The Dissertation Committee for Deanna Tamika Longino Certifies that this is the approved version of the following dissertation:

Sibling Mediated Communication Intervention for Children with Neurodevelopmental Disorders

Committee:

Mark F. O'Reilly Supervisor

Terry S. Falcomata

James Patton

Mary Anne Nericcio

Marie-Anne Suizzo

Sibling Mediated Communication Intervention for Children with Neurodevelopmental Disorders

by

Deanna Tamika Longino, B.A.; M.S.CCC-SLP

Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

The University of Texas at Austin

August 2015

Dedication

This book is dedicated to my husband, Perry Camp Jr. and my amazing parents Larry and Rosilind Longino.

Acknowledgements

I would like to take this opportunity to thank those that have provided encouragement and support throughout this process. Ephesians 3:20 reads, "Now to Him who is able to do exceedingly abundantly above all that we ask or think, according to the power that works in us." As a person that is guided by faith and love in Christ, I know that this journey would not have been possible without the grace and mercy of my Lord and Savior. To my husband, Perry Camp Jr. who has endured this race with me, thank you for your unending support, love and understanding. A long distance relationship is no easy task but your loving words, surprise care packages and sacrifice gave me the strength to achieve this accomplishment. There are no words to describe my appreciation.

This book is dedicated to my parents, Larry and Rosilind Longino. Thank you for your love and encouragement. Thank you for reminding me of the Little Engine That Could and always being a source of laughter and positive energy throughout this journey. You both have instilled in me the value of hard work, dedication and commitment. To my Aunt Betty and Uncle Walter "Otto," thank you for providing me a warm place to stay and delicious food to eat when I embarked upon this journey. To my friends, Ashley Logan, Tiffany White and Ebone Ball, thank you for always providing a listening ear and scriptures when I needed them the most.

I would especially like to thank my chair, my advisor, Dr. Mark O'Reilly. It has been a privilege to work with you. I am forever grateful of your feedback and how you always managed to keep what seemed to be a formidable task possible. Even when I thought the worst, you kept it positive. I would also like to extend a special thank you to my committee members. Dr. James Patton, Dr. Mary Anne Nericcio, Dr. Marie-Anne Suizzo and Dr. Terry Falcomata, thank you for your inspiration and generous feedback. I feel truly blessed to have the opportunity to work with such respected scholars.

Finally, I must say thank you to my colleagues and classmates, Laura Rojeski, Cindy Gervater, Irene Jones, Brooke Jones and Elizabeth Reynolds for your support and collaboration. I would be remisse not to acknowledge my friend and colleague, Dr. Nigel Pierce. I made it! Thank you for your mentorship and guidance.

Sibling Mediated Communication Intervention for Children with Neurodevelopmental Disorders

Deanna Tamika Longino, Ph.D.

The University of Texas at Austin, 2015

Supervisor: Mark F. O'Reilly

Neurodevelopmental disorders are characterized by impairments of personal, social, academic, or occupational functioning. The range of deficits varies from specific limitations of learning to global impairments of social skills. Individuals who have difficulty acquiring and using language lose opportunities to benefit from basic social interactions such as sharing or other intimate components of peer relationships. Interactions between siblings are viewed as important opportunities to develop skills necessary for communication, socialization and the acquisition of cultural norms. Developing social relationships can be challenging when there is a language or communication deficit present. Delayed or deficient language acquisition affects social relationships and sibling relationships in many ways.

The purpose of this study was to examine the efficacy of including a sibling in the intervention package of children with neurodevelopmental disorders. A multiple baseline design was used across three sibling dyads to examine the effectiveness of the intervention. The siblings were taught skills to elicit communication during play.

Generalization probes were conducted with one sibling dyad and indicated the sibling was able to generalize the skills in a different setting. Results showed positive increases in communicative interactions between siblings. Ratings by observers who were naïve to the study documented the social validity of the intervention effects and showed positive changes in the sibling's communicative interactions.

Table of Contents

List of Tables

List of Figures

Definitions

- Speech generating device (SGD): A speech generating device is a form of alternative and augmentative communication. Augmentative and alternative communication (AAC) includes all forms of communication (other than oral speech) that are used to express thoughts, needs, wants, and ideas.
- Time-Delay: Allowing a regular or progressive pause between the presentation of an instruction and a prompt for a response in order to increase independence in responding (Charlop, Schreibman, & Thibodeau, 1988).
- Prompt Hierarchy: Prompting procedures include any help given to learners that assist them in using a specific skill. Prompts are generally given by an adult or peer before or as a learner attempts to use a skill. Least-to-most prompts: This prompting procedure is also referred to as the system of least prompts. The hierarchy is comprised of at least three levels. The first level provides the learner with the opportunity to respond without prompts. The remaining levels are sequenced from the least amount of help to the most amount of help (Nietzel & Wolery, 2009).
- Intelligibility: refers to how much is understood by the listener and the ability to use speech to communicate effectively in everyday situations.

CHAPTER ONE: INTRODUCTION

Sibling relationships are an important aspect to a child's social and interpersonal development and in some cases; sibling relationships can represent the first social relationship experience (Baker, 2000 & Aronson, 2009). The birth of a sibling brings excitement about the prospect of a new playmate for an older brother and sister, along with shared hopes and dreams of the future with the new addition to the family (Aronson, 2009). Conversely, hopes and dreams for the future can collide with fear and anxiety when a child is diagnosed with a neurodevelopmental disorder.

Neurodevelopmental disorders are characterized by impairments of personal, social, academic, or occupational functioning. The range of deficits varies from specific limitations of learning to global impairments of social skills. An intellectual disability (i.e. Down Syndrome, Cerebral Palsy) is characterized by deficits in general mental abilities resulting in impairments in adaptive functioning including communication and personal independence at home or within the community. Additionally, children with autism spectrum disorder (ASD) will display impairments-usually present during the early developmental period- in communication and social interaction across multiple contexts, including deficits in social reciprocity, nonverbal communicative behaviors used for social interaction, and skills in developing, maintaining, and understanding relationships (American Psychiatric Association [APA], 2013). Individuals who have difficulty acquiring and using language lose opportunities to benefit from basic social

interactions such as sharing or other intimate components of peer relationships (El-Ghoroury and Romanczyck, 1999).

Interactions between siblings are viewed as important opportunities to develop skills necessary for communication, socialization and the acquisition of cultural norms (Ellis, Rogoff & Cromer 1981). The dynamics of these interactions can change over time as children get older. According to Ellis et al., (1981), companionship with children other than the sibling is preferred by ages 7-8. Children within this age range may have skills such as initiation and topic maintenance and other skills needed for selective interactions with other children (Ellis et al., 1981). Developing social relationships can be challenging when there is a language or communication deficit present.

The role within a sibling relationship-when one child has a disorder-is an important factor through the lifespan for both individuals. Unlike typical sibling dyads that flow more organically as sibling age increases, sibling relationships that involve children with disabilities tend to become unbalanced regardless of whether the typical sibling is older or younger (Smith, Romski & Sevcik, 2013, Stoneman, 2005). Smith, Romski & Sevcik (2013) found that children with limited expressive language abilities exhibited behaviors like younger children regardless of their birth order. Additionally, the younger sibling may take on the role of teaching, managing and protecting the siblings with the disorder. These roles may continue well into adolescence and into adulthood.

There are several variables that can affect the nature of sibling relationships when one has a disorder. Delayed or deficient language acquisition affects social relationships and sibling relationships in many ways (Travis & Sigman, 1998). For instance, relationships between siblings can be difficult to develop and maintain due to challenging behaviors. The typically developing sibling may have little interest in dealing with their sibling or their efforts to engage may be met by limited reciprocal interactions or aggression (Farraioli, Hansford et al., 2012). Likewise, conversational difficulties amongst siblings may impair the ability to coordinate play with one another, thereby limiting the opportunity for social engagement (Travis & Sigman, 1998). As a result, the quantity and quality of social play between siblings has been characterized as generally ineffective (Baker, 2000; Farraioli & Harris; 2011).

In terms of communicative skills, interactions between typically developing siblings and children with mild language speech impairments generally are not negatively affected as much as children with severe language and speech impairments. Researchers have suggested that having a sibling with a disability did not affect the quality of interaction when the child with the disability had higher cognitive and linguistic skills. Having a sibling with lower cognitive and linguistic skills resulted in a more asymmetrical relationship when it comes to the quality of the interaction and sharing chores and responsibilities within the household (Smith, Romski & Sevcik, 2013).

Studies have shown that the type of disability can also affect the quality of interaction differently. Typically developing siblings of children with Down Syndrome

have been found to spend more time with their sibling than children with Autism (Kaminsky & Dewey, 2001). Additionally, in comparison to having a sibling with Down Syndrome, siblings of children with autism reported significantly less positive attitudes towards their sibling (Bagenholm & Gillberg, 1991). In other studies examining the quality of sibling relationships amongst these two disabilities, the siblings of children with autism were comparatively well adjusted as siblings of other developmental disorders such as Down Syndrome (Smith, Romski, &Sevcik, 2013; Pollard, Barry, Freedman & Kotchick, 2013). In general, research findings have been mixed as to whether having a sibling with a disorder is related to positive outcomes or negative outcomes (Pollard, Barry, Freedman & Kotchick, 2013). Various factors involving different sibling characteristics can attribute to the quality of the sibling interactions such as the maturity of the typically developing sibling, well developed coping strategies, how well the disability is understood and positive responses from parents and peers towards the child with the disability (Kaminsky & Dewey, 2001; Pollard, Barry, Freeman & Kotchick, 2012).

Aronson (2009) found that through proper education regarding the myths and misperceptions of disorders, the typically developing child felt empowered and was able to develop coping skills to deal with their siblings when potentially difficult questions arise. Providing support and giving clear explanations about their sibling's disability -in developmentally appropriate language- can foster closer relationships despite difficulties that may arise related to the child's disorder (Aronson, 2009). Improved and effective

social interactions between siblings not only can provide positive effects for the children but can also provide a sense of respite for parents who need more time to complete household chores, engage in family activities or time to relax.

