	.62	24.8	2.5	55	5.5
Module 3							10.1	1.0
Module 3							18	1.8
Module 4	36.1	3.6	31.9	3.2	26.8	2.7	32.8	3.3
Module 4	21	2.1	35.6	3.5				
Generalization 1	47.6	4.8	0	0	35.3	3.5	90.4	9.1
Generalization 2	56.3	5.6	9.7	1.0	16.3	1.6		
Generalization 3			0	0				
Follow-up 1	137.4	13.7	18.1	1.8	20.7	2.1	42.5	4.3
Follow-up 1	90	9.0	31.5	3.2	46.7	4.7	38.2	3.9

Notes: Seconds = duration of social-engagement in seconds across entire 10-minute play session; Rate = rate of social-engagement per minute across 10-minute play sessions; shaded = parent reached fidelity criteria before this session; therefore, this session was not part of the parent's training.

Figure 7. Child social-engagement in 10-minute play sessions across conditions



4.4.1 Dion

During the baseline sessions, Dion's duration of social-engagement was variable with an average of two seconds with a range of zero to six seconds per 1-minute interval in the 10-minute play sessions. In the second baseline session, he engaged in social-engagement behaviors for 358.6 seconds or 60% of the 10-minute session. It is important to note that during this session his mother did not use any toys during play; she used a large beanbag and trampoline. During all other sessions a variety of toys were used. As Dion's mother was taught to set up the environment and imitate her child (module 1 and 2), duration of social-engagement was low; a slight increase was observed after she was taught to describe her child's play (module 3). Social-engagement maintained at low rates when she was instructed on imitation training techniques (module 4); a slight increase was observed again during the generalization sessions. During the first follow-up session Dion's duration of social engagement was higher than during all treatment sessions at 137.4 seconds. Although a slight decrease was observed in the second follow-up session, duration of social-engagement was similar to the rate observed when Dion's mother was taught to describe her child's play.

4.4.2 Joshua

Joshua's duration of social-engagement during baseline was near zero less than 10 seconds in each of the five sessions. When Joshua's mother was introduced to RIT, taught to imitate her child and describe her child's play (module 1, 2, and 3) his rate of social-engagement increased

slightly. When imitation training was taught (module 4) Joshua's social-engagement increased to over 30 seconds in both sessions. A "dip" to zero seconds was observed in the first and third generalization sessions with a slight increase in the second. During the two follow-up sessions, Joshua maintained higher (but still low) durations than in baseline of 18.1 and 31.5 seconds.

4.4.3 Nikhil

In baseline, Nikhil's social-engagement was variable ranging from 12.8 to 51.1 seconds with an average of 27.7. The duration of social engagement was at a moderate level during the first four baseline sessions, and then dropped to below 15 seconds in the final two sessions. After Nikhil's mother was taught module 1 and 2, social-engagement increased to two times as long as in the last baseline session. Rates remained relatively stable after Nikhil's mother was taught to describe her child's play (module 3) and use imitation training techniques (module 4), but decreased in the second generalization session. During the first follow-up session, Nikhil's duration of social-engagement lasted longer; this trend continued in the second follow-up session. In the second follow-up session his length of social-engagement was 46.7 seconds.

4.4.4 Ryan

During the six baseline sessions, the duration of Ryan's social-engagement was low with an average of 13.3 seconds with a range of 4.3 to 29.5. After Ryan's mother was taught to set up her home for success and imitate her child (module 1 and 2), his duration of social-engagement was much longer at 99 seconds. A slight decrease to 55 seconds was observed with the onset of training focused on describing her child's play (module 3); this downward trend continued into

the second and third training sessions for module 3. It is important to note that Ryan's mother required three in vivo sessions to meet fidelity in the individual modules when she was trained in module 3 techniques (module 1, 2, and 3). In this case, Ryan's decreasing duration of social-engagement is concurrent with his mother's inability to meet fidelity criterion. With the onset of instruction of imitation training (module 4) his social-engagement improved to 32.83 seconds; this increasing trend continued into the generalization session (90.42 seconds). A shorter duration was observed in the two follow-up sessions, although rates were still higher than baseline.

4.4.5 Summary of child social-engagement

Improvements in the duration of social-engagement were variable across children. For Joshua, the length of social-engagement remained relatively short in duration across all conditions although a slight increase was observed when his mother was taught imitation training. Conversely, Ryan's social-engagement was short in baseline, but was much longer in the treatment and follow-up conditions. Both Dion and Nikhil's social-engagement was longer in one and two baseline sessions than it was during treatment or follow-up. For Dion, Joshua and Nikhil social-engagement in at least one follow-up session was the second longest duration observed during the study. These results suggest that in the case of all four children, the longer children are delivered RIT, the more likely they are to improve in social-engagement levels with their parents.

4.5 PRE/POST TREATMENT MEASURES

Table 12. Percent improvement in pre and post treatment scores for percentile rank of child development and raw score for imitation measures among four children enrolled in RIT study

Children	DOCS	CSBS Social Composite	CSBS Speech Composite	CSBS Symbolic Composite	CSBS Total Composite	MIS
Dion	No changes reported	(2 – 5) +3%	(37 – 75) +38%	(50 – 91) +41%	(10 – 50) +40%	(87 - 100) +13%
Joshua	No changes reported	(1 – 1) 0%	(2 – 1) -1%	(1– 1) 0%	(1– 1) 0%	(6 – 6) 0%
Nikhil	No changes reported	(2 – 9) +7%	(91 – 95) +4%	(63 – 91) +28%	(50 – 75) +25%	(65 – 96) +31%
Ryan	No changes reported	(5 – 9) + 4%	(63 – 50) - 13%	(2 – 5) +3%	(12 – 13) +1%	(6 – 25) +19%

Note: CSBS = Communication and Symbolic Behavior Scales, Developmental Profile, Behavior Sample (Wetherby & Prizant, 2002); MIS = Motor Imitation Scale (Stone, 1997) ; APSI = Autism Parenting Stress Index (Silva & Schalock, 2012); (+) = percentage of child improvement; (-) = percentage of lowered improvement.

This section describes the results of the measures collected pre and post treatment for children and parents. First, changes in elicited motor imitation will be described, followed by improved child development. Then, changes in parent stress related to parenting a child with autism will be discussed.

4.5.1 Motor Imitation Scale

Improvements were observed on the MIS for three participants, Dion, Nikhil and Ryan. Nikhil improved the most, with an increase of 31%; he imitated 65% of the object and gesture movements pre-treatment and 96% post-treatment. Ryan was second, with a 19% increase from 6% to 25%. His accurate imitation of behaviors, however, was lower than Dion and Nikhil. Dion improved 13%, starting with 87% in pre-treatment and imitated 100% of the behaviors post-treatment. Joshua, on the other hand, only partially imitated one behavior in the pre-test (i.e., walking dog across the table) and post-test (i.e., tapping hands on table). The sign-test was used

to evaluate changes in pre/post object, gesture and total imitation scores. Results of the two-sided test suggest that there were no significant changes among object ($p=0.625$), gesture ($p=0.125$) and total ($p=0.625$) imitation following the intervention.

4.5.2 Developmental Observation Checklist System – Parent Report/Profile Form

All parents were provided with a copy of the profile form they completed pre-treatment. Then, the parents were asked to review the form and indicate if their responses had changed. All parents reported that their children's development did not change during the course of the treatment.

4.5.3 Communication and Symbolic Behavior Scales, Developmental Profile, Behavior Sample

Social, speech, symbolic and total raw composite scores were converted to percentile rank scores for each individual on the CSBS Behavior sample. Dion's percentile ranks were much higher in post-treatment than pre-treatment for all scores, with the exception of the social domain. Joshua showed no change in percentile rank in any of the four domain areas. Conversely, Nikhil improved from pre- to post-test with modest increases in all domains. Like Dion and Joshua, his improvement in the social domain was lower than all other scores. Ryan made pre to post improvements in social, symbolic and the total score, but fell to a lower percentile rank in speech.

4.5.4 Autism Parenting Stress Index

Overall, with the exception of Ryan's mother, no substantial improvements (decreases in raw score) were observed on the APSI. In the case of Nikhil's mother, her stress increased 2-points pre to post treatment. The score of Ryan's mother score decreased 19-points from 38 to 19 (with 52 being the highest score). Dion's mother and Joshua's mother decreased 1-point and 7-points, respectively. Dion's mother was most stressed about communication, diet, and concern for her child's future before and after treatment. Joshua's mother was concerned less than the other parents; her highest scores pre and post treatment were diet and potty training. For Nikhil's mother the measure used to assess stress was similar in pre and post assessments. The areas she rates the most stressful were her child's social development and communication, making transitions, not feeling close to her child, and her child's future. Finally, Ryan's mother was very concerned about communication, self-injurious behavior, and her child's future. Based on her post-treatment score, her stress in most of those areas decreased with her major concerns being potty training and her child's future.

4.6 SOCIAL VALIDITY

After treatment was completed all parents completed the BIRS (modified version of Elliot & Treuting, 1991) indicating the program usability, acceptability and effectiveness of the intervention. All parents responded favorably with the mean of all scales over 5.5 on a 6-point scale.

Table 13. Mean and range of parent ratings of program usability, acceptability, and effectiveness of the intervention on the BIRS

Scales	Mean (range)
Program usability (14 items)	5.69 (4.5 - 6.0)
Program acceptability (11 items)	5.69 (3.0 - 6.0)
Program effectiveness (8 items)	5.519 (3.0 – 6.0)

Note: 1 = strongly disagree, 3 = neutral, 6 = strongly agree

Parents also completed an open-ended questionnaire about the benefits of the program, improvements observed in their children, and strategies they believed they learned. The responses of parents varied. Overall, results of the open-ended questions indicated parents enjoyed the combination of Internet-based modules and in vivo coaching and that they would not remove any part of the program.

Table 14. Examples of parent responses to post-treatment open-ended questions regarding benefits, improvements, and parent learning

Questions	Responses
What was the most helpful part of the program? Why?	Dion's mother: *"The completion of the Internet modules and the in-home training. I needed to be able to watch the intervention being performed by someone else before I could try it myself. I liked the ease and privacy of the Internet modules but needed the coaching to actually be able to do this. The in-home coaching also kept me accountable for the practice sessions."* Joshua's mother: *"Learning that imitation can go both ways and that It is just as important to imitate my son during play if I want him to imitate me and others."*
What have you learned throughout the course of the program?	Dion's mother: *"I learned how to play with my son! I got a better sense of what is both motivating and fun for him, not what I thought he should enjoy. We have played more in the past two months than we ever have and he seems more content and engaged."* Nikhil's mother: *"To take each opportunity to interact with my child in a positive way, to be patient before seeing results of spontaneous imitation."* Ryan's mother: *"How to get Ryan to do things that he sometimes doesn't want to do - such as imitating me, engaged longer periods of time."*
Did you enjoy the Internet modules? Why?	Dion's mother: "*I loved the Internet modules because I needed to see the videos that demonstrated both the right and wrong way to implement the techniques. I printed the materials and homework assignments so that I can use them for future reference. I liked being able to complete this at my convenience."* Ryan's mother: "*Yes, they were cool. It showed me more steps and it was interesting to see other kids learning.*

Did you enjoy the in person coaching? Why?	Dion's mother: *"Yes!!! Johanna's demeanor and teaching style was perfect for our family. We never felt judged or looked down upon as we learned the strategies. We wish we could have Johanna for more in home training."* Nikhil's mother: *"Yes, the most because it really helped me during moments of frustration or when I felt unsure of how to move play along."*
Please describe the improvements you've seen in your child throughout the course of the program.	Dion's mother: *"Dion is more attentive, more content, more engaged, more verbal. He imitates so well!! Even the teachers and aids at school have commented on the changes in him."* Joshua's mother: *"He has become much more babbly with sporadic words tossed in. He is also observing others more."* Nikhil's mother: *"He is making somewhat more eye contact and seems more socially interested. As of now, he is still more interested; however, in repetitive play at times and hasn't really taken off with spontaneous imitation."* Ryan's mother: *"Imitation is better especially with my husband; playing with toys that he hadn't before."*

4.7 SUMMARY OF RESULTS

It is evident that parents learned to implement RIT strategies presented in four Internet-based modules and in vivo coaching at higher rates; almost all parents implemented those techniques with fidelity throughout treatment and maintained during follow-up. Across participants, as parents completed each module and progressed through in vivo coaching, they began to increase the frequency of and appropriate use of strategies. The parents all reached overall fidelity in the RIT techniques presented in the four Internet-based modules during the training sessions for modules 1, 2, and 3. All four parents met overall fidelity during generalization; however, only three met fidelity for all four modules within three generalization sessions. Three out of four parents maintained overall fidelity at follow-up.

Along with improvements in parental use of strategies, children increased their use of imitation, specifically spontaneous imitation within parent-play sessions. With the exception of one participant, modest improvements in spontaneous imitation were observed during the treatment condition when compared to baseline. Additionally, slight improvements were observed in child imitation and development based on the changes of standardized measures conducted pre and post treatment. Slight decreases were also observed in the stress of three parents. Furthermore, based on social validity ratings and open-ended questions, all parents believed the intervention was enjoyable and effective for their children to learn imitation skills.

5.0 DISCUSSION

The purpose of this chapter is to discuss the relationship between the results of the present study and the existing literature on training parents of children with ASD to implement RIT. This chapter presents a summary of the findings then discusses how they relate to training parents through a combination of Internet-based modules and in vivo coaching. The discussion is followed by a presentation of the limitations of the current study. Recommendations for future research in the area of parent training, and parent-implemented social-communication interventions using distance-based instruction and in vivo coaching are offered. Finally, conclusions regarding the research study are provided.

5.1 SUMMARY OF FINDINGS

The goal of this study was to examine the effectiveness of training four parents of children with ASD to implement RIT using a multiple-probe design. Parents were taught the techniques through a combination of four Internet-based modules and in vivo coaching. The parents completed each module independently and then were coached in their home to use the techniques presented in the module. While the modules were completed individually, they comprised a package of strategies that made up RIT. The results of this study showed that as the parents completed each module, their use of the techniques presented in that module began to increase

(or decrease, i.e., demands/questions). In some cases the parents used techniques they had not yet learned in the modules. The mothers of Ryan and Dion started to use linguistic mapping at higher rates than baseline when they were introduced to RIT and taught to imitate their children's behaviors (module 1 & 2) and all parents decreased their use of demands/questions after module 1 & 2 although this strategy was not taught until module 3. Ryan's mother began to use imitation training techniques when she was taught to describe her child's play (module 3). For all participants, when imitation training techniques were presented, a "dip" was observed in contingent imitation; the rate of parent behaviors increased slightly and then maintained at stable rates within one or two sessions during treatment. Additionally, a slight decrease was seen in linguistic mapping for two participants after module 4 (imitation training) was completed. With the exception of the fourth participant, linguistic mapping increased with one to two sessions, then continued with an upward trend or maintained at stable rates during follow-up. Regarding rates of imitation training, all participants increased the frequency at which they used the techniques after module 4 was completed. Two participants increased their use of imitation training through generalization and follow-up. Specifically, Dion's mother reached rates that were substantially higher than during baseline and treatment and the behaviors of Joshua's mother slightly increased and maintained at the higher rate. Of the other two participants, one maintained stable rates of parent behaviors throughout all generalization and follow-up sessions, but did not show improvement and the other, showed a decreasing trend ending the final session with zero rates of imitation training.

Indeed, parents learned to use RIT techniques with high fidelity when trained using a combination of Internet-based and in vivo instruction. Across all parents, less than three in vivo coaching sessions were required to meet the criteria for high overall fidelity (i.e., 4 out of 5 on

the rating scale). Ryan's mother was the only parent to lower her fidelity rating below criteria during the remainder of treatment and follow-up sessions. The "dip" during treatment was observed during the in vivo coaching sessions for module 3 and is believed to be due to Ryan's engagement in high rates of problem behaviors (i.e., crying, dropping to floor). When these behaviors occurred, she was unable to imitate him and began to ask him questions to determine why he was upset. Aside from the overall fidelity rating gathered, parents were also rated on their ability to use the techniques corresponding with each individual module (e.g., module 3 taught the parents to use linguistic mapping, eliminate demands and questions, etc.). All parents reached fidelity for modules 1 and 2 in the first in vivo coaching sessions. Three met fidelity for module 3 with only one session; Ryan's mother required three. Two parents required two sessions to learn the techniques in module 4; two required only one. Dion and Nikhil's mothers met fidelity for generalization with two in vivo sessions and Ryan's mother needed only one. In generalization sessions, Joshua's mother never met the fidelity criteria in all modules. Three parents met fidelity, and in some cases increased/improved in strategy use during follow-up.

Parent-implemented RIT did have an impact on the spontaneous imitation of the four children in this study. All children increased in their ability to spontaneously imitate their play partner during the intervention; specifically, after parents were taught module 4, rates of imitation began to increase. Two exceptions to this statement were observed. First, Nikhil's rates of imitation were higher during baseline than during treatment. The reason for these rates are attributed to his mother's newly formulated interest in teaching her child to imitate. Nikhil had been diagnosed shortly before the study began, and his mother reported she was in the process of investigating the diagnosis of autism as well as the skills she needed to teach her child so that he would succeed in life. After the researcher discussed the purpose of the study to Nikhil's mother,

she may have inferred that she should demonstrate how she currently taught her child to imitate. When told to "play with her child as she typically would" during baseline sessions 2 through 6, she set up scenarios where she tried to elicit imitation from her child. She rarely used the combination of imitation techniques taught in module 4; however, Nikhil did engage in some spontaneous imitation regardless. When treatment began, she quickly acquired the techniques used in the modules; in module 1, 2 and 3 the parents are told to imitate their children, not teach imitation. Therefore, spontaneous imitation rates decreased until module 4 was completed. After module 4 was taught, she started to use imitation techniques; thereby, eliciting spontaneous imitation again. The second instance where imitation decreased in the intervention was observed with Ryan's. Ryan's rate of imitation during the second follow-up session was zero. One possible reason for this result was that in the second follow-up session, his mother never used imitation training techniques; therefore, he was never presented with modeled behaviors to imitate. Although she rapidly met fidelity with the techniques in modules 4 and used these correctly during generalization, fidelity decreased during follow-up to below criteria. Ryan's mother did not record practicing the strategies in the home on the data sheet provided. She also cancelled many sessions before follow-up. Therefore, another possible reason for the low rate of imitation may have been lack of practice or the extended latency period between the final treatment session and generalization leading to a lack of recollection of how to implement the RIT techniques.

Improvements in the duration of social-engagement were variable overall. Dion and Nikhil had longer durations of social-engagement during one or more baselines sessions than during treatment or follow-up. Conversely, Dion's duration was much higher during follow-up than during any treatment sessions. The length of Joshua and Ryan's social-engagement

gradually was longer in baseline in some treatment sessions than in baseline, specifically when parents were taught to imitate their child (Ryan) and use imitation training techniques (Joshua).

Another variable that was explored in this study was stress related to parenting a child with autism. Three of the four participants rated their stress as lower post-treatment. It is difficult to say, however, if the decreasing stress levels were a result of the parent training methods used in this study. The rating scale generally asked parents about stress in various areas; two items related to skill development. Therefore, decreases in stress may be attributed to other variables existing in the parent's life. It is recommended that future research use an additional measure that may more accurately reflect changes observed in a social-communication intervention and how those relate to stress.

5.2 DISCUSSION OF FINDINGS

This study provides support for training parents of children with ASD to use RIT, specifically, the effectiveness of combined Internet-based modules and in vivo coaching in the home. Wainer and Ingersoll (2012) trained three parents of children with ASD using Internet-based modules; when parents did not meet fidelity after completing the modules, only then was in vivo coaching used. This study extends the research of Wainer and Ingersoll (2012) by examining the use of similar Internet-based modules in combination with a different component - each module was followed by in vivo coaching sessions until fidelity was reached with RIT techniques. Then, parents were assigned new modules until they completed all four and generalized their abilities. There are several reasons why the results of this study are meaningful. First, when young children with ASD are diagnosed, parents often seek out what they believe to be the best

interventions for their children. Distance-based interventions can provide parents with immediate access to evidence-based treatments, specifically when a trained practitioner is not available. Secondly, distance-based interventions can augment in person training so that parents can rapidly acquire knowledge of evidence-based treatments when time allotted with practitioners is limited.