Although it seems sibling relationships are both positively and negatively affected by issues related to social communication (Bass & Mulick, 2007; Ferraioli, Hansford et al., 2012; Farraioli & Harris, 2011), there seems to be a dearth of research that utilizes the typically developing siblings in their sister or brother's treatment. One type of treatment that has been shown to be effective is sibling mediated intervention (SMI). SMI is a treatment approach in which the typically developing sibling(s) are trained to participate in the intervention to facilitate social and communication interactions and to decrease challenging behaviors for the child with a disorder (El-Ghurory et al., 1999, Celiberti, and Harris, 1993; Strain and Danko, 1995). Inclusion of siblings in the child's intervention package can serve a dual purpose of increasing the interaction between the children while simultaneously providing additional opportunities to sustain these learned skills in the future (Ferraioli et al., 2012). It may be that having siblings can promote social development in children with disabilities due to the opportunities to engage in collaborative interaction inherent in sibling role reciprocity (Knott, Lewis & Williams, 2007).

Despite the potential advantages of including siblings in the intervention package, most interventions that focus on social skills competence have occurred mostly in classroom settings or within school contexts (Tsao and Odom, 2006; Strain and Danko,

1995). Several researchers have conducted studies involving peer involvement in improving social skills in children with autism-peer mediated intervention (Strain, 1990, Mirenda, 2003; Bass and Mulick, 2007). Including peers in the intervention package provides opportunities for social engagement as well as presenting the peers with strategies to improve social interaction. Peer models have been taught through prompts, reinforcement and training to implement intervention techniques such as pivotal response training to improve social skills (Harper, Symon and Frea, 2008). Social skills and initiations were monitored by peer tutors thus increasing the social interactions between peers and children with autism (Morrison, Kamps, Garcia, and Parker, 2001). Multiple studies have supported the notion that peers can be valuable assets in improving social, behavior and communicative interactions for children with neurodevelopmental disorders (Harper et al, 2008; Owen-DeSchryver Carr, Cale and Blakeley-Smith, 2008; Trottier, Kamp and Mirenda, 2011). It may be possible to extend this intervention approach to the homes by placing siblings in the same role as peers in the classrooms.

Recent research has begun to examine the effects of involving siblings in the treatment package of children with neurodevelopmental disorders (Ferraioli & Harris, 2011; Danko, 1995; Baker, 2000; Tsao and Odom, 2006; Koegel, Koegel, and L.R., 1998). This work has contributed to a growing body of evidence supporting the effectiveness of sibling involvement. For example, Tsao and Odom (2006) investigated the effectiveness of a sibling mediated intervention in supporting the social behaviors of young children with autism. The typically developing siblings (2 girls, 2 boys) were

taught strategies to socially engage their brothers. They were also trained on several common behavioral strategies such as establishing eye contact, initiating conversations and expanding the content of the target child's speech. The results showed positive changes in joint attention as well as changes in social behavior.

As mentioned previously, challenging behaviors can also interfere with sibling interactions. Koegel, Stibel and Koegel (1998) utilized a sibling mediated intervention to reduce aggression in children with autism toward their sibling. The challenging behaviors consisted of yelling, pinching, hitting and head butting. The results showed that after the intervention there were: (1) large reductions in the children's aggression toward their infant or toddler sibling, (2) increases in parent and child happiness level, and (3) increases in strangers' level of comfort with respect to interacting with the family.

Although previous research supports the positive effects of sibling involvement, sibling mediated interventions involving teaching communication skills to the other sibling has not been specifically addressed in previous research. Communication skills play an important role in sibling relationships, but it has not been the main focus of studies for sibling intervention. Communication and language skills are important variables to add to the literature to further explain the role it has on the experiences of sibling relationships.

Given the success of previous peer and sibling mediated intervention research, it is reasonable to assume that involving the sibling in the intervention package to improve communication skills for children with neurodevelopmental disorders may also enhance

results. By incorporating natural communication strategies that can be utilized to improve social interaction between the siblings, this dissertation will extend the existing literature base for including siblings in the intervention delivery by examining the following questions (a) would a sibling-mediated intervention increase the communication skills of children with neurodevelopmental disabilities; (b) can the results of this intervention be generalized across settings and (c) are the outcomes of the intervention socially valid?

CHAPTER TWO: SIBLING MEDIATED COMMUNICATION INTERVENTION FOR CHILDREN WITH NEURODEVELOPMENTAL DISORDERS: A REVIEW

Using siblings in various roles has been proposed as part of intervention packages for individuals with disorders in the research literature (Baker, 2000; Celiberti and Harris, 1993; Tsao and Odom, 2006). Although there is evidence of successful inclusion of a sibling as part of the intervention, little is known regarding the communication benefit, particularly with individuals with limited communication skills. Thus, the aim of this chapter is to systematically review the research literature to determine the feasibility of using siblings as part of and intervention package for children with neurodevelopmental disorders.

Several studies have addressed the benefits of including siblings in the treatment of children with neurodevelopmental disorders. However, a review of research examining the influence of sibling mediated interventions on communication and social skill deficits is absent from the literature. Therefore, a current, comprehensive and systematic review is needed.

The review is organized as follows. The first section of this chapter (Method) describes the inclusion and exclusion criteria, details the search procedure and provides a table of reviewed studies. In the table, intended outcomes and the method in which the siblings were trained are summarized. The following section (Results) analyzes the intervention components and reports the findings. The final section (Discussion)

identifies factors concerning sibling involvement and provides suggestions for future research.

METHOD

Search Procedures

This review involved an analysis of studies that focused on the use of siblings in the treatment of children with neurodevelopmental disorders. Articles were analyzed and summarized according to the following criteria; (a) participants receiving the intervention, (b) interventionists, (c) method of training, (d) intervention components and intended outcomes and (e) certainty of evidence.

The initial search Communication and Mass Media Complete (CMMC), Education Source, ERIC, Psych Info and Google Scholar yielded 42 articles that were considered for this study. Search terms included "autism", developmental dis*", "neurodevelopmental dis*", "siblings", and "communication". The publication year was not restricted, but the search was limited to peer-reviewed and empirical studies. The reference lists for studies meeting these criteria were also reviewed to identify additional articles for possible inclusion. The abstracts of the resulting studies were reviewed to identify studies for inclusion.

In order to be included in this review, an article had to be an intervention study that included siblings in the intervention package to improve social, communication and/or behavior skills to treat a child with a neurodevelopmental disorder. Studies were excluded if they did not explicitly state the participants' diagnosis or if the sibling played too limited a role in the intervention. Specifically, this excludes involvement that

consisted of only observing the sibling with a neurodevelopmental disability without any interaction between the two. A total of 12 articles met these criteria and are included in this review.

Data Extraction

Each identified study was first assessed for inclusion or exclusion. Then studies selected for inclusion were summarized in terms of the following features: (a) participant characteristics, (b) interventionists, (c) method of training the typically developing siblings, (d) intervention procedures (e) certainty of evidence. In addition, Horner et al. (2005) identified the assessment of social validity as a feature of high quality single subject design. Social validity estimates the importance, effectiveness, and/or satisfaction people experience in relation to a particular intervention (Kennedy, 2005). Due to the importance of sibling relationships and the complex process of involving a sibling in the intervention package, the presence/absence of social validity was addressed. Certainty of evidence was evaluated by considering the findings reported by the author as well as visual analysis. The certainty of evidence was then rated as either conclusive or inconclusive.

Evaluating the certainty of evidence followed a two- step process. First, only studies that included a recognized experimental design (i.e. multiple baseline or ABAB) were considered as having the potential to provide conclusive evidence. Second, the data had to provide a compelling demonstration of an intervention effect. For single subject designs, this effect can be analyzed through visual analysis. According to Horner et al.

(2005), visual analysis involves systematic comparison within and across phases. Based on visual analysis, results were categorized as positive (intervention effects across all participants), mixed (intervention effect for some participants, but not all) or negative (no intervention effect).

RESULTS

Table 1 summarizes the (a) participants receiving intervention, (b) siblings, (c) method of training siblings, (d) intervention components and intended outcome, (e) social validity, and (f) certainty of evidence. To reduce confusion, the term 'sibling' will be used to describe the typically developing sibling and the term 'participant' will be used to describe the sibling with the neurodevelopmental disorder receiving the intervention.

Participants Receiving the Intervention

Collectively, the 12 studies provided intervention to a total of 34 participants. Participant ages ranged from 6 months to 12 years old with one study reporting the participant's developmental age as 15 years old but his functional age as 3 years old. The sample size for participants receiving intervention ranged from 1-4. Two studies included only one participant while the remaining 10 studies included 2-4 participants. The most common diagnosis was autism (31 participants) and one study reporting a Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) diagnosis (2 participants). The remaining study involved a participant diagnosed as severely neurologically impaired.

Siblings Implementing Intervention

In each study, the siblings were integrated in the intervention and delivered some component of the intervention. Collectively, the 12 studies involved 37 siblings with two of those studies including both parents as well as the siblings. The participant and sibling dyads age difference ranged from 0 to 6 years.