The findings in this study extend the research on RIT and parent-implemented RIT, most of which has been conducted in a clinical setting (Ingersoll, 2012; Ingersoll & Gergans, 2007; Ingersoll & Lalonde, 2010; Ingersoll & Schreibman, 2006). Young children with ASD spend most of their time engaging in daily activities with their parents in the home; therefore, the findings in this study generalize its application from the clinic to more natural environments. Indeed, this approach taught parents to implement RIT; however, it is still unclear if one of the two delivery methods (i.e., Internet modules or in vivo coaching) is more effective for teaching parents to reach fidelity, or if both are necessary. In the case of Ingersoll and Wainer (2012), two out the three parents met fidelity criteria after completing the modules without any in vivo coaching; however, only two post-treatment sessions were conducted for each parent. It would have been interesting to observe if parents maintained the same fidelity ratings over time. The findings of three out of four parents in this study support the notion that the addition of in vivo coaching maintains parent fidelity over time, and in some cases improves it. Future research should focus on comparing the effectiveness of in vivo coaching and Internet-based modules, as well as other approaches (e.g., modules and therapist coaching over video conferencing) to train parents to use RIT. Research should also investigate the individual components of the intervention program to determine if all components (e.g., feedback, live coaching, video review, etc.) are necessary to achieve improvements and determine which components promote the best outcomes over time.

Children in this study made improvements in spontaneous imitation, a pivotal skill that has been shown to lead to positive changes in other behaviors (Ingersoll & Lalonde, 2010). The imitation rates observed in this study (with the exception of Dion) are comparable and slightly higher to the findings in other investigations of parent-implemented RIT (Ingersoll and Gergans, 2007; Wainer and Ingersoll, 2012). Notably, the results are similar to past studies, but the length of treatment is substantially shorter than Ingersoll and Gergans (two times per week for 10 weeks); therefore, the results support the use of Internet-based modules as a mechanism to decrease treatment duration, while obtaining similar or slightly better results. It would be interesting to investigate the use of Internet-based modules and in vivo coaching over longer treatment duration. It is possible that when the treatment is extended, greater improvements would be observed in imitation as well as other parent and child behaviors.

All parents increased their use of RIT strategies across treatment beginning with the onset of the first and second module. All parents maintained high rates of strategies at follow-up with the exception of Ryan's mother, a similar finding to Alicia's mother in Ingersoll and Gergans (2007). Ryan's mother cancelled nine sessions extending follow-up to four and seven weeks. Clearly, she used lower rates (or in the case of demands/questions, higher rates) of all techniques during follow-up, with the exception of imitation training, these findings were still better than baseline. As a result of the cancellations, Ryan's mother provided follow-up data over a longer duration than the other participants. Although we have these data, it is still difficult to predict what rates might have been for the other three participants because the results of Ryan's mother represented an individual that canceled sessions frequently.

Along with cancellations, it is important to consider other variables that may have affected parent and child progress. First, it is possible that parent education level may have led to

faster strategy acquisition and increased technique use. Dion and Nikhil's parents completed the treatment more rapidly than the other two participants. Dion and Nikhil's parents held masters and doctoral degrees, respectively, while Joshua and Ryan's mothers held associate degrees. Further, Dion and Nikhil's parents had experienced fewer interactions with trained professionals prior to treatment. Joshua and Ryan were both receiving behavioral health services prior to and during treatment for approximately 10-hours per week. A behavior consultant was assigned to meet with them weekly; however they reported the individual did not provide training in a structure manner, and during many weeks no support was provided at all. It is possible that Dion and Nikhil's parents were more motivated to learn the strategies than Joshua and Ryan's because opportunities to learn from trained professionals were limited. Another factor that may have played a part in the child's improvements during treatment was his motivation to attend to and use toys functionally prior to the intervention. Ingersoll (2012) found that children engaging in higher rates of spontaneous actions with toys pre-treatment had higher rates of imitation post-treatment; this result indicated that it is possible children with specific characteristics may achieve better outcomes through RIT. However, the measurement procedures in the current study do not allow for this comparison; therefore, it may be helpful in the future to design data collection procedures that account for these differences.

A final factor that may have influenced treatment was adherence to practice sessions. All parents were asked to practice RIT with their children for 20-minutes per day during treatment (on the days when in vivo sessions were not conducted) and during the latency period between the last generalization session and follow-up. Both Dion and Nikhil's parents recorded practicing over 15 times on the data sheet provided. During in vivo training sessions it was clear they had been practicing; this observation was based on the detailed examples they provided and

questions they asked. On the other hand, Joshua and Ryan's parents anecdotally reported practicing the techniques; however, it was clear they had not practiced because it was difficult for them to locate toys to use during in vivo sessions when the researcher arrived at the home and they did not provided clear examples of using techniques. It appears that practicing the strategies outside of sessions may have had an affect on how rapidly and accurately the four parents acquired techniques, and how well they maintained them over time.

One final point of discussion is the relationship between improvements in parent use of RIT techniques and/or fidelity and the child dependent variables. First, the data clearly demonstrated that when parents learned to use imitation training techniques, the rate of spontaneous imitation increased similar to the findings in Ingersoll (2012). When parents continued to implement RIT techniques with fidelity over time then, spontaneous imitation rates gradually increased. Conversely, Joshua's mother did not meet fidelity in the follow-up sessions and a decrease in imitation was noted. These results suggest there may be a relationship between the parent's ability to implement the intervention with fidelity and the child's rate of spontaneous imitation. However, the results of this study did not demonstrate a clear functional relationship between fidelity and social-engagement. Although social-engagement did occur for longer durations during some treatment sessions and even longer during follow-up, durations longer than those occurring in all treatment and follow-up conditions were seen during baseline for two participants. Overall fidelity ratings for those parents were low during baseline; therefore supporting the notion there may be factors (such as duration RIT use) other than the independent variable impacting the child's social-engagement. Specifically, in Dion's second baseline session social-engagement was observed for over half of the session. During this session, his mother used a beanbag and trampoline indicating that these gross motor activities promoted social-

engagement better than play with toys. It is clear that more research should be conducted on the relationship between fidelity with RIT techniques and improvements in child behaviors.

5.3 LIMITATIONS AND FUTURE RESEARCH

Although parents met fidelity with the intervention strategies, improved parent use of techniques, and child imitation rates increased, limitations existed in this study. One limitation was the short treatment duration. Overall, parents completed the treatment in an average of six in vivo sessions. Progression through treatment was determined by parental performance rather than child improvement; therefore, although the data supports an increase in imitation, the rate of improvement may not have been significant enough for parents themselves to access reinforcement through observation of their child's improvements. Three out of the four parents reported they wished they had been provided with more time to practice the strategies with the therapist and one reported during a treatment session that she was frustrated because she could not see the improvements in her child. Further, one component of RIT is engaging the child through interactive techniques (those taught in modules 1, 2, and 3) before teaching the child to imitate. It is hypothesized that in some cases, parents used imitation training techniques when the child was not as engaged as he could have been because they wanted to demonstrate to the researcher that they could appropriately use the strategies.

Another possible limitation is generalization of the training method. It is possible that other professionals and parents may not have access to the Internet; thereby, limiting the feasibility of this approach. Furthermore, two of the parents reported difficulty with two of the videos in the modules after the in vivo sessions for the techniques were already completed. It is

possible that parents that were able to watch the two videos implemented the strategies during in vivo sessions more accurately because they observed examples with other children. Issues with technology will always be a factor with the implementation of distance-based training for parents.

Although small improvements were observed in the MIS, one limitation is that this measure has minimal construct validity for the intervention. The MIS is designed to measure child improvements in elicited behaviors, while the study itself was investigating changes in generalized spontaneous imitation within play. It is possible that using an unstructured measure such as the UIA (McDuffie et al., 2007; used in Ingersoll, 2010) may have better demonstrated improvements in the target child behaviors. In this assessment the experimenter engaged the child in free play then alternated between imitating the child and presenting behaviors for the child to imitate without providing instruction to imitate.

The results of this study are also limited in that the number of training sessions differed for each participant. Parents completed in vivo training sessions one or two times per week. This inconsistency was due to parent cancellations and may have affected how well parents recollected the strategies they learned in the Internet modules or the suggestions and feedback provided by the therapist. Another factor that may have limited the results of the study was the inconsistency that existed in the length of components during in vivo sessions. While implementation fidelity was 100% for each participant, certain components of the sessions were shorter than others for different parents. These inconsistencies were usually due to the child's temperament and attention span during in vivo sessions. For example, in some cases, Ryan engaged in high rates of problem behavior, thereby limiting the extent to which the researcher modeled strategies with the child. Additionally, Joshua moved very rapidly from one toy to

another and after 10 minutes of play often appeared to be disinterested in the selected toys; then, he began to climb on furniture or lie on the floor and stare into the air. Therefore, at times, therapist modeling of techniques was short in duration to maintain higher levels of motivation to play with his mother. Further, this study was limited in that the follow-up sessions for each participant differed, especially with Ryan's mother. This variation makes it difficult to compare the parents' maintenance of strategies over time.

Although limitations existed in this study, overall it supports the use of RIT, this parent training program, and parent-implemented RIT. The effectiveness of this study has led the researcher to develop recommendations for extending this study. First, distance-based instruction has demonstrated its' effectiveness in a small sample; however, now researchers need to conduct investigations with a larger sample of children that are less homogeneous so that substantiations can be generalized. Second, it is clear that a combination of Internet-based modules and in vivo coaching was effective for training parents in RIT techniques; now researchers need to conduct component analyses on the components of this approach to determine if all of the aspects are necessary, or if eliminating some (i.e., video observation, question/answer sessions, homework) would produce the same result. Additionally, this study supported the importance of adherence to assigned practice in the home outside of treatment sessions. Researchers should determine ways to better monitor parental practice, thereby providing more evidence for the significance of this component in parent training interventions. Third, research needs to be conducted comparing various durations of treatment and their effect on maintenance of strategies over time. The results of this study appeared to produce similar results to Ingersoll and Wainer (2012) in that study the use of the modules alone (without in vivo sessions) was evaluated. They did not provide evidence of maintenance of parental use of strategies and child behavior improvements;

therefore, more research should be conducted to evaluate which approach is more effective. Furthermore, it is important for researchers to consider investigating other methods of distance-based instruction (e.g., coaching over video conferencing) for parents that are unable access in vivo coaching in their homes.