Table 1.: Summary of included studies

Citation	Participants	Siblings Implementing Intervention	Method of Training siblings	Intervention Components and Skills Addressed	Social Validity	Outcomes; Certainty of Evidence
Baker (2000)	3 children 5-6 years old Autism	siblings 7-8 years old	Adult Explanation, fading of parents Taught how to include ritualistic thematic behaviors in play session	Prompt with verbal praise, initiate play Intended to increase sibling/social play, JA and affect	X	Conclusive; Positive
Celiberti et al. (1993)	3 children 4-7 years old Autism	Siblings 7-10 years old	Verbal Explanation, Demonstration	Elicit play and play related speech; prompts and praise Intended to teach behavior skills	X	Conclusive; Positive
Colleti et al. (1977)	2 children 9-10 years old Autism Neurologically impaired	Siblings 9-11 years	Verbal Explanation, Ongoing feedback	Give verbal instruction; provide reinforcement; use praise and reprimand Intended to teach behavior modification		Conclusive; Positive
Dodd et al. (2008)	2 children 9-12 years old PDD-NOS	Parents Siblings 10 years old	Verbal Explanation	Siblings read social story together Intended to increase target social skills:	X	Conclusive; Positive
Ferraioli et al. (2011)	4 children 4-5 years old Autism	Siblings 6- 8 years old	Review Procedures, role play, prompts	Provide physical prompts, error correction, repeated trials ; Intended to increase JA	X	Conclusive; Positive
Koegel et al. (1998)	3 children 4-5 years old Autism	Parents Siblings 6 mos-8 mos	Consultation model; functional analysis	Change contextual stimuli Intended to decrease aggression towards siblings	X	Conclusive; positive
Rayner et al. (2011)	1child 15 years old *fa: 3 years old Autism	Sibling 12 years old	Verbal explanation; Video modeling	Modeled play interactions; Intended to promote positive play interactions		Inconclusive; Positive

Table 1 (continued)

Reagon et al. (2006)	1 child 4 years old	Sibling 6 years old	Learn lines to participate in activity; Video modeling	Act as model in video; Intended to increase play and social interactions	X	Conclusive; Positive
Reichle et al. (2007)	4 children 3-6 years old Autism	Siblings 4-11 years old	Prompts; social skills lesson	Prompted, initiated; Intended to promote sibling mediated social interaction	X	Conclusive; mixed
Strain et al. (1995)	3 children 3-5 years old Autism	Siblings; Parents	Shown video of a model of standard social skills intervention; Practice skills	Deliver prompts; Intended to encourage social interactions between siblings	X	Conclusive; positive
Tsao et al. (2006)	4 children 3-6 years old Autism	Siblings 4-11 years old	Taught strategies similar to Stay, Play, Talk Program; practice skills	Use strategies while playing with siblings; deliver praise; Intended to increase play	X	Conclusive; Positive
Walton et al. (2012)	4 children NR Autism	Siblings 8-13 years old	Verbal explanation of RIT Manual written in child friendly language; Role Play	Deliver social praise, physical guidance; Intended to increase use of contingent imitation	X	Conclusive; Positive

In eleven studies, the siblings were the same age or older than the child receiving the intervention. In the remaining study, the siblings were younger than the child receiving the intervention. In each study, the siblings involved in the intervention were reported as not having a diagnosis.

Method of training siblings

A variety of methods were used to train siblings to implement the intervention. Verbal explanation was used in 11 studies in conjunction with other training methods. Verbal explanation involved detailing the reason why the intervention was important and how the intervention was to be implemented. After the verbal explanation, role play or practice (i.e. sibling and trainer act out the intervention with trainer pretending to be the participant) was used in four studies to ensure the siblings understood how to carry out the intervention. For example, in the study conducted by Ferraioli and Harris (2011), the sibling participated in a brief interactive instruction with the experimenter, including modeling (trainer performs intervention while the sibling observes) and role plays with experimenter feedback. One study used a video to explain how the social skills package would be delivered. In this study, the parents watched the video then trained the typically developing child how to encourage social interactions. Strain and Danko (1995) showed the parents a 5 minute video segment of a social skills intervention implemented in the classroom. After they watched the video, the parents had a chance to ask questions, practice and then taught the typically developing child these strategies. Other methods used consisted of having the typically developing child read an instruction manual written in child friendly language outlining the intervention and an experimental checklist.

Types of skills addressed and intervention components

The most common intervention component involved prompting the sibling to initiate an interaction with the participant receiving the intervention. This occurred in eight of the reviewed studies and ranged from initiating simple play to attempting to engage the participant in conversation. In the eight studies, the trainer or the parents prompted the sibling to initiate play. Baker (2000) for example, instructed the sibling to say, "Let's play" if the participant failed to initiate play independently. In one study, the trainer prompted the sibling, through a headset, to provide a verbal instruction, "Sally, string the beads" if the participant didn't perform the task independently and within 5 seconds (Colleti and Harris, 1977). Six studies taught siblings to provide contingent reinforcement to participants following appropriate behavior. For example, Colleti and Harris, (1977) told the sibling to give the participant a candy reward and to deliver the reward as quickly as possible after the correct answer had been given. Two studies trained the siblings to provide physical guidance during the intervention (Ferraioli and Harris, 2011; Walton and Ingersoll, 2012). Ferraioli and Harris (2011) instructed the sibling to provide a gentle finger to the chin to engage the participant in joint attention and eye contact.

Two studies provided fairly comprehensive intervention packages. Walton and Ingersoll (2012) incorporated Reciprocal Imitation Training (RIT) in their intervention package. The trainers taught the siblings to deliver social praise, imitate actions, contingent imitation and linguistic mapping. These skills were taught to the siblings for 10 weeks in 15-30 minute sessions. Ferraoili and Harris (2011) taught the siblings

strategies to provide opportunities for turn taking, prompting, error correction procedures and repeated trials. Other intervention components implemented by the siblings in two studies included script reading and modeling target play interactions while they were being videotaped. In the study conducted by Reagon et al. (2006), after the participant watched the video, the siblings participated together in the same play activity that was modeled on the video.

Skills taught to children with neurodevelopmental disorders

Eight studies used siblings to increase or improve play/social interaction (Baker, 2000; Celiberti and Harris, 1993; Dodd et al., 2008; Rayner, 2011; Reagon, Higbee and Endicott, 2006; Reichle, 2007; Strain and Danko, 1995; Tsao and Odom, 2006). Two studies used video modeling as their intervention to improve play/social interaction (Rayner, 2011; Reagon et al., 2006). Of the studies, Dodd et al., (2008) used social stories to improve sportsmanlike behavior during games and to give compliments to others while playing. One study focused on increasing joint attention through role play (Ferraioli and Harris, 2011). Siblings were used as interventionist to specifically target reduction in aggressive behaviors (Koegel, Koegel, and L.R., 1998) in which the siblings played an active role in changing the contextual stimuli. Challenging behaviors were addressed in two studies specifically, ritualistic thematic behaviors, (Baker, 2000) and out of seat behavior (Colleti and Harris, 1977).

OUTCOMES

The majority of the studies reviewed reported positive results. One study reported inconclusive results in which the author attributed to short intervention phases, lack of inter-observer agreement and lack of treatment fidelity. Most of the studies provided at least some measure of social validity and found the involvement of the siblings to be appropriate and beneficial to the interactions between the siblings.

Of the studies measuring social validity, six provided quantifiable social validity data from parent or sibling completed Likert scales (Baker, 2000; Dodd et al., 2008; Ferraioli and Harris, 2011; Koegel et al., 1998; Reagon et al., 2006; Strain and Danko, 1995). Four of the studies used graduate students to watch video segments and rate the quality of the interaction between siblings. For example, Tsao and Odom (2006), used a 3 item rating scale to answer questions such as "Was the child having fun?" or "Was the child involved in social play?"

Discussion

This literature review yielded 12 studies involving siblings in the intervention package when treating children with neurodevelopmental disorders. Summary and analysis of these studies revealed that the existing literature base is limited with respect to including siblings in the intervention package. Overall, the reviewed studies suggest that the involvement of the siblings in the intervention package to be appropriate and

beneficial to the interactions between the siblings as well as an effective intervention approach for children with neurodevelopmental disabilities.

The results of this review indicate that the siblings were able to learn new intervention strategies to initiate and maintain play/social interaction, reduce aggressive behaviors exhibited by the participant and to increase joint attention. The siblings were taught prompting procedures, contingent reinforcement following appropriate behaviors and how to use physical guidance (gentle finger to the chin to engage the participant). They were also taught how to model target (appropriate) behaviors, deliver social praise by giving high fives or verbal praise and linguistic mapping. These findings indicate that siblings can be used as intervention agents to target various skill deficits in their older or younger sibling with a neurodevelopmental disorder.

SIBLING INVOLVEMENT

Studies have shown that having a sibling with a disability causes anxiety, frustration, depression and jealousy in the typically developing sibling (Aronson, 2009; Lobato et al., 2011). Sibling mediated intervention may require some consideration of the typically developing sibling's desire to want to participate which may affect its social validity. Although, siblings are a natural part of the environments where children develop a style of social exchange, having a sibling with a disability can cause a monumental shift between family members.

In an effort to support the sibling prior to integrating them in the intervention, education regarding the sibling's disability should be explained in a manner that is developmentally appropriate. This will empower them and give them tools when

challenging situations arise (Aronson, 2009). The typically developing sibling should also be taught coping skills when interacting with their sibling. In doing so, the myths and perceptions of having a disability can be corrected while acknowledging the reality. Integrating the sibling in the intervention package will not merely address impairments exhibited by the child with a disability but it could also increase and improve interactions between siblings as well as allow the typically developing child more psychological freedom and greater access to their experiences (Aronson, 2009).

There are several factors that must be considered when involving typically developing siblings that can negatively affect the experience on both siblings. Sibling mediated interventions require some consideration of the child's environment and the sibling's comfort level in providing the intervention (Tsao and Odom, 2006). The typically developing sibling may lack the desire or motivation to participate. Interacting with the sibling with a neurodevelopmental disability may cause frustration or the typically developing sibling may feel they are not effective if they don't notice immediate changes in the interactions. The child with the disability may not initially respond favorably to their sibling's attempts (Celiberti and Harri, 1993).

Another concern that should be considered is the educational or developmentally appropriate skills of the typically developing sibling. The typically developing sibling's perception of the disability and the capabilities or difficulties that the child with the disability exhibits should be understood and acknowledged before involvement in the intervention. There are some skills needed in order to effectively teach the sibling how to provide prompting techniques or other instructional strategies to the child with a

developmental disability. These concepts may be particularly challenging for younger siblings to teach (Ferraioli et al., 2012).

A final concern that should be considered is the behavioral topographies that the child with the disability exhibits. These behaviors could interfere with the outcome of the intervention as well as introduce a detriment to the siblings' social interaction that wasn't previously present. If the behaviors pose a potential danger to the sibling, particularly a younger sibling, then sibling involvement should be done under the supervision of a caregiver and implemented systematically to ensure safety.

To address these concerns, it is important to make the intervention or the involvement of the sibling as natural as possible. This can be achieved by designing interventions that motivate the siblings to interact with each other and incorporating the sessions during naturally occurring playtimes (Bass and Mulick, 2007; Ferraioli et al., 2012). The typically developing sibling should be acknowledged and reinforced for their role in the intervention and should also be given the freedom and breaks to engage in their own activities. As with most behavioral principles, the typically developing sibling may need constant reinforcement such as tokens, points or other desired items while they are engaging in the intervention to get them through the challenging and frustrating moments that they may encounter.