5.4 CONCLUSIONS

This experiment has supported the use of Internet-based modules interspersed with in vivo coaching to train parents and improve imitation in young children with ASD. Parents learned to generalize the techniques using novel toys, and in the case of three parents, maintained fidelity over time. Along with high fidelity and technique use, parent-implemented RIT led to increased rates of spontaneous imitation within naturalistic, play-based sessions. Results of social-engagement improvements were variable with no distinct functional relationship observed. Further, although only small improvements were observed in parental stress post-treatment, parents reported high satisfaction with the combination of distance and in-person training elements.

Findings of this study extended the literature in several areas. First, this investigation supports the use of parent training through a combination of Internet-based modules and in vivo coaching as an effective way to rapidly teach parents to use RIT with fidelity. Second, the results of this study demonstrate that parents can increase their use of RIT techniques and maintain use at higher rates than baseline over time. Third, this study provides the literature base with additional evidence supporting the use of RIT for young children with ASD as a mechanism to teach spontaneous imitation, a pivotal deficit area observed in this population.

Deficits in imitation have been observed to be one of the most significant issues in children with ASD. Imitation, specifically spontaneous, promotes the acquisition of learning and social interactions within daily activities. Therefore, it is imperative that studies involving more participants continue to investigate the most effective methods to teach imitation within naturalistic contexts. The findings of this study indicate that augmenting traditional in vivo coaching with distance-based instruction may be an effective combination to provide parents with access to treatment and teach them to rapidly acquire and maintain skills over time.

APPENDIX A

IMITATION INTERVENTION STUDIES

Research on imitation interventions for children with autism spectrum disorder

References	Participants	Design	Independent Variables	Teaching Strategies	Dependent Variables	Results
Cardon & Wilcox (2011)	6 males aged 28 – 43 months	MBD across participants & conditions	Group 1: NAT intervention, RIT procedures (CI, LM, MP, AP, SR) to teach O-IM and G-IM Group 2: VM to teach O-IM and G-IM	Group 1: adult and child Group 2: adult	O-IM, G-IM, MIS, ESCS	O-IM improved in Tx 1 & Tx 2. Tx 1: IM increases maintained, VM: gains in frequency of O-IM by second session
Ingersoll (2012)	27 children aged 27 – 49 months	RCT (cont. of Ingersoll, 2010)	NAT intervention, RIT procedures (CI, LM, MP, AP, SR) to teach O-IM and G-IM	Adult and child	MIS, UIA, ESCS	Tx group made significant gains post treatment in joint attention on the ESCS Social-Emotional Scale. Children were found to maintain skills at two and three month follow-up sessions
Ingersoll (2010)	21 children mean age 41.36 months	RCT	NAT intervention, RIT procedures (CI, LM, MP, AP, SR) to teach O-IM and G-IM	Adult and child	MIS, UIA, ESCS	Tx group made significantly more gains in elicited/spontaneous IM, suggested children with better play repertoires make greater gains
Ingersoll & Lalonde (2010)	4 males aged 35 – 41 months	MBD across participants	NAT intervention, RIT procedures (CI, LM, MP, AP, SR) to teach O-IM, G-IM, and V-IM	Adult and child	V-IM, MIS, UIA	3/4 participants showed stable improvements in language and verbal IM, all made improvements in O-IM and G-IM, IM on MIS & UIA
Ingersoll, Lewis & Kroman (2007)	5 males aged 31 – 42 months	MBD across participants	NAT intervention, RIT procedures (CI, LM, MP, AP, SR) to teach O-IM & G-IM	Adult and child	O-IM, G-IM, V-IM, MIS, descriptive gestures	Increased spontaneous gestures and collateral social-communication skills
Ingersoll & Gergans (2007)	3 males aged 34 – 49 months	MBD across participants	NAT intervention, Parent-implemented RIT procedures (CI, LM, MP, AP, SR) to teach O-IM for 3 children, instruction of G-IM also for 1 child	Adult and child	O-IM, G-IM, MIS, parent frequency of MP, SR, CI, LM	All parents met high treatment fidelity during Tx, 1 did not maintain at follow-up

Ingersoll & Schreibman (2006)	5 males aged 29 – 45 months	MBD across participants	NAT intervention, RIT procedures (CI, LM, MP, AP, SR) to teach O-IM and G-IM	Adult and child	O-IM, G-IM, V-IM, MIS, JAA, SLO, descriptive gesture, spontaneous language, play, JA	All made gains in SO-IM, decreased during generalization and maintenance phases, MIS % and SLO not significant, improvements in JA
Ingersoll, Schreibman, & Tran (2003)	15 typical children (5 males, 9 females) 14 children with ASD (9 males, six females) aged 23 – 53 months	Group comparison	Structured, discrete trial presentation, MP of action 3x while child observed, if no response in 10 s VP of "What can you do with this?"	Adult	G-IM, social initiations, object engagement, emotional cognition, positive affect	All children imitated actions with sensory component more than social component, children with ASD less JA, pos affect, social initiations, same % of object engagement
Kleeberger & Mirenda (2010)	1 male aged 2 years, 11 months	MBD across activities	VM prompting/fading, highlighting, social reinforcement	Adult and child	G-IM, generalized IM, MIA	Generalized imitation to actions not previously mastered
Metz (1965)	1 male & 1 female both aged 7 years	MBD across participants	Structured, discrete trial presentation, token training w/ primary reinforcer, MP, AP used to teach motor IM	Adult	O-IM, G-IM, generalized IM,	Generalized imitation ability increased for both
Stephens (2008)	2 males & 2 females aged 5.2 – 8.9 years	MPD across action-word pairs	Musical social milieu (MSM): CI, LM, motor and verbal MP, spontaneous IM followed by social reinforcement	Adult and child	G-IM + V-IM, joint attention, emotional cognition	3 children increased spontaneous action/word IM to criteria combined total of 8 times, 1 child increased only 2 times
Wainer & Ingersoll (2012)	Sample 1: 6 undergrads 5 children < 5 yrs Sample 2: 3 parent-child dyads < 5 yrs	MBD across participants	NAT intervention, Therapist and parent implemented via web-based system to deliver RIT procedures (CI, LM, MP, AP, SR) to teach object and gesture IM	Adult and child	O-IM, G-IM, Tx fidelity, therapist/parent frequency, utilization, knowledge	Sample 1: Children improved IM, no improvement in JA, therapists met Tx fidelity Sample 2: Children improved IM, parents required coaching in-home to reach Tx fidelity after web-based instruction

Walton & Ingersoll (2012)	6 typical siblings (2 males, 4 females ages 8 to 13 years), 4 children with ASD (4 males < 4 yrs of age)	MBD across participants	NAT intervention, Siblings taught RIT strategies (CL, LM, MP, AT, SR) to teach O-IM	Adult and child	CI, LM, IM training, Tx fidelity, IM, joint engagement	Siblings: Six learned to use CI, but only 4 maintained after LM was taught, low rates of IM training strategies, Children with ASD: Three children showed increases in imitation, increase in joint engagement in all children

Notes: RCT = Randomized Control Trial, MBD = Multiple baseline design, RIT = reciprocal imitation training, VM = video modeling, CI = contingent imitation, LM = linguistic mapping, MP = model prompt, AP = adult prompt, SR = social reinforcement, JA = joint attention, COM = communication, IM = imitation, O-IM = object imitation, G-IM = gesture imitation, V-IM = vocal imitation, NAT = naturalistic, Tx = treatment

APPENDIX B

UNIVERSITY OF PITTSBURGH IRB APPROVAL

University of Pittsburgh
Institutional Review Board

3500 Fifth Avenue
Pittsburgh, PA 15213
(412) 383-1480
(412) 383-1508 (fax)
http://www.irb.pitt.edu

Memorandum

To: Johanna Taylor, MEd
From: Sue Beers, PhD , Vice Chair
Date: 7/17/2013

IRB#: PRO12010592
Subject: Teaching Reciprocal Imitation Training to Parents of Children with ASD Through Combined Internet-Based and In Vivo Instruction

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The University of Pittsburgh Institutional Review Board reviewed and approved the above referenced study by the expedited review procedure authorized under 45 CFR 46.110 and 21 CFR 56.110. Your research study was approved under:
45 CFR 46.110.(6)
45 CFR 46.110.(7)

The IRB has approved the advertisement that was submitted for review as written. As a reminder, any changes to the approved advertisement would require IRB approval prior to distribution.

The signature of one parent is required on the consent document.

The risk level designation is Minimal Risk.

Approval Date: 7/17/2013
Expiration Date: 7/16/2014

For studies being conducted in UPMC facilities, no clinical activities can be undertaken by investigators until they have received approval from the UPMC Fiscal Review Office.

Please note that it is the investigator's responsibility to report to the IRB any unanticipated problems involving risks to subjects or others [see 45 CFR 46.103(b)(5) and 21 CFR 56.108(b)]. Refer to the IRB Policy and Procedure Manual regarding the reporting requirements for unanticipated problems which include, but are not limited to, adverse events. If you have any questions about this process, please contact the Adverse Events Coordinator at 412-383-1480.

The protocol and consent forms, along with a brief progress report must be resubmitted at least one month prior to the renewal date noted above as required by FWA00006790 (University of Pittsburgh), FWA00006735 (University of Pittsburgh Medical Center), FWA00000600 (Children's Hospital of Pittsburgh), FWA00003567 (Magee-Womens Health Corporation), FWA00003338 (University of Pittsburgh Medical Center Cancer Institute).

Please be advised that your research study may be audited periodically by the University of Pittsburgh Research Conduct and Compliance Office.

APPENDIX C

INTRODUCTORY SCRIPT

Hello. My name is Johanna Taylor and I am doctoral student at the University of Pittsburgh. I am recruiting subjects for a study focused on improving social-communication skills in your child. The purpose of this research study is to teach parents of children diagnosed with an Autism Spectrum Disorder (ASD) to implement Reciprocal Imitation Training (RIT). She will be instructing you to use RIT strategies two time per week over three to four months, which may lead to improvements in your child's social-communication skills including language, eye contact, and imitation and will require that you complete four Internet modules. If you are willing to participate, the I will come to your home to discuss the study further. Foreseeable risks to you include the anxiety or stress you may encounter as you learn to implement the strategies. Direct benefits of being part of this study include improvements in the relationship you have with your child and your ability to interact and gain your child's attention. Additionally, your child may benefit by experiencing improvements in language, eye contact, imitation, joint attention, and pretend play skills. My advisor, research assistants, and I will be the only individuals that have access to your information. All identifying information will be kept under lock and key in an office at the University of Pittsburgh. Your participation is voluntary, and you may withdraw from this project at any time. Are you interested? Thank you.

APPENDIX D

PARENT QUESTIONNAIRE

Participant: _____ Date: __/__/__

Reciprocal Imitation Training

Parent Questionnaire

Name: _____

Address: _____

Gender: ☐ Male ☐ Female **Age:** _____

Ethnicity: ☐ Caucasian ☐ African American
☐ Asian ☐ Hispanic ☐ Other _____

Educational Degree			
	High school		Masters
	Associates		PhD
	Bachelors		Other
☐ Focus: _____			

Employment:

☐ full employee ☐ part time employee ☐ unemployed ☐ homemaker

If employed, what is your position?

Position: _____

Is your child on medications? ☐ YES ☐ NO

If *yes*, describe: _____

Medical problems: ☐ asthma ☐ diabetes ☐ high blood pressure ☐ thyroid disease ☐ seizures ☐ GI problems

List additional medical conditions: _____

Has your child received intervention services, previously, or currently (biomedical, speech-language intervention, early intervention, occupational therapy, etc.) (Reports are helpful and can be attached in lieu of an explanation)? ☐ YES ☐ NO

If *yes*, describe: _____

If *yes*, what type of treatment methods have been used in these programs?:

Have you participated in a structured parent training program before? ☐ YES ☐ NO

If *yes*, describe: _____

Have you participated in distance-based instruction before (e.g., Internet modules, video chat, etc.)?
☐ YES ☐ NO

If *yes*, describe: _____

What are activities/toys your child enjoys (list at least 5): _____

APPENDIX E

PARENT AND CHILD CONSENT FORM

UNIVERSITY OF PITTSBURGH

SCHOOL OF EDUCATION

Parental Consent for a Child to Participate in a Research Study

Study Name:	Teaching Reciprocal Imitation Training to Parents of Children with ASD Through Combined Internet-Based and In Vivo Instruction
Principal Investigator:	**Johanna P. Taylor, MEd., BCBA** Doctoral Student Department of Instruction and Learning School of Education, Posvar Hall Pittsburgh, PA 15260 (412) 716-3455 jpt24@pitt.edu
Co-investigator/Mentor:	**Dr. Louise Kaczmarek, PhD** Department of Instruction & Learning School of Education Posvar Hall 5160 230 S. Bouquet St. Pittsburgh, PA 15260 kaczmk@pitt.edu
Study Sponsor	University of Pittsburgh School of Education

We are interested in learning the effect of a combination Internet-based and in-person home-based parent training has on your acquisition of Reciprocal Imitation Training (RIT) strategies. We are also interested in learning the effect of parent-implemented RIT on the imitation and collateral skills (e.g., toy play, social engagement, language) in your young child with autism spectrum disorder (ASD).

The purpose of this study is to investigate the effectiveness of Reciprocal Imitation Training when implemented by parents of children with autism. RIT is an intervention designed to improve imitation skills in young children with ASD. By conducting this research study, I hope to provide support to parents and professionals on improving imitation and subsequent collateral skills of children with autism. At this time, I am looking for children under the age of four years old who have a diagnosis of Autism Spectrum Disorders (ASD). Your child's therapist has referred you and your child for participation in the study. During your participation in this study you will be taught to use RIT through a combination of Internet modules and in-person teaching.

Listed below are the following assessments and documents required for your child to be accepted into the study.

- You will complete a *parent questionnaire* with your name, address, gender, age, ethnicity, education level, employment, and salary. The questionnaire will ask you if you have participated in structured training program in the past or distance-based instruction in the past. You will also be asked if your child is taking medication, has medical problems, and if

you have Internet and computer access.

- We will complete The *Motor Imitation Scale*, which is an assessment that will evaluate your child's ability to imitate motor movements when presented by an adult.
- We will ask you to complete the *Childhood Autism Rating Scale*, which will provide us with information about your child's autism severity.
- We will also ask you to provide us with your child's *diagnostic assessment report*.

The screening procedures will take place at your home and will take approximately 1 hour to complete.

If your child is eligible for the study, we will schedule a time to complete the pre-treatment measures one week after this visit. Pre-treatment measures will include a parent-completed assessment evaluating your child's current social, communication, and adaptive developmental level and your stress level. Then, together we will complete a checklist to assess your child's current social-communication skills related to those you will learn through the intervention. After the pre-treatment measures are completed I will schedule two home sessions per week in which you will be asked to play with your child for 10 minutes as you typically would in the home. After a few sessions, we will begin the intervention, which includes four modules and in-home coaching.

To begin the intervention you will complete Internet Modules 1 and 2 independently. A researcher at the University of Michigan designed the Internet modules. I will provide you with login information and instructions on how to access the Internet site. The modules will include a pre/post test, narrated PowerPoint presentation, example videos, reflection questions, and multiple-choice questions to check your understanding of the strategies. After you complete each module your information will be sent from a researcher at the Michigan State University to me directly. They will not have access to your identifying information.

Then, we will schedule a home visit within 72 hours of your completion of these modules. The home visit will include 2 play sessions with your child and coaching, practice, and feedback to assist you in learning intervention strategies. Additionally, you will be asked to review and reflect on videos of your implementation of the strategies with your child. In order for you to progress to the next online module, you must obtain a certain score of strategies use in the home sessions. You will have three sessions to reach this score. If you have not reached this score by the third session, then, you will be asked to complete Internet Module 3. Again, we will schedule a home session within 72 hours of your completion of Module 3.

We will follow the same procedure described above to advance to Module 4. The targeted behaviors will consist of your child's imitation ability and your ability to implement the intervention components discussed in all four modules. The strategies presented in the modules build on one another; therefore, by the end of the intervention, you will be taught to use a combination of all strategies presented.

Following your mastery of the intervention strategies discussed in all four modules, we will teach you to use these strategies with novel toys in other settings in your home. Again, you will have three sessions to learn these strategies. After three sessions (or less if you learn the strategies quickly) we will conduct post-treatment measures to evaluate your child's skills after the intervention has been applied. The post-treatment measures will be exactly the same as pre-treatment, with the addition of a questionnaire asking you to rate your satisfaction with the program.

Following the post-treatment measures, an assessment of maintenance will be conducted 1-month after the completion of the intervention. Maintenance of skills will include two follow-up sessions, conducted two weeks apart. During these first follow-up sessions you will be asked to play with your child using the strategies we taught you during the intervention. Consequently you may participate in this study for up to four months.

Your participation in this study may be approximately 12 weeks.

The potential risks to you or your child for taking part in this study are minimal. The intervention has been designed to be enjoyable for the child. However, if engaging in the intervention sessions appear to distress your child or any occurrence of challenging behaviors such as crying, aggression, property damage is noticed, possible alternatives/modifications will be discussed with you. Additionally, you may experience small amounts of stress or anxiety as you implement the intervention at home or in the clinic with the therapist you are free to withdraw from the study at any time. You and your child's identity, assessment records, and data related to the research will be kept confidential. Data collected before withdrawal will continue to be used in this research. Pseudonyms will be used in data files and any publications resulting from this research. The data will be stored on computers with password protection. However, there is a minimal risk for breach of confidentiality.

The potential benefits to you for taking part in this study are improvements in your ability to interact and play with your child. Your child may improve in imitation and additional skills including joint attention, eye contact, language, and pretend play. However, no benefits are guaranteed. The results of this investigation may help you to gain a better understanding of how to improve your child's imitation and play skills. Allowing your child to participate will also help identify interventions that promote imitation skills.

To protect your privacy and maintain the confidentiality of information we obtain from you and your child, we will keep all information about you in a secure location. At the end of the study, any records that personally identify your child will remain stored in locked or password protected files and will be kept for a minimum of seven years. In unusual cases, your child's research records may be released in response to an order from the court of law. It is also possible that authorized representatives from the University of Pittsburgh Research Conduct and Compliance Office may review your child's data for the purpose of monitoring the conduct of this study. Also, if the investigators learn that your child or someone with whom your child is involved is in serious danger or potential harm, they will need to inform the appropriate agencies, as required by Pennsylvania law. Only persons directly involved in this study will view identifiable information.

Although we will do everything in our power to protect your privacy and the confidentiality of your child's research records, just as with the use of your medical information for health care purposes, we cannot guarantee the confidentiality of your research records. However, **no third party**, including relatives, personal physicians or insurance companies, or other researchers **will have access to your child's identifiable** information, with three exceptions. The primary investigator's advisor and two graduate students will have access to videos and data collection. They will discuss your progress with the primary investigator when applicable.

With your consent, I plan to video record all conditions of this study for subsequent data collection

and reliability purposes. You can indicate your permission to video record for several purposes by checking the appropriate boxes following the signature line.

You and your child's participation in this project will occur on a voluntary basis and with no charge to you. You have the right to withdraw yourself and your child from the study at any time without adverse consequences. If you wish to discontinue your child's participation at any time, you will be free to do so with no effect on current or future educational services or your participation in future research studies. If your child refuses to participate in the study, we ensure you that he/she will not be forced to participate in the study. In addition, if your child does not meet all inclusion/exclusion criteria then you and your child will not be eligible to continue participation in the study. If you have any further questions, you can reach **Johanna Taylor** at **(412) 716-3455** or jpt24@pitt.edu or Louise Kaczmarek, Ph.D., Associate Professor at the University of Pittsburgh, who is supervising this research study, at (412) 648-7449 or kaczmk@pitt.edu.

_____

Printed Name of Child

I understand that, as a minor (age less than 18 years), the above named child is not permitted to participate in this research study without my consent. Therefore, by signing this form, I give my consent for his/her participation in this research study.

By signing this form, I also agree to participate, and will complete several questionnaires, as described above.

_____ _____

Caregiver's Signature **Date**

_____

Relationship to Child

Please check the following agreements regarding video taping of you and your child:

___I give permission to be videotaped.
___I give permission for my child to be videotaped.
___I give permission for the videotape segments to be used to instruct professionals learning to implement Reciprocal Imitation Training.
___I give permission to use the videotape segments as part of my instruction while I am learning to implement Reciprocal Imitation Training.

Verification of Explanation:

I certify that I have carefully explained the purpose and nature of this research study to the above named participant in appropriate language. He/she has had an opportunity to discuss it with me in detail. I have answered all his/her questions and he/she has provided affirmative agreement (i.e., assent) to participate in this study.