Although this review contributes to a growing body of evidence supporting the effectiveness of sibling supporting the development of children with neurodevelopmental disorders, this review presents some limitations. The current review must be considered limited because of the scarcity of studies (n=12) and the relatively small number of

participants (n=34). An additional limitation should be the lack of reporting by the reviewer, for the total duration of each baseline and intervention package. Perhaps the amount of time requiring typically developing siblings to learn an intervention could have an effect on the social validity and acceptance of the intervention by the family members. Of the studies that did explore social validity, the data were limited, although they generally suggested moderately to strongly positive benefits. Social validity data should be explored further in future research, specifically strategies to explore the perceptions of all people directly and indirectly impacted by the intervention.

FUTURE RESEARCH

In terms of the aim of this research to evaluate the efficacy of including siblings as part of the intervention package, the existing research suggests that they can contribute to the social, communicative and behavior skills development of a brother or sister with a neurodevelopmental disability. Involving siblings can improve overall social interaction and engagement. The sibling can learn techniques to initiate social activities and games and reduce anxiety or frustration that may arise when attempting to connect with their sibling. Ancillary gains in other social and communicative abilities can serve as an additional positive effect in involving siblings and peers.

Informing and guiding families and practitioners interested in the use of siblings in the intervention package was another goal of this review. Sibling involvement should be designed to promote and improve generalization and maintenance of skills across settings and people. Using a sibling to improve communication, behavior and social

skills provides multiple opportunities to target different skills. The use of the sibling can double or even triple the amount of service time and in a more relaxed nature.

In an effort to guide and extend future research aimed at improving the efficacy of involving siblings to improve skills of children with developmental disorders, there is large space for more research to be done given the lack of common independent variables within the existing studies. The mixed nature of independent variables in this review makes it impossible to draw strong conclusions regarding the causal effects of a teaching role of a sibling as the interventionists targeting communication skills for a child with autism. The current issues in research on the role of siblings in treatment align with some of the issues involved in teaching skills to children with neurodevelopmental disorders especially as reflected in literature regarding peer mediated intervention.

Treatment planning must be approached with caution due to the various cognitive and developmental implications when involving a typically developing child (Ferraioli et al., 2012). Age variation is an additional consideration when involving siblings. It would be valuable to examine the characteristics of the siblings in regards to intervention effectiveness. Tsao and Odom. (2006) suggests it would be valuable to examine systematically how the characteristics of the siblings (e.g., age, gender) are related to the effectiveness of the intervention.

As mentioned previously, many of the reviewed studies provided at least some measure of social validity and all that did so found the intervention to improve and/or increase the interactions between the siblings. Six studies provided quantifiable social validity data from parent or sibling completed Likert scales. Four of the studies used

graduate students to watch video segments and rate the quality of the interaction between siblings. Perhaps other measures could assess the acceptability of participating in treatment such as questionnaires assessing the typically developing sibling's understanding of the disability or conducting an interview with the typically developing sibling. Guided questions such as "How often do you interact with your sibling?" or "What happens when you try to play with your sibling?" could provide information outlining the nature of the siblings' interactions and their answers could be used to teach intervention concepts.

This chapter provided a systematic review of sibling mediated interventions. This review suggests that there is a limited research base regarding integrating siblings in the intervention package for children with neurodevelopmental disorders. Specifically, research that incorporates natural communication partners, considers the supports needed for both siblings and research that targets socially valid skills using socially valid technologies remains lacking. Future research efforts could identify specific communication interventions for nonverbal siblings with a neurodevelopmental disorder as well as a systematic examination of the typically developing siblings' characteristics and its relation to the effectiveness of the intervention. The purpose of this dissertation is to examine the influence of a sibling mediated intervention on the communication skills of children with neurodevelopmental disorders and to determine if the skills learned could be generalized across different settings.

CHAPTER THREE: METHOD

This chapter will describe the methodology used in this study. Participant characteristics will be described followed by a description of the settings and materials that were used. Operationalized definitions of target behaviors, the experimental design and study procedures will be described. Additionally, the process of measuring inter-observer agreement, treatment fidelity and social validity will be reviewed.

Participants

Four sibling dyads (four children with a neurodevelopmental disorder-ND- and four typically developing siblings) participated in this study. All participants were diagnosed by physicians independent of this project. The first author-a licensed speech and language pathologist- evaluated all of the participants to assess their speech and language skills to determine their expressive language abilities. The Preschool Language Scales-Fifth Edition (PLS-5) was administered to each participant. Standard scores between 85-115 are considered average.

Siblings

The typically developing siblings had no identified social, cognitive or behavioral problems that could likely interfere with the study. The siblings closest in age were recruited. The age constraint is placed on the siblings due to the developmental progression of the relationship. Sibling relationships change over time and siblings who have large age differences will have different experiences than those closer in age (Stoneman, 2005, Smith, Romski and Sevcik, 2013).

The first sibling dyad consisted of CJ, a 5 year old boy diagnosed with eosinophilic esophagitis with a global delay and his 8 year old brother K. CJ used mostly babbling, pointing and some approximated sign language ("my turn", "drink" and "finish") to communicate. He required hand over hand assistance as well as moderate to maximum prompts to utilize new sign language. He received an Expressive Language standard score of 50 and an age equivalent of 1:0. CJ preferred to play with books, trucks and balls. Both children were homeschooled and K usually played with CJ during unstructured play time.

The second dyad consisted of Mya, an 8 year old girl diagnosed with Down Syndrome and her 5 year old sister JJ. Mya produced some words but her speech was mostly unintelligible at least 70-75% of the time. A child her age should be intelligible at least 80% of the time. Mya produced words such as "help me", "no", "hey" and would identify the researcher as "Ms. D." Both siblings attended school full time and would mostly interact with each other after school and on the weekends. Mya was tested by the first author and received an Expressive Language age equivalence of 2:3 on the PLS-5. A standard score could not be reported because the patient's chronological age is out of the age range of this particular assessment. However, based on the patient's communicative and functional age, the PLS-5 was used for anecdotal data and to determine an age equivalence for expressive communication. Mya preferred to play with puzzles, play-doh and picnic toys.

Sibling dyad 3 consisted of Maddy a 5 year old girl diagnosed with Down Syndrome and her 10 year old sister CC. Maddy attended a half day Preschool Program

for Children with Disabilities (PPCD) and received private services in home. Maddy spoke in single word utterances and required prompts to use sign language. She played well with her sister CC and preferred to play with puzzles, her kitchen toy set and a ball. Maddy received an Expressive Language standard score of 50 on the PLS-5. She had to be supervised at all times while playing with her sibling as she would often elope or hit others out of excitement.

Dyad 4 was composed of Gio, a 5 year old boy diagnosed with Autism spectrum disorder and his 9 year old sister Jada. Gio attended a half day PPCD program and received private services in home. Gio used a multimodal form of communication consisting of sign language, picture exchange and some verbalizations. His language consisted of mostly 1-2 word utterances and uses 1-2 pictures to request items. He played well with his sister and preferred to play with books with large print and his tablet. Gio received an Expressive Language standard score of 50 on the PLS-5 and age equivalent of 1:1. The consent form was received for this participant and his sibling at the initiation of this study and baseline sessions were conducted. However, as the study progressed, this participant was no longer available due to a death in the family, illnesses and other family conflicts.

Table 2. Participant Characteristics

Participant	Age, Gender/Diagnosis	Age Equivalence	PLS-5 Standard score
CJ	5 yr. male/Global Delay	1:0	61
Maddy	5 yr. female/Down Syndrome	1:5	50
Mya	8 yr. female/Down Syndrome	2:3	____
Gio	5 yr. male/ ASD	1:1	50

Setting and Materials

Pre-intervention, baseline and intervention sessions were conducted in the participants' homes in the play area. Play materials were selected based on the interests of the children with a neurodevelopmental disorder and their siblings and availability. All sessions occurred during a day and time that was convenient for the family. Generalization probes (Maddy) were conducted outside in the backyard of the home during baseline and intervention phases.

Video Equipment

Video recording was conducted using a Flip Video™ camera with high quality video output and built-in microphone. The video camera was setup in the therapy room prior to each session and used for each baseline, intervention and generalization probes.

Pre-baseline assessment

An informal pre-baseline assessment (see interview questions, Appendix A) were conducted by the primary researcher and lasted approximately 15 minutes for each sibling in a designated space. The assessment was conducted via a questionnaire and given to the siblings to identify concrete information and strategies that would help the siblings during their interactions with the child with the ND and as an opportunity to consent to their involvement in the study and. The results of the assessment were used anecdotally to determine the communicative interactions that would be targeted as the dependent variable.

DEPENDENT VARIABLE

Target Interactions

The primary dependent variable was the amount of communicative interactions (CIs). Communicative interactions were defined as requests and object identification via vocalizations, sign language or speech generating device activation directed toward the sibling that served a communicative function (Shumway & Wetherby, 2009). Requests will be defined as sibling to sibling interaction asking for specific toys, games or food. Other communicative interactions included requests using 3-4 word utterances ("I want cookie please") to increase the participant's mean length utterance.

Table 3 provides the list of participants and their targeted communicative interactions (dependent variable). Targeted interactions were ascertained through the pre-baseline assessment as well as interactions from each of the participants' Individualized

Education Program (IEP) speech and language goals. Due to the severity of 2 of the participants' expressive language disorders, the communicative interactions were limited to one word utterance, picture exchange or sign language. The communicative interactions were coded as either prompted (a direct result of corrective attention provided by the sibling, including verbal and/or gestural prompts) or independent (produced by the target child independently, without any type of prompt).

Table 3. Target Communicative Interactions

Participant	Age/Diagnosis	Target Goal	Operational Definitions
CJ	5y/o Global Delay	Requesting book, ball, more using sign language	Body and eye contact directed toward sibling, produces approximated sign for preferred item
Maddy	5y/o Down Syndrome	Requesting block, jump Identifying pictures	Body and eye contact directed toward sibling, produces sign or verbalizations for preferred item
Mya	8 y/o Down Syndrome	Increasing mean length of utterance (MLU) through requesting and object identification	Body and eye contact directed toward sibling, uses carrier phrase "I want cookie please."
Gio	5 y/o Autism	Requesting using picture exchange	

Topographies of Communication by Participants

The target communication for CJ was requesting preferred items such as ball, book and more. He struggled with making requests on a consistent basis and would use gestures such as pointing to request items. This behavior was defined as CJ using sign

language indicating the desired item. Due to the severity of CJ's communication and motor skills, the sign language was a previously agreed upon approximation. Non-requests were pointing towards item or reaching for item. Requesting for CJ was an IEP/speech goal implemented by his speech pathologist and his school.