_____ _____

Investigator's Signature **Date**

APPENDIX F

AUTISM PARENTING STRESS INDEX

Date: _____ Name of child: _____ Person completing checklist:_____

Autism Parenting Stress Index

	Stress Ratings				
Please rate the following aspects of your child's health according to how much stress it causes you and/or your family by placing an X in the box that best describes your situation.	**Not stressful**	**Sometimes creates stress**	**Often creates stress**	**Very stressful on a daily basis**	**So stressful sometimes we feel we can't cope**
Your child's social development	0	1	2	3	5
Your child's ability to communicate	0	1	2	3	5
Tantrums/meltdowns	0	1	2	3	5
Aggressive behavior (siblings, peers)	0	1	2	3	5
Self-injurious behavior	0	1	2	3	5
Difficulty making transitions from one activity to another	0	1	2	3	5
Sleep problems	0	1	2	3	5
Your child's diet	0	1	2	3	5
Bowel problems (diarrhea, constipation)	0	1	2	3	5
Potty training	0	1	2	3	5
Not feeling close to your child	0	1	2	3	5
Concern for the future of your child being accepted by others	0	1	2	3	5
Concern for the future of your child living independently	0	1	2	3	5
	Subtotal				
				Total	

APPENDIX G

MOTOR IMITATION SCALE

MOTOR IMITATION SCALE

Participant #: _____ Date: _____

Session: _____

#	Target Imitation	1	2	3
1	Shake noisemaker			
2	Push toy car across table			
3	Walk toy dog across table			
4	Hold string of pop-beads behind neck			
5	Bang spoon on table			
6	Push teacup across table			
7	Walk hairbrush across table			
8	Place small block on head			
9	Clap hands			
10	Wave hand			
11	Bend index finger up and down			
12	Scratch tabletop with fingers			
13	Open and close fist			
14	Drum hands on tabletop			
15	Pat cheek			
16	Pull on earlobe			

APPENDIX H

PARENT AND CHILD DATA SHEETS AND CODING MANUAL

Parent and Child Behavior Data Sheet
(For Behaviors that Required a Frequency or Duration)

Participant #:___ **Session #:___**
Coder:_____

Directions: *Record (tally) a frequency count of the behaviors that occur in each interval. **Record the total duration in seconds the child engaged in the behaviors. Place the total in the cell next to social-engagement.

Parent Behaviors	0:00 – 00:30	00:30 – 1:00	1:00 – 1:30	1:30 – 2:00	2:00 – 2:30	2:30 – 3:00	3:00 – 3:30	3:30 – 4:00	4:00 – 4:30	4:30 – 5:00	5:00 – 5:30	5:30 – 6:00	6:00 – 6:30	6:30 – 7:00	7:00 – 7:30	7:30 – 8:00	8:00 – 8:30	8:30 – 9:00	9:00 – 9:30	9:30 – 10:00
Contingent Imitation*																				
Linguistic mapping*																				
Demand/Question																				
Imitation Training																				
Child Behaviors																				
Prompted Imitation*																				
Spontaneous Imitation*																				
Social-Engagement**																				

RIT DEFINITIONS MANUAL

Directions

Frequency count: For dependent variables that require a frequency count, please tally the number of behaviors and list the final number (e.g., 5) at the end of the row on data sheet.
Duration: For dependent variables that require duration recording, use the timer on your iPhone to measure the length of time the individual engages in the behavior. Start and stop the timer until the 10-minute segment has finished. List the total duration in the cell next to the behavior on the data sheet.

Parent Behavior Definitions

Behaviors	Definitions
Contingent Imitation The parent imitates the child's behaviors (i.e., actions with toys, gestures/body movements, and vocalizations) at the same time as the child engages in them, or within one to two seconds of the occurrence of the behavior.	• Parent says the same sound/words as the child. • Parent moves in the same way as the child. • Each sentence/phrase is counted as one instance of contingent imitation. If a word is repeated this is counted as another instance (e.g., "the ball fell. Ball." = two instances of contingent imitation). • If parent imitates vocalization and gesture or play with toy at the same time count this as two instances. • Count individual verbalizations each as one instance of contingent imitation even if they are connected (e.g., be-be-be-be = 4 instances). • If the child says something while engaging in a behavior – and the parent imitates the behavior and says something similar to the child (or imitates the child's vocalization) this is counted as 2 – contingent imitation. If the child is not vocalizing but engages in a behavior – and the parent imitates the behavior then says a vocalization, this is considered 1 – linguistic mapping, 1 – contingent imitation. • If parent imitates child's continuous movement with a behavior (e.g., moving a ball back and forth) count the total number of seconds the parent moves the ball back and forth. This is the total frequency count for that behavior.

Linguistic mapping
The parent describes what the child is attending to or doing using simple language (e.g., "you built a tower) with or without sound effects.
	• Count as linguistic mapping if the parent uses a word or phrase describing the toys in front of him/her or the actions of the parent/child.
	• Only imitation of words should not be considered linguistic mapping unless the parent expands by adding another sound or word to the child's sound/word.
	• In order to count needs to be developmentally appropriate:
	  o If child is using gestures/single words: parent should use no more than 3-4 words to describe.
	  o If child is using one-two word phrases then the parent should use more than 2-3 words to describe.
	• Each phrase/sentence of linguistic mapping is defined by where the punctuation would be (e.g., the ball. Ball. = two instances of linguistic mapping).
	• Count a repeated word or phrase as another instance of linguistic mapping (e.g., parent says, "The race track is back. It's back buddy **or** he's sleeping, he's sleeping– would be counted as two instances of linguistic mapping). Other example: pop, pop, pop, pop, pop would be five instances of linguistic mapping.
	• Sound effect (e.g., animal, car sound) is counted as linguistic mapping. If break in between same sound count as 2 instances. Examples may

	include: uh oh, gasping, oh no! • Only count verbal praise that is behavior specific (e.g., good job moving the car, I like that jump). Do not count verbal praise that is unaccompanied by specific praise (e.g., good job, nice work!). • To count as linguistic mapping the item/object/toy described needs to be in front of the parent/child. If it is still in a box out-of-sight to the child, this is not counted as linguistic mapping. • Count descriptions that occur after a demand (e.g., Look, it's a dog!). That would be counted as one demand and one linguistic mapping. • Directions directed towards objects (e.g., open up) are considered linguistic mapping.
Demand/question Parent asks child a question or places a demand on the child.	• Count as single instances of demand/question if parent says three different commands in a row ("Come here…look…come here" (e.g., three instances). Count repetitions as single instances of demands/questions. • Phase can be any number of words (e.g., You want to send the car down the ramp?) • Count demands that sound like statements as demands (e.g., first…then, Mommy want to play…) or if the parent gives the child an item and say "here." • Demand includes verbal reprimands (e.g., no scream) • Demands or questions with more than one word (e.g., ready? catch!) count this as two instances of demand/question • "Your turn or "child's name" turn is considered a demand if it occurs before the child engages in a behavior. If it occurs after the behavior then it is considered linguistic mapping. "My turn" or "Mommy's turn" is considered to be linguistic mapping if she is using a toy without directing the child to give it to her. • If she directs the child (e.g., by holding out her hand or taking the toy from him) then it is considered a demand. • Directions directed towards objects (e.g., open up) are considered linguistic mapping. • If the parent says, "we'll do that later" – this is considered a reprimand. • Double count demands if they are also paired with a model or a prompt (e.g., parent says "push the car" and models pushing the car behavior – this would be 1 model, 1 demand).
Imitation Training Combination of model (may be 1, 2, or 3 models) + prompt + reinforcement together.	**Model:** The parent models an action with a toy or gesture related to the child's play behavior. The actions may be paired with a verbal statement describing the action. • If the parent says "do it like this" or "look" – this is considered a demand and a model (1, demand – 1, model). **Prompt:** The parent using physical guidance, a verbal command, or gesture prompt to encourage the child to imitate a modeled action at any point. **Reinforcement:** The parent providing social reinforcement after the child imitates the parent's model. This may include physical behaviors such as high fives, waving hands in the air, providing hugs or vocal behaviors such as saying "Yay! You did it"). • Only count verbal praise/social praise (e.g., Yay, clapping) that occurs after a behavior is modeled for the child to imitate) or if the parent praises an imitation that was modeled earlier in the session (and is repeated by the child later in the session.

Child Behavior Definitions

Behaviors	Definitions
Prompted object imitation	• Child is prompted to imitate the parent's movements with an object. This may include physical, gesture, or verbal prompting. • Child is prompted to imitate the parent's movements. This may include physical, gesture, or verbal prompting.
Spontaneous object imitation	• Child imitates the parent's movements with an object. • Count as imitation even if it is paired with a verbal demand (e.g., parent modeled throwing ball in the box and then tells child to do the same while saying "throw in the box). • Count if it is delayed imitation less than 10-seconds after model presented (e.g., parent models putting ball into the box then child later on puts the ball into the same box – a behavior he has never done during the session before the parent modeled the behavior). • Child imitates the parent's movements.
Social-engagement	**Combined total duration of five behaviors:** 1) *social gaze*: child orients face towards parent's face within one foot; eye contact may or may not be observed concurrently. 2) *mutual gaze*: child and parent are directed towards one another making eye contact concurrently. 3) *responding to joint attention*: child follows the direction of parent's gaze, head turn, or gesture. 4) *initiating joint attention*: child uses eye contact/gestures to spontaneously initiate/coordinate attention with parent. 5) *initiating behavior requests:* child uses eye contact/gestures to initiate coordinate attention with parent in order to gain object or activity.

Parent Intervention Fidelity Definitions

Coding Directions

Interval recording: For dependent variables that require interval recording, please list a 1 = behavior occurred at any point during the interval, 0 = behavior was not observed at any point during the interval. Shade any cell where an opportunity was not present. Leave the cell blank. *(Note: See frequency data collection sheet for detailed definitions of some behaviors listed below.)*

Fidelity Item	Clarification Notes
Let's child choose the activity	• If parent says, "what do you want to do?" or "let's play" count this as allowing the child to choose the activity even though it is a question/demand. • If child is sitting or walking around code as letting child choose the activity if the parent follows them around until they choose a toy.
Face to face and at eye level	• If parent bends down to pick something up and is across from the child count this as face to face at eye level.
Imitates the child's actions with toys	• If child is engaging in a gesture place a 0 in the cell and highlight. • Include objects or food.
Imitates the child's gestures without toys	• If child is engaging with a toy place a 0 and highlight the cell in which this occurs for gestures.
Imitates the child's vocalizations	• Code as imitating vocalizations if the parent says a word to replace an unintelligible sound.