Mya's target communication was requesting preferred items using the carrier phrase "I want____ please" as well as identifying objects. Increasing Mya's mean length of utterance (MLU) is a goal in her current IEP. Normal MLU range for a child Mya's age is >4.0-6.8 (Paul, 2006). Mya's current MLU is 2-3. Identifying objects was another target behavior. This goal is also targeted in Mya's current IEP. Non-responses consisted of Mya pointing to object or reaching for object without attempting vocalization.

Maddy's target communication was requesting "jump," "water", "more" or "block." These requests were counted if Maddy attempted a sign language request or a verbalization. Identifying objects was also counted as a targeted communicative interaction. Requesting and object identification were goals targeted in Maddy's current IEP. Non responses consisted of Maddy reaching for object or pointing to object.

Experimental Design

A multiple baseline across participants was used to evaluate the communicative interactions (Kennedy, 2005) with generalization probes across settings to evaluate Maddy's interactions. For CJ and Mya, the study consisted of three phases: baseline, sibling training, intervention. For Maddy, the study consisted of four phases: baseline, sibling training, intervention and generalization.

Baseline

During the baseline condition, interactions between the siblings were observed for ~30 minutes without providing any specific instructions, feedback, or prompts. The typically developing sibling was told that the purpose of this period of time is to see how they interacted with each other. If the child with the neurodevelopmental disorder (ND) left the play area and the sibling was not able to get him/her back within 1 minute or when the target child acted aggressively toward his sibling, the researcher intervened to a) bring the child back to the play area and intervened to b) prevent harm to the sibling or the target child.

Sibling training

The focus of this phase was sibling training. Contingent upon the results from the pre-baseline assessment, the researcher prompted the sibling to model use of communicative interactions and had opportunities to practice the sign or the utterance. For example, during this phase, the researcher prompted the sibling to model "ball" in sign language. The sibling was taught to hold or place the preferred item away from the participant. When the participant reached for it, the sibling was taught to ask "what do you want?" The sibling was taught to wait for 5 to 10 seconds before providing prompts each time during play so that the target child would have an opportunity to independently produce the sign or verbal utterance. If no communication occurred, the sibling was taught to ask the question again, provide a verbal or gestural prompt and then hand over hand assistance- if needed.

A verbal prompt was defined as a spoken utterance designed to get the attention of the child with the disorder or direct the child to produce an utterance. A gestural prompt was defined as a point or other motion toward the ball that. If needed, the researcher provided a verbal prompt informing the sibling how to provide assistance (i.e. *Call his/her name and ask what do you want* while holding the ball). Once the target child, said "ball" the sibling immediately offered praise and gave the child the ball. The primary researcher practiced the training steps by role-playing with the sibling prior to the start of each intervention session.

Intervention

This phase was different from sibling training in that the sibling would hold the preferred item and encouraged the participant to request with minimal to no assistance of the researcher. The sibling was encouraged to use the new strategies while playing or interacting with the target child. The sibling was told to praise the target child for any communicative interactions. The praise consisted of hi-fives and/or "good job saying, "ball".

Generalization

Before and after intervention, the sibling and the participant (Maddy) participated in a 10 minute generalization probe conducted outside in the backyard to assess the extent to which the skills acquired by the sibling could be transferred to equivalent interactions.

Data Collection

Each session was video recorded. The video camera was set up prior to the session in an inconspicuous location in the room that captured the participant and the

sibling interacting. Videos were later observed and coded by the primary researcher. Each session (baseline and intervention) lasted for 15-30 minutes. Each session was later broken down into 5 minute increments for data collection. The rate of spontaneous and prompted communicative interactions per minute was calculated by dividing the total number of interactions by five.

Inter-observer agreement

Two data collectors independently observed at least 30% of all treatment, baseline sessions with each participant for assessment of interoberserver agreement (IOA). An observer who was blind to the purpose of the study was provided with operational definitions of all dependent variables and was trained until we obtained at least 90% accuracy across two consecutive study videos that were not used to assess IOA. Data were compared for agreements and disagreements. An agreement was scored when both observers recorded an occurrence or nonoccurrence. Any discrepancy between the observer's scoring resulted in a disagreement. Interobserver agreement on each target behavior was calculated for each session using the formula:

$$\text{Interobserver Agreement} = \frac{\text{Agreements}}{\text{Agreement + Disagreement}} \times 100$$

Table 4. Mean Interobserver Agreement

	Maddy		Mya		CJ	
Dependent Variables	Mean %	Range %	Mean %	Range %	Mean %	Range %
Prompted	90	89-92	94	91-100	88	86-91
Spontaneous	96	83-100	96	90-100	91	75-100

Treatment Fidelity

Appendix B provides a task analysis for fidelity of treatment for the intervention protocol implemented by the sibling. Treatment fidelity was collected during 30% of intervention sessions. The primary investigator and a second observer independently observed data of the target interaction(s). Treatment fidelity was then calculated by dividing the number of correct steps completed by the total number of steps required and multiplied by 100 to determine a percentage.

SOCIAL VALIDITY

The process of social validation has been used to ensure the social importance of the goals and the social effects of the treatment (Fawcett, 1991). The present study assessed social validation of the treatment effects. Aside from depicting behavior change, it was important to demonstrate that the siblings' skill acquisition and subsequent

changes in play topography were noticeable. Naïve observers viewed segments of videotaped sibling play in both baseline and post-training conditions and rated them on several dimensions.

A 5 point scale (Appendix C) adapted from Celiberti and Harris (1993) was used to rate the vignettes based on the behaviors of the siblings and the appropriateness of play. Higher scores signify more positive perceptions. The scale comprised of 8 items. Some of the items addressed affective factors in the sibling's style of interaction with the child with the disability, including the rater's perception of the sibling's level of frustration, their level of confidence towards the participant and the level of interest. Sibling behaviors that were addressed included enthusiasm towards the child and the effectiveness of the interaction. The degree to which the interaction was beneficial was addressed as well as the participant's perceived interest in the sibling. The participant's behavior was evaluated in terms of cooperation with the sibling.

CHAPTER FOUR: RESULTS

This chapter presents the results of this study by participant to address the following questions: (a) does a sibling mediated intervention increase the communication skills for children with neurodevelopmental disorders and (b) can the results of this intervention be generalized across settings. The results are presented in Figure 1.

Mya

During baseline, Mya initially produced an average rate of .05 spontaneous communicative interactions per minute (.2/min; range=0-0.2). She then produced no spontaneous communicative interactions across 5 sessions. Her sibling made no attempts or prompts to elicit any form of communication. Upon implementation of intervention, Mya's rate of prompted CIs increased immediately averaging .19/min (range =0-.8). Her rate of spontaneous CIs increased and then dropped for 2 sessions. During these 2 sessions, her sibling attempted to prompt Mya but was met with resistance and Mya preferred to point to items instead of producing words. For the remaining sessions, Mya's spontaneous CIs increased steadily (mean .58/min; range =0-1).

CJ

During baseline, CJ produced no spontaneous communicative interactions. His sibling made no attempts to elicit communication. Upon implementation of intervention, CJ's rate of prompted CIs increased averaging .68/min (range =0-.8). His rate of spontaneous CIs did not increase immediately. As the intervention progressed, CJ's

spontaneous CIs slowly increased averaging .58 (range =0-.8). There were sessions in which CJ's sibling preferred to "play" with his brother and would not elicit communication. It was reported that on this specific day, CJ's sibling just returned from a sleepover with friends and did not sleep the night before. It was also observed on video during two sessions that CJ's sibling would often lie down on the floor and didn't interact with his brother. This resulted in 0 prompts as well as a concurrent low rate of spontaneous interactions by CJ.

Maddy

During baseline, Maddy made no spontaneous communicative interactions. Her sibling attempted prompts to elicit communication averaging .4/min (range 0-.8). Maddy's sibling (Cierra) has watched speech therapy sessions previously conducted by the researcher (independent of this research project) and attempted to mimic strategies that she observed. Her prompts consisted of Cierra touching Maddy's mouth with her index finger while giving the directive "say___." This strategy is an imitation technique used to elicit speech sounds but is not the strategy used for this project. This is considered a limitation and is mentioned in the Discussion section. Before each intervention, Cierra had to be reminded to play with Maddy and to forget the strategies she has previously observed. Cierra's rate of prompted CIs decreased and remained steady across five sessions.

Upon implementation of the intervention, Maddy's rate of prompted CIs immediately increased, averaging 1.1/min (range 0-2). Her rate of spontaneous

communicative interactions required two sessions to show change and then increased steadily (overall mean=1.52/min; range 0-3). While the emphasis in this study was on communicative interactions during play, Maddy's sibling, Cierra, chose to sit Maddy at a table and do table top activities such as shape puzzles and picture cards. In doing so, she was able to elicit more communication than the other participants who used more of a play based approach.

Generalization

Maddy and her sibling, Cierra, was observed in baseline and intervention generalization sessions. (The generalization probes are indicated as open shapes.) The generalization setting was outside in the family's neighborhood. Cierra made no attempts to elicit communication in the baseline and Maddy did not produce any spontaneous communicative interactions. Upon implementation of the intervention, Maddy's rate of prompted CIs increased averaging 1.4/min (range=.8-2). Her rate of spontaneous CIs increased averaging .9/min (range =.6-1.2). The results suggest Cierra appeared to elicit forms of communication in the generalization probe thus increasing Maddy's spontaneous communicative interactions while playing outside.

Treatment Fidelity

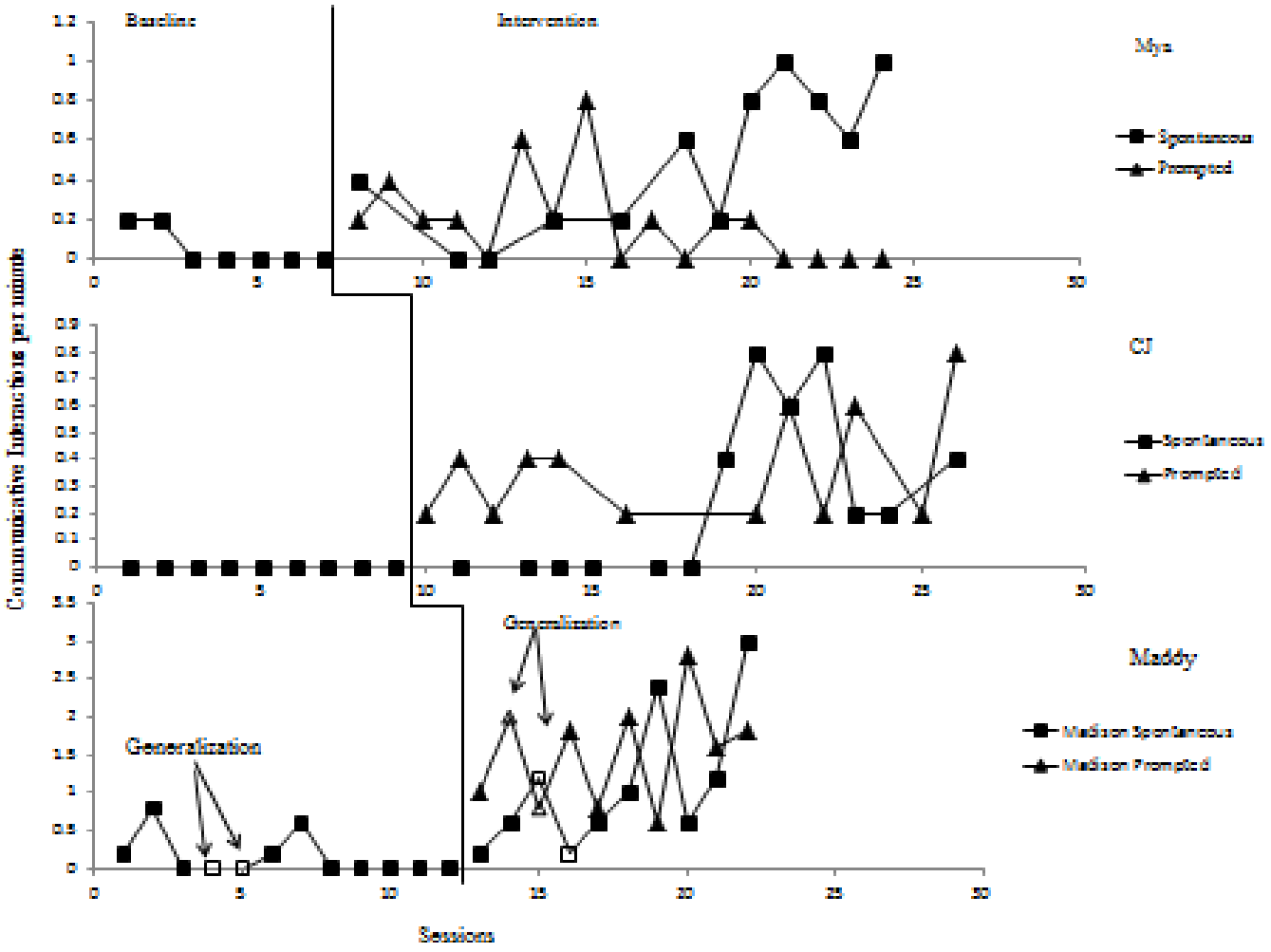
The primary investigator and a second observer independently observed data of the target interaction(s). An implementation checklist was used to code the sibling's performance and a total percent correct score was calculated for 30% of the intervention sessions. Appendix B provides a task analysis for fidelity of treatment for the intervention

protocol implemented by the sibling. Fidelity of treatment was calculated by dividing the number of steps completed correctly by the total numbers of steps in the procedure then multiplying by 100.

Table 5. Treatment Fidelity

Sibling	Intervention Protocol
Jolie (Mya)	*M* =77% (range 50-100%)
Cierra (Maddy)	*M* = 96% (range 88-100%)
Clarke (CJ)	*M* = 82% (range 62-100%)

Figure 1. Communicative Interactions per Minute



Social Validity

This section addresses the social validity of this sibling mediated intervention. Means were obtained for ratings of baseline and intervention. This data were computed separately for the sibling dyads for all 8 factors assessed in the social validity rating scale. Table 6 reflects the mean values of comparison between baseline and intervention.

The results of the social validation assessment provided support for the notion that the trained siblings exhibited behaviors detectable by naïve observers and are perceived to be positive in nature. For Mya, the sibling was not perceived to be frustrated in baseline and the intervention sessions. The sibling's confidence, interest and enthusiasm showed improvement from baseline to intervention. CJ's sibling made mild gains across all aspects. CJ's cooperation to produce communication during play made the most improvement. Maddy's ratings were the highest across each item in both baseline and intervention sessions. The sibling was perceived as being confident, interested and enthusiastic to elicit communication. The sibling's effectiveness as well as the level of benefit to the participant made the most improvement. All three siblings were perceived to show no frustration and exhibited an increase in their confidence during the intervention. Finally, all three participants appeared to improve in their cooperation to produce communication during play.

Table 6. Social Validation Ratings

	Mean	Mya	CJ	Maddy
1.Sibling's frustration	Baseline Mean	1	1	1
	Intervention Mean	1	1	1
2.Sibling's confidence	Baseline Mean	1	3	4.5
	Intervention Mean	3	4	5
3.Sibling's interest	Baseline Mean	1.5	2.5	4
	Intervention Mean	3	3.5	5
4.Sibling's enthusiasm	Baseline Mean	1	2.5	4
	Intervention Mean	2.5	3.5	5
5.Sibling's effectiveness	Baseline Mean	1	1	2
	Intervention Mean	4.5	4	5
6.Benefit to participant	Baseline Mean	1.5	1	2
	Intervention Mean	4	4	5
7.Participant's interest	Baseline Mean	2	1	2.5
	Intervention Mean	4.5	3	5
8.Participant's cooperation	Baseline Mean	2.5	1	4.5
	Intervention Mean	5	4	5

CHAPTER FIVE: DISCUSSION AND CONCLUDING COMMENTS

The purpose of this study was to evaluate the effectiveness of a sibling mediated intervention (SMI) on communication skills of children diagnosed with a neurodevelopmental disorder. Towards this purpose, various communication interactions were assessed using a multiple baseline design across participants with generalization probes.

This chapter will summarize the findings with respect to the following research questions: (a) does a sibling mediated intervention increase the communication skills of children with neurodevelopmental disabilities; (b) can the results of this intervention be generalized across settings and (c) are the outcomes of the intervention socially valid? The remaining portion of this chapter will discuss implications on existing research for including siblings in the intervention package of children diagnosed with neurodevelopmental disorders, identify limitations of this study, provide future direction and provide concluding comments.

Previous studies on sibling training demonstrated that typically developing siblings were taught new strategies such as: prompting procedures, contingent reinforcement following appropriate behaviors and how to use physical guidance (gentle finger to the chin to engage the participant). They were also taught how to model target (appropriate) behaviors, deliver social praise by giving high fives or verbal praise and linguistic mapping and modeling to teach skills to the participants with the disorder.

(Baker, 2000; Colleti and Harris, 1977; Ferraioli and Harris, 2011; Walton and Ingersoll, 2012). This study corresponds favorably to previous studies in which the siblings were taught how to facilitate communication through prompting techniques and how to provide communicative models when requesting preferred items. Additionally, the siblings delivered social praise such as high fives and verbal praise when the participant produced the targeted communicative interactions.

A review of the literature indicated that a variety of methods were used to train siblings to implement various interventions. Verbal explanation was used in 11 of 12 studies reviewed in conjunction with other training methods. Verbal explanation involved detailing the reason why the intervention was important and how the intervention was to be implemented. After the verbal explanation, role play or practice (i.e. sibling and trainer act out the intervention with trainer pretending to be the participant) was used in four studies to ensure the siblings understood how to carry out the intervention. (Baker, 2000; Celiberti and Harris, 1993; Dodd et al., 2008; Rayner, 2011; Reagon, Higbee and Endicott, 2006; Reichle, 2007; Strain and Danko, 1995; Tsao and Odom, 2006; Ferraioli and Harris, 2011; Colleti and Harris, 1977; Walton and Ingersoll, 2012).

For each dyad pair, the training protocol/treatment fidelity checklist (Appendix B) was reviewed with the parents and the siblings. Verbal explanation was used for each sibling in child friendly language. The siblings were then asked to role play with the researcher before each intervention session to ensure the siblings understood each step. Data was not collected to determine the rate of acquisition of the training protocol but the

researcher used clinical judgement to determine if the sibling was ready to implement the intervention. This is considered a limitation for this study.

Consistent with previous research on sibling training, the current study demonstrates that involving siblings in the intervention package can be a viable training for increasing communication and social skills for children with disabilities as well as reduce the frequency of challenging behaviors (Baker, 2000; Celiberti and Harris, 1993; Dodd et al., 2008; Rayner, 2011; Reagon, Higbee and Endicott, 2006; Reichle, 2007; Strain and Danko, 1995; Tsao and Odom, 2006). This study extended previous research by specifically targeting communicative skills by increasing communicative interactions.

For the purposes of this study, communicative interactions were defined as requests and object identification via vocalizations, sign language or speech generating device activation directed toward the sibling that served a communicative function (Shumway & Wetherby, 2009). Requests were defined as sibling to sibling interaction asking for specific toys, games or food. Other communicative interactions included requests using 3-4 word utterances ("I want cookie please") to increase the participant's mean length utterance. Each participant presented with unique expressive language deficits and information was ascertained through each participants' IEP to determine targeted communicative interactions. Results shown in Figure 1.indicate that the sibling mediated intervention increased the communication skills of each participant.

Although the sibling training intervention was generally successful for each participant, as evidenced in Figure 1., CJ made only moderate gains in his spontaneous

communicative interactions. One explanation for his results is the severity of his diagnosis and disorder. Research has shown that a child with lower expressive language capabilities as well as complex communicative needs can affect the quality of sibling interaction (Kaminsky & Dewey, 2001). CJ needed most to least prompting to increase his communication and his sibling, on occasion, "just wanted to play" resulting in limited opportunities to communicate and lower levels of improvement.