Is animated	• Parent uses loud voice or places emphasis on tone of voice or imitated behavior. **Code as 1** only if the parent imitates the child's play with objects, gestures, or vocalizations. If none of these three are coded as 1, then "is animated" is also **coded as 0.**
Simplify language	• **Code as 1** = Parent provides a description of her behavior or the child's behavior using age appropriate language for the child's developmental level o If child is using only single words and gestures descriptions sound include 1 – 3 words. o If child is using 2-3 word phrases then description can be up to five words.
Speak slowly	• **Code as 0** if the parent only uses questions or demands. • **Code as 1** if parent uses at least 1 descriptive statement in the interval and uses a slow paced words.
Stress important words	• **Code as 0** if the parent only uses questions or demands. • **Code as 1** if parent places vocal emphasis on one or more word in the phase.
Repetitive	• **Code as 0** if the parent only uses questions or demands. • **Code as 0** if parent does not repeat any words within the interval. • **Code as 1** if parent says a word in a phrase, a single word, or a phrase more than 1x in the interval or the adjoining interval. • **Code as 1** if parent makes a sound associated with the toy or what the child said more than one time.
Expand language	• **Code as 0** if the parent only uses questions or demands. • **Code as 1** if the parent repeats a word/phrase/sound the child says and then adds one or more words to it (Note: parent should use language developmentally appropriate for the child e.g., if child is using gestures/one-two words, then parent should use no more that 3-4 words to expand. If child is only using sounds the parent may not expand language, but repeat the sound. Count this as no opportunity if the parent repeats the sound but doesn't expand.
Question/demand	Includes: • Questions (e.g., why is that happening?, what is going on?, what do you want to do now?) • Demands (e.g., tell me the color, put that person on the car) • Statements that are phrased using question tone (e.g., You want to do it?, No?) • **Code as 0** if the parent only uses questions or demands. • **Code as 1** if the parent doesn't use any questions/demands. • If parent says: "clean up" at any point in the interaction this is coded as a **0.** • If parent physically prompts child to engage in behavior to which there was no model (e.g., making the sign "open") then this would be considered a demand.

APPENDIX I

INTERVENTION FIDELITY CALCULATION EXAMPLE

Parent Intervention Fidelity Calculation Example

Rating Scale

0 = Parent never uses RIT techniques and misses all opportunities.
1 = Parent uses RIT techniques minimally and misses a majority of opportunities.
2 = Parent uses RIT techniques occasionally, but misses a majority of opportunities.
3 = Parent uses RIT techniques more than half of the time, but misses many opportunities.
4 = Parent uses RIT techniques most of the time, but occasionally misses opportunities.
5 = Parent uses RIT throughout the entire session.

Parent: Dion's Mother
Session: Baseline 1

Module 1
(Rating scale)

Fidelity Item	Fidelity Score
Reduces physical area/creates defined space for intervention.	2
Clutter in room has been reduced (i.e., limited toys and furniture).	2
Possible distractions have been reduced (Television/radio off or removed and number of people present in identified area reduced).	5
Identifies 4-6 sets of toys and places them on the floor of identified area.	1
Selected toys are sets or toys with multiple pieces/uses that have been identified as preferred.	1
Overly absorbing materials have been removed.	3
Average	**2.33**

Module 2
(30-second interval recording converted to rating)

Coding:
0 = Parent does not use the technique during the entire interval; 1 = Parent uses the technique during the interval; shaded = No opportunity for parent to use technique (shaded not factored into total)

Session # Date: Baseline 1, 9/25	Lets child choose activity	Face to face and eye level	Imitates child's actions with toys	Imitates child's body movement/gestures	Imitates vocalizations/words	Is animated	Ignores inappropriate behaviors
00:00 – 00:30	1	1	0	0	0	1	
00:30 – 01:00	1	1	0	0	0	1	
01:00 – 01:30	1	1	0	0	0	1	0
01:30 – 02:00	1	0	0	0	0	1	0
02:00 – 02:30	1	0	0	0	0	0	0
02:30 – 03:00	1	0	0	0	0	0	0
03:00 – 03:30	1	0	0	0	0	0	
03:30 – 04:00	1	0	0	0	0	0	
04:00 – 04:30	0	0	0	0	0	0	
04:30 – 05:00	0	1	0	0	0	0	
05:00 – 05:30	1	1	0	0	1	0	
05:30 – 06:00	1	1	0	0	0	1	
06:00 – 06:30	1	1	0	0	0	1	
06:30 – 07:00	0	1	0	0	0	1	
07:00 – 07:30	1	1	0	0	0	1	
07:30 – 08:00	1	1	0	0	0	1	
08:00 – 08:30	0	1	0	0	0	1	0
08:30 – 09:00	0	1	0	0	1	1	0
09:00 – 09:30	0	0	0	0	0	1	
09:30 – 10:00	1	0	0	0	0	1	
(SUM / 20)*100	70%	60%	0%	0%	10%	65%	0%
Rating	3.5	3	0	0	0.5	3.25	0
Average Score	**1.46**						

Percentage	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Converted to Rating	0	.5	1	1.5	2	2.5	3	3.5	4	4.5	5

Module 3
(30-second interval recording converted to rating)

Coding:
0 = Parent does not use the technique during the entire interval; 1 = Parent uses the technique during the interval; shaded = No opportunity for parent to use technique (shaded not factored into total).

Session # Date: Baseline 1, 9/25	Simplify language	Speak slowly	Stress important words	Be repetitive	Expand language	Question/ demand
00:00 – 00:30	0	0	0	0	0	1
00:30 – 01:00	0	1	1	1	0	0
01:00 – 01:30	0	1	0	0	0	0
01:30 – 02:00	0	1	0	0	0	0
02:00 – 02:30	0	1	0	0	0	0
02:30 – 03:00	0	1	0	0	0	0
03:00 – 03:30	0	1	0	0	0	0
03:30 – 04:00	0	1	0	0	0	0
04:00 – 04:30	0	1	0	0	0	0
04:30 – 05:00	0	1	0	0	0	0
05:00 – 05:30	1	1	1	0	0	0
05:30 – 06:00	0	1	1	0	0	0
06:00 – 06:30	1	1	1	1	0	0
06:30 – 07:00	1	1	1	1	0	0
07:00 – 07:30	0	1	1	0	0	0
07:30 – 08:00	0	1	1	0	0	0
08:00 – 08:30	0	1	1	0	0	0
08:30 – 09:00	0	1	0	0	1	0
09:00 – 09:30	1	1	0	1	1	0
09:30 – 10:00	0	1	0	0	0	0
(SUM / 20*)*100	20%	95%	40%	20%	10%	10%
Rating	1	4.5	4	1	0.5	0.5
Average	**1.63**					

Percentage	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Converted to Rating	0	.5	1	1.5	2	2.5	3	3.5	4	4.5	5

Module 4
(Rating scale)

Rating	Use of Imitation Training Techniques
0	Parent does not use imitation training correctly and never uses modeling prompting or reinforcement during the session.
1	Parent does not use imitation training correctly and uses imitation training strategies at least 1 time during the session.
2	Parent does not use imitation training correctly, but does use modeling, prompting, or reinforcement at least 3 times during the session.
3	Parent uses imitation training correctly at least **1 time** during the 10-minute session. This includes: model action with verbal model two-three times, followed by a prompt if child does not imitate and reinforcement (verbal praise) follows. If parent models action and child imitates immediately - if this is followed by reinforcement (verbal praise) then it is counted a correct.
4	Parent uses imitation training correctly at least **3 times** during the 10-minute session. This includes: model action with verbal model two-three times, followed by a prompt if child does not imitate and reinforcement (verbal praise) follows. Parent models action and child imitates immediately for more than 3 imitations and this is followed by reinforcement (verbal praise), then it is counted a correct. Parent must demonstrate use of correct imitation training at least 1 time during the session.
5	Parent uses imitation training correctly at least **5 times** during the 10-minute session in at least 3, 1:00 minute intervals. This includes: model action with verbal model two-three times, followed by a prompt if child does not imitate and reinforcement (verbal praise) follows. If parent models action and child imitates immediately - if this is followed by reinforcement, then it is counted a correct.
Rating	**2**

Calculation of Overall Fidelity Score

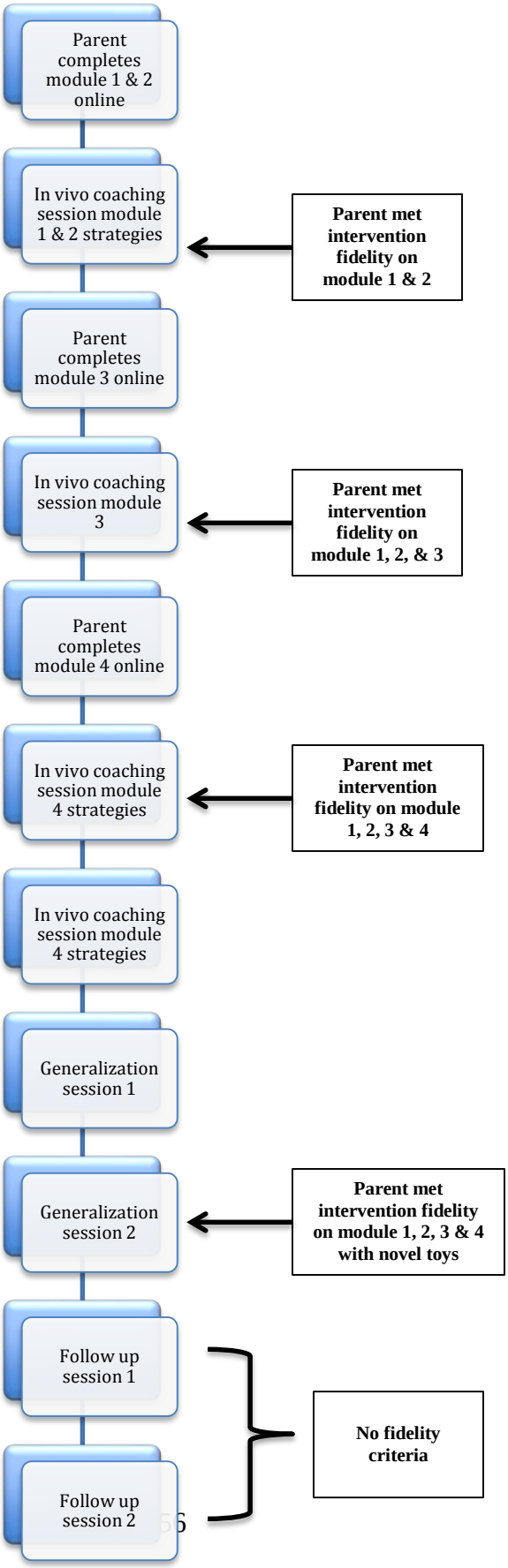
Module	Score
1	**2.33**
2	**1.46**
3	**1.63**
4	**2**