It was also noted that while the researcher was in their home, CJ and his sibling wanted to play with the researcher instead of each other. During one session, CJ brought a book to the researcher and wanted to look at pictures. The researcher could not leave the room and this possibly affected the interactions between the siblings. Also, as noted earlier, during two sessions, CJ's sibling would lie down on the floor and his mom reported he was tired and did not get any sleep the night before. Perhaps, these additional variables also attributed to limited communicative gains for this participant.

As demonstrated in Figure 1., Mya's spontaneous communicative interactions increased as the intervention progressed but there were 2 sessions when she did not want to use verbalizations. This could be due to various factors. One potential factor could be that Mya's sister, Jolie, is younger than Mya. Mya is 8 and Jolie is 5. Mya has additional siblings in the home, a 15 year old sister and an 18 year old brother. The decision was made to choose the sibling closest in age. Research suggests that children closest in age have higher levels of warmth and closeness. (Smith, Romski & Sevcik, 2013; Burhmester & Furman, 1990). In light of this, research has shown that regardless of the typically

developing sibling's age, the relationship becomes asymmetrical as the siblings get older (Smith, Romski & Sevcik, 2013). One can only assume that Mya-given her diagnosis- is aware that she's older than her sister. Although Jolie is younger than the other siblings involved in this study, she was able to learn the training protocol and she immediately started prompting her sister. However, Jolie seemed to tire out towards the end of each session and preferred to play alone. She also needed higher reinforcement at the end of each session and wanted to play with a puzzle each time the researcher was in her home.

Maddy's sister, Cierra was the oldest of all the sibling participants. Maddy is 5 and Cierra is 10. Maddy also has additional siblings in the household. There is 16 year old brother and a 12 year old sister. Cierra was chosen for 2 reasons. First, the researcher wanted to stay consistent and choose the sibling closest in age. Second, when Maddy's parents were presented with the invitation to be involved in this study, they excitedly told the researcher that Cierra would be perfect and Maddy get along better than any of the other siblings. They also reported that Maddy "will listen to Cierra before she listens to her parents."

Cierra's maturity relative to the other sibling participants was evidenced during the baseline and intervention sessions. Cierra and Maddy enjoyed jumping on the trampoline and playing outside but inside "play" consisted of Cierra performing teacher roles. She and Maddy would sit at a table and play with puzzles and books. The structured nature of Maddy's and Cierra's play contributed to increased communicative interactions as demonstrated in Figure 1. It can be assumed that the nature of their sibling

relationship was restricted to a more teacher/student role but it was observed in numerous sessions that Maddy and Cierra would often kiss each other affectionately and Cierra would reinforce Maddy with hugs- mirroring a sibling relationship.

Generalization probes with Maddy and Cierra revealed that Cierra used her trained skills which increased Maddy's spontaneous communicative interactions while playing outside. Other studies have also found that siblings could learn social skills, communicative skills and behavior modification strategies and use those skills in different settings (Celiberti & Harris, 1993; Tsao & Odom, 2006; Baker, 2000).

According to Tsao and Odom (2006) sibling mediated interventions require some consideration of the child's environment and the sibling's comfort level in providing the intervention. The typically developing sibling may lack the desire or motivation to participate. Interacting with the sibling with a neurodevelopmental disability may cause frustration or the typically developing sibling may feel they are not effective if they don't notice immediate changes in the interactions. To address this, the researcher designed the intervention involving the sibling as natural as possible. Researchers suggest designing interventions that motivate the siblings to interact with each other and incorporating the sessions during naturally occurring playtimes (Bass and Mulick, 2007; Ferraioli et al., 2012). In this study, the intervention was done in the participants' home during their normal play times. The sessions were structured to involve a more naturalistic approach. Each sibling was acknowledged and reinforced for their role in the intervention and given

the freedom and breaks to engage in their own activities. Maddy and CJ's sibling needed multiple breaks and in some cases, they preferred to play alone.

Of the studies reviewed, six provided quantifiable social validity data from parent or sibling completed Likert scales (Baker, 2000; Dodd et al., 2008; Ferraioli and Harris, 2011; Koegel et al., 1998; Reagon et al., 2006; Strain and Danko, 1995). The studies that provided at least some measure of social validity found the involvement of the siblings to be appropriate and beneficial to the interactions between the siblings. The results of the social validation assessment provided in this study supports the notion that the trained siblings exhibited behaviors detectable by naïve observers and are perceived to be positive in nature. All three participants appeared to improve in their cooperation to produce communication during play.

Early in the intervention, there was one session in which Maddy did not want to produce words which caused apparent frustration with her sibling. Additionally, as mentioned previously, there were sessions, during the early stages of the intervention, when CJ's sibling was tired and just wanted to play with his brother and due to the nature of CJ's need for prompting, his sibling seemed to lack confidence and desire to continuously prompt his brother. Nevertheless, each sibling was reinforced of their efforts regardless of the cooperation of the child with the disorder. This feedback may have caused more comfort with the nature and extent of demands placed upon the sibling and they became more intrinsically interested in the interactions. The intrinsic motivation, the increase in communicative interactions and appropriate responses by the

participants may have influenced the siblings giving them a feeling of pride and may positively influence the maintenance of skills over time (Celiberti & Harris, 1993).

Anecdotal Information

During the intervention, CJ's mom reported that during community outings, she noticed a difference in the interaction between the siblings. She noted that CJ's sibling would prompt CJ, wait, prompt him again and give him the desired object. She also stated that she has noticed CJ has made more attempts at using sign language to request items.

Limitations and Future Research

The data presented in this study, while promising, have several limitations and cautions which should be addressed. First, although four participants were secured, only three participants with ND and their siblings participated in this study. The results showed an increase in communicative interactions, however, the results could be strengthened with a greater number of participants and siblings. Future research should replicate thus study with a greater number of participants and siblings.

A second limitation involved the location of the researcher during the intervention phases. The researcher was present for all baseline sessions but due to the presence of the researcher during some of the intervention sessions, the participants and siblings were distracted and would often talk to the researcher instead of each other. For example with Maddy, she would often run to or hug the researcher while playing with her sibling. Similarly, with Mya, and her sister, they both would ask random questions and try to

involve the researcher in the activities. These scenarios often kept the interactions between the siblings at a minimum thus affecting the rate of interactions during intervention sessions.

Third, maintenance data were not collected due to time restraints. Although, the data indicates that Cierra was able to generalize her skills to a different setting, the generalization phase was limited to one participant and the results should be interpreted with caution.

Another limitation included the researcher's previous interactions with the participants during individual speech therapy sessions done prior to the study. Unknowingly, the siblings have previously observed the researcher during these therapy sessions and during baseline sessions for this study, one of the siblings- Cierra (Maddy) mimicked speech strategies implemented previously by the researcher affecting baseline data.

An additional limitation is the length of the sessions. The researcher implemented baseline sessions for 30 minutes because typical speech and language therapy sessions are typically 30 minutes in length. All of the participants (with the ND) are involved in speech therapy sessions and typically tolerate working for 30 minutes. However, it was noticed the siblings, specifically the younger siblings, would tire out and play alone quietly during the last few minutes of the session.

Finally, the siblings' skill acquisition was not systematically assessed in this study. The researcher would practice the training protocol with each sibling before each intervention but data were not collected to determine the rate in which the skills were acquired. Future studies should investigate skill acquisition rate and its intervention affects.

Dyad characteristics involving age and gender wasn't explored in depth in this study. According to Ellis, Rogoff and Cromer (1981), studies have shown that children of various ages would prefer companions of the same sex. In this study, each dyad consisted of the same gender with the exception of Gio-the 4th participant who was unable to complete the study. Research should explore age and gender characteristics involving sibling interactions and involvement in interventions.

In this study, colleagues with similar training and educational background as the researcher completed a survey for social validity. Although, the results of the social validity showed support for the notion that the trained siblings exhibited behaviors perceived to be positive in nature, future research should examine social validity by comparing observations of the parents involved, the siblings as well as educators/speech pathologists.

Implications for Practice

The present study contributed to a growing body of evidence concerning the effectiveness of siblings in supporting the learning of young children with

neurodevelopmental disorders. The results of this study have several implications for practitioners. Studies have documented the large caseloads of speech and language pathologists (SLPs) as well as a shortage of home based therapists (ASHA, 2009). In light of these constraints, siblings can be taught strategies to utilize at home and within the community to treat communication skills. In essence, the siblings can be mini-interventionists in the absence of the therapists, providing additional treatment time outside of the standard 30 minute therapy sessions.

In this study, the communicative interactions between the siblings increased. It is possible that the typically developing siblings grew more comfortable as they were given strategies to increase opportunities to interact with each other. The results of this study further illustrate that given strategies to elicit communication may have simultaneously increased social components such as initiation and social reciprocity. As in other peer and sibling mediated studies, when sibling or peer partners were taught strategies to engage in social interactions, in general, the social engagement of the child with the disability increased (Tsao & Odom, 2006; Celiberti & Harris, 1993). Sibling relationships play an important role in children's development and researchers have linked positive sibling relationships with positive friendships and general peer interactions (McCoy, Brody, & Stoneman, 1994).

Parents play an important role in facilitating interactions between siblings. Previous research has shown the potential long term benefits of training parents to facilitate and improve social and communicative interactions amongst siblings (Celiberti

& Harris, 1993). Although this study focused more on sibling intervention, parents can also be taught strategies to improve skills of children with disorders. Research efforts could explore the role that parents can assume in teaching and maintaining these skills. Providing parents with education on how to monitor and assess their child with a disorder could also empower them and give them a sense of comfort in knowing what to do when a communication breakdown occurs. The family and the children can benefit from the consistency and this could translate into a potentially better outcome for all people involved.

Summary

The purpose of this study was to determine the efficacy of sibling mediated intervention on the communication skills of children with neurodevelopmental disorders. The results demonstrated increased communication skills for each participant. This study corresponds favorably to previous studies in which the siblings were taught how to facilitate communication through prompting techniques and how to provide communicative models when requesting preferred items. The siblings were trained skills that most therapists use during speech therapy sessions and they were able to use those skills to teach communication while in the home setting. The results of the social validity of this study showed support for the notion that the trained siblings exhibited behaviors perceived to be positive in nature. When siblings are willing to try to learn new strategies to interact with their brother or sister with a disorder, the chances for a successful

intervention increases (Harris & Glassburg, 2003). These findings extend the current literature concerning the effectiveness of siblings in supporting the learning of young children with neurodevelopmental disorders. Furthermore, this study provides the bases by which multiple lines of research in this area may be addressed. Future research is warranted to address the magnitude and further investigate the effects of involving typically developing siblings in the intervention package of children with neurodevelopmental disorders.