Overall Average Fidelity = 1.85

APPENDIX J

EXAMPLE PARTICIPANT SCHEDULE

Dion's Schedule



APPENDIX K

BEHAVIOR INTERVENTION RATING SCALE

	Behavior Intervention Rating Scale Directions: Please circle the rating you feel most accurately describes your experience and your child's behaviors following the parent training. **ITEMS**	**Strongly Disagree**	**Disagree**	**Neutral**	**Slightly Agree**	**Agree**	**Strongly Agree**
1	This was an acceptable intervention for my child's acquisition of imitation skills.	1	2	3	4	5	6
2	Most parents would find this intervention appropriate for the acquisition of imitation skills.	1	2	3	4	5	6
3	I would suggest the use of this intervention to other parents.	1	2	3	4	5	6
4	My child's imitation deficits were severe enough to warrant the use of this intervention.	1	2	3	4	5	6
5	Most parents would find this intervention suitable for the behavior described.	1	2	3	4	5	6
6	I would be willing to use this in another setting (community).	1	2	3	4	5	6
7	This intervention did *not* result in negative side-effects for my child	1	2	3	4	5	6
8	This intervention is an appropriate intervention for a variety of children with autism and imitation skill deficits.	1	2	3	4	5	6
9	This intervention is consistent with those I have used in home-based settings.	1	2	3	4	5	6
10	This intervention was a fair way to handle teaching my child imitation skills.	1	2	3	4	5	6
11	This intervention is reasonable for the behavior described.	1	2	3	4	5	6
12	I like the procedures used in the intervention.	1	2	3	4	5	6
13	This intervention was a good way to promote my child's imitation skills.	1	2	3	4	5	6
14	Overall, the intervention was beneficial for my child.	1	2	3	4	5	6
15	This intervention quickly improved my child's imitation.	1	2	3	4	5	6
16	This intervention produced lasting improvements in the child's imitation skills	1	2	3	4	5	6
17	This intervention would improve my child's imitation skills to the point that it would not noticeably deviate from other children of his/her same age.	1	2	3	4	5	6
18	Soon after using the intervention, I noticed a positive change in imitation skills	1	2	3	4	5	6
19	My child's imitation skills will remain at an improved level even after the intervention is discontinued	1	2	3	4	5	6
20	Using the intervention should not only improve my child's imitation skills at home, but also in other settings (e.g., classroom, community).	1	2	3	4	5	6
21	Other behaviors (e.g., eye contact, language) related to imitation were improved by the intervention.	1	2	3	4	5	6
22	The online format of the program was appropriate for learning the intervention strategies.	1	2	3	4	5	6
23	The Module slideshows were helpful for teaching me to use and understand RIT strategies.	1	2	3	4	5	6
24	The Module exercises were helpful for teaching me to use and understand RIT strategies	1	2	3	4	5	6
25	The Module homework was helpful for reflecting on the RIT strategies I was taught.	1	2	3	4	5	6
26	The Module reflections were helpful for reflecting on the RIT strategies I was taught.	1	2	3	4	5	6

27	The Modules were easy to use and navigate.	1	2	3	4	5	6
28	The in-person modeling of strategies by a therapist was helpful as I learned the RIT techniques.	1	2	3	4	5	6
29	The in-person coaching while I was using the strategies was helpful as I used the strategies with my child.	1	2	3	4	5	6
30	The video review of my use of strategies was helpful as I learned to use the RIT techniques.	1	2	3	4	5	6
31	The review homework at the beginning of the session was helpful as I learned to use the RIT techniques.	1	2	3	4	5	6
32	The amount of training and support received at home was sufficient for me to learn the intervention strategies.	1	2	3	4	5	6
33	The parent training materials were easy to understand.	1	2	3	4	5	6

APPENDIX L

IMPLEMENTATION FIDELITY CHECKLISTS

Implementation Fidelity Checklist
[First Coaching Session]

Participant: _____ Date: ___/___/___
Time: _____ Session #: _____

Instructions: Place a "+" when the participant completes the following steps and "-" when he/she does not. When finished, calculate the total below.

#	Target Behavior	+/-
1	Asks parent if she has any initial questions/comments/difficulties using the module.	
2	Briefly reviews over the content of the first module.	
3	Assists parent in setting up the environment.	
4	Assists parent in determining toys to use in the intervention.	
5	Briefly reviews over the techniques presented in the second module.	
6	Asks parent if she has any questions/comments.	
7	Models target RIT techniques with the child while verbally discusses the interaction and the techniques used (if applicable).	
8	Observes the parent demonstrating techniques in the first module with the child.	
9	Provides coaching (e.g., suggestions to improve interactions, changes to techniques, corrections) while the parent is interacting with the child.	
10	Asks the parent if he/she has questions regarding the interactions or techniques.	
11	Responds to the parents' questions with feedback and suggestions.	
12	Provides the parent with an opportunity to practice the skills just discussed.	
13	Observes the play session without commenting, asking questions, or providing feedback.	
14	Provides positive/corrective statements after the parent is finished demonstrating the strategies with his or her child.	
15	Reviews over homework (additional modules to complete if applicable and home practice form)	

Total number of steps completed: ____
Total number of steps not completed: ____
Fidelity percentage: _____%

Implementation Fidelity Checklist
[Coaching Sessions <u>That Occur Directly</u> After Module Completion]

Participant: _____ Date: ___/___/___
Time: _____ Session #: _____

Instructions: Place a "+" when the participant completes the following steps and "-" when he/she does not. When finished, calculate the total below.

#	Target Steps	+/-
1	Reviews over parent homework and practice in the home.	
2	Responds to questions parent has about techniques.	
3	Shows parent video clip of play with child.	
4	Discusses positive behaviors and provides constructive feedback.	
5	Models target RIT techniques with the child while verbally discusses the interaction and the techniques used.	
6	Observes the parent demonstrating techniques described in target modules.	
7	Provides coaching (e.g., suggestions to improve interactions, changes to techniques, corrections) while the parent is interacting with the child.	
8	Provides positive feedback statements and corrective feedback statements after the parent is finished demonstrating the strategies with his or her child.	
9	Asks the parent if he/she has questions regarding the interactions or techniques.	
10	Responds to the parents' questions with feedback and suggestions.	
11	Provides the parent with an opportunity to practice the skills just discussed in 10-minute play session.	
12	Observes the play session from side of room without providing comments, questions, or feedback.	
13	After play session provides positive/corrective feedback statements after the parent is finished demonstrating the strategies with his or her child.	
14	Discusses assigned homework (practice of strategies/completion of next module) if applicable.	

Total number of steps completed: ____
Total number of steps not completed: ____
Fidelity percentage: _____%

Implementation Fidelity Checklist
[Coaching Sessions <u>That Do Not Occur Directly</u> After Module Completion]

Participant: _____ Date: ___/___/___
Time: _____ Session #: _____

Instructions: Place a "+" when the participant completes the following steps and "-" when he/she does not. When finished, calculate the total below.

#	Target Steps	+/-
1	Reviews over parent homework and practice in the home.	
2	Responds to questions parent has about techniques.	
3	Shows parent video clip of play with child.	
4	Discusses positive behaviors and provides constructive feedback.	
5	Models target RIT techniques with the child while verbally discusses the interaction and the techniques used (if applicable).	
6	Observes the parent demonstrating techniques described in target modules.	
7	Provides coaching (e.g., suggestions to improve interactions, changes to techniques, corrections) while the parent is interacting with the child.	
8	Provides positive feedback statements and corrective feedback statements after the parent is finished demonstrating the strategies with his or her child.	
9	Asks the parent if he/she has questions regarding the interactions or techniques.	
10	Responds to the parents' questions with feedback and suggestions.	
11	Provides the parent with an opportunity to practice the skills just discussed in 10-minute play session.	
12	Observes the play session from side of room without providing comments, questions, or feedback.	
13	After play session provides positive/corrective feedback statements after the parent is finished demonstrating the strategies with his or her child.	
14	Discusses assigned homework (practice of strategies and/or completion of next module) if applicable.	

Total number of steps completed: ____
Total number of steps not completed: ____
Fidelity percentage: ____

Implementation Fidelity Checklist
[Coaching Sessions <u>That Do Not Occur Directly</u> After Module Completion Without Therapist Modeling]

Participant: _____ Date: ___/___/___
Time: _____ Session #: _____

Instructions: Place a "+" when the participant completes the following steps and "-" when he/she does not. When finished, calculate the total below.

#	Target Steps	+/-
1	Reviews over parent homework.	
2	Responds to questions parent has about techniques.	
3	Shows parent video clip of play with child.	
4	Discusses positive behaviors and provides constructive feedback.	
5	Observes the parent demonstrating techniques described in target modules.	
6	Provides coaching (e.g., suggestions to improve interactions, changes to techniques, corrections) while the parent is interacting with the child.	
7	Provides positive feedback statements and corrective feedback statements after the parent is finished demonstrating the strategies with his or her child.	
8	Asks the parent if he/she has questions regarding the interactions or techniques.	
9	Responds to the parents' questions with feedback and suggestions.	
10	Provides the parent with an opportunity to practice the skills just discussed in 10-minute play session.	
11	Observes the play session from side of room without providing comments, questions, or feedback.	
12	After play session provides positive feedback statements corrective feedback statements after the parent is finished demonstrating the strategies with his or her child.	
13	Discusses assigned homework (practice of strategies and/or completion of next module) if applicable.	

Total number of steps completed: ____
Total number of steps not completed: ____
Fidelity percentage: ___

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