APPENDIX A

PRE-BASELINE ASSESSMENT/INTERVIEW QUESTIONS

(A) Would you like to learn how to teach your brother/sister to use basic sign language to communicate?

(B) What are some activities that you can do with your brother/sister

(C) What can you do if your brother/sister wants something but doesn't know how to ask

(i.e. use basic sign language such as food or juice).

APPENDIX B

Treatment Fidelity Checklist

Training Protocol	**Implemented Y/N**
1. Keep preferred item out of reach of participant	
2. Watch and block access to item	
3. Wait-if not requested independently	
4. Ask- "what do you want"	
5. Sign correct word or provide verbal prompt	
6. Wait-if no response-prompt again using soft hand over hand assistance	
7. Give item	
8. Reinforcement	
Total:	Yes= No=

APPENDIX C

Social Validity Rating Scale (BASELINE)
Instructions: Please watch the vignettes and rate each item. Typically developing sibling

is denoted as 'sibling.' Sibling with a disability will be denoted as 'participant.'

1. Siblings' frustration while (attempting to) elicit communication with participant

1	2	3	4	5
No Frustration				Very Frustrated

2. Sibling's confidence while eliciting communication with participant

1	2	3	4	5
Not very confident				Very confident

3. Sibling's interest in eliciting communication with participant

1	2	3	4	5
Not very interested				Very interested

4. Sibling's enthusiasm to elicit communication

1	2	3	4	5
Not very enthusiastic				Very enthusiastic

5. Sibling's effectiveness in eliciting communication

1	2	3	4	5
Not very effective				Very effective

6. Benefit to participant

1	2	3	4	5
Not very beneficial				Very beneficial

7. Participant's interest in communicating during play

1	2	3	4	5
Not very interested				Very interested

8. Participant's cooperation to communicate during play

1	2	3	4	5
Not cooperative				Very cooperative

Social Validity Rating Scale (INTERVENTION)

Instructions: Please watch the vignettes and rate each item. Typically developing sibling is denoted as 'sibling.' Sibling with a disability will be denoted as 'participant.'

1. Siblings' frustration while interacting with participant

1	2	3	4	5
No Frustration				Very Frustrated

2. Sibling's confidence while interacting with participant

1	2	3	4	5
Not very confident				Very confident

3. Sibling's interest in interacting with participant

1	2	3	4	5
Not very interested				Very interested

4. Sibling's enthusiasm to elicit communication

1	2	3	4	5
Not very enthusiastic				Very enthusiastic

5. Sibling's effectiveness in eliciting communication

1	2	3	4	5
Not very effective				Very effective

6. Benefit to participant

1	2	3	4	5
Not very beneficial				Very beneficial

7. Participant's interest in communicating during play

1	2	3	4	5
Not very interested				Very interested

8. Participant's cooperation to communicate during play

1	2	3	4	5
Not cooperative				Very cooperative

References

American Psychiatric Association (2013). Diagnostic and Statistical Manual of Mental Disorders,(5th ed.). Arlington, VA: American Psychiatric Association.

Aronson, S. (2009). Am I my brother's keeper? Challenges for the siblings of autistic children. *Journal of Infant Child and Adolescent Psychotherapy, 8*(1), 49-56.

Bagenholm, A., & Gillberg, C. (1991). Psychosocial effects on siblings of children with autism and mental retardation: A population based study. *Journal of Mental Deficiency Research, 35*, 291–307.

*Baker, M. (2000). Incorporating the thematic ritualistic behaviors of children with autism into games: Increasing social play interactions with siblings. *Journal of Positive Behavior Interventions, 2*(2), 66-84.

Bass, J. & Mulick, J. (2007). Social play enhancement of children with autism using peers and siblings as therapists. *Psychology in the Schools, 44*(7), 727-735

Buhrmester, D. & Furman W. (1990). Perceptions of sibling relationships during middle childhood and adolescence. *Child Development, 61*, 1387-1398.

*Celiberti, D. & Harris, S. (1993). Behavioral intervention for siblings of children with autism: A focus on skills to enhance play. *Behavior Therapy 24*, 573-599.

Charlop, M., Schreibman, L., & Thibodeau, M. (1985). Increasing spontaneous verbal responding in autistic children using a time delay procedure. *Journal of Applied Behavioral Analysis. 18*(2), 155-166.

*Colleti, G. & Harris, S. (1977). Behavior modification in the home: Siblings as behavior modifiers, parents as observers. *Journal of Abnormal Child Psychology, 5*(1), 21-30.

Dempsey, A., Llorens, A., Brewton, C., Mulchandani, S., Goin-Kochel, R. (2012). Emotional and behavioral adjustment in typically developing siblings of children with autism spectrum disorders. *Journal of Autism and Developmental Disabilities, 42*, 1393-1402.

*Dodd, S., Hupp, S., Jewell, J. & Krohn, E. (2008). Using parents and siblings during a social story intervention for two children diagnosed with PDD-NOS. *Journal of Developmental and Physical Disabilities, 20*, 217-229.

El-Ghoroury, N. & Romanczyk, R. (1999). Play interactions of family members towards children with autism. *Journal of Autism and Developmental Disabilities, 29*(3), 249-258.

Ellis, S., Rogoff, B., & Cromer, C. (1981). Age segregation in children's social interactions. *Developmental Psychology, 17*(4), 399-407.

Ferraioli, S. Hansford, F., & Harris, S. (2012). Benefits of including siblings in the treatment of autism spectrum disorders. *Cognitive and Behavioral Practice, 19*, 413-422.

*Ferraioli, S. & Harris, S. (2011). Teaching joint attention to children with autism through a sibling mediated behavioral intervention. *Behavioral Interventions, 26*, 261-281.

Harper, C., Symon, J. & Frea, W. (2008). Recess is time in: Using peers to improve social skills of children with autism. *Journal of Developmental Disorders, 38*, 815-826.

Harris, S. L. & Glasberg, B.A. (2003). *Siblings of children with autism: A guide for families*. Bethesda, MD: Woodbine House.

Horner, R., Carr, E., Halle, J., McGee, G., Odom, S. & Wolery, M. (2005). The use of single subject research to identify evidence based practice in special education. *Council for Exceptional Children, 71*(2), 165-179.

Kaminsky, L., & Dewey, D. (2001). Sibling relationships of children with autism. *Journal of Autism and Developmental Disorders, 4*, 399-410.

Kennedy, C. (2005). *Single case designs for educational research*. Boston: Pearson.

Knott, F., Lewis, C. & Williams, T. (2007). Sibling interaction of children with autism: Development over 12 months. *Journal of Autism and Developmental Disorders, 37*, 1987-1995.

*Koegel, L.K., Stibel, D., & Koegel, R.(1998). Reducing aggression in children with autism towards infant or toddler siblings. *Journal of the Association for Persons with Severe Handicaps, 23*(2), 111-118.

Lobato, D. Kao, B., Plante, W., Seifer, R., Grullon, E., Cheas, L. & Canino, G. (2011). Psychological and school functioning of Latino sibling of children with intellectual disabilities. *Journal of Child Psychology and Psychiatry, 52*(6), 696-703.

McCoy, J.K., Brody, G., & Stoneman, Z. (1994). A longitudinal analysis of sibling relationships as mediators of the link between family processes and youths' best friendships. *Family Relations, 43*, 400-408.

Mirenda, P. (2003). Toward functional augmentative and alternative communication for students with autism: manual signs, graphic symbols, and voice output. *Language, Speech, and Hearing Services in Schools, 34*, 203-216.

Morrison, L., Kamps, D., Garcia, J. & Parker, D. (2001). Peer mediation and monitoring strategies to improve initiations and social skills for students with autism. *Journal of Positive Behavior Interventions, 3*(4), 237-258.

Neitzel, J., & Wolery, M. (2009). *Overview of prompting*. Chapel Hill, NC: The National Professional Development Center on Autism Spectrum Disorders, Frank Porter Graham Child Development Institute, The University of North Carolina

Owen-DeSchryver, J. S., Carr, E. G., Cale, S. I., & Blakeley-Smith, A. (2008). Promoting social interactions between students with autism spectrum disorders and their peers in inclusive school settings. *Focus On Autism And Other Developmental Disabilities*,*23*(1), 15-28.

Paul, R. (2006). *Language disorders from infancy through adolescence* (3rd ed.). St. Louis, Missouri: Mosby Elsevier

Pollard, C., Barry, C., Freedman, B. & Kotchick, B. (2013). Relationship quality as a moderator of anxiety in siblings of children diagnosed with autism spectrum disorders or Down syndrome. *Journal of Child and Family Studies, 22*, 647-657.

*Rayner, C. (2011). Sibling and adult video modeling to teach a student with autism: Imitation skills and intervention suitability. *Developmental Neurorehabilitation, 14*(6), 331-338.

*Reagon, K., Higbee, T., & Endicott, K. (2006). Teaching pretend play skills to a student with autism using video modeling with a sibling as model and play partner. *Education and Treatment of Children, 29*(3), 517-528.

*Reichle, J. (2001). Strategies to promote sibling mediated social interaction interventions resulting in modest effects for young children with autism. Evidence-Based Communication Assessment and Intervention, 1, 32-34. Doi: 10.1080/174893300701246266

Schepis, M., Reid, D., Berhmann, M., & Sutton, K. (1998). Increasing communicative interactions of young children with autism using a voice output communication aid and naturalistic teaching. *Journal of Applied Behavior Analysis,* 31, 561-578.

Shumway. S., & Wetherby, A. (2009). Communicative Acts of Children with Autism Spectrum Disorders in the Second Year of Life. J*ournal of Speech, Language and Hearing Research, 52*(5), 1139-1156.

Smith, T., Polloway, E., Patton, J. & Dowdy, C. (2012). T*eaching students with special needs in inclusive settings*. Boston: Pearson.

Smith, A., Romski, M. & Sevcik, R. (2013). Examining the role of communication on sibling relationship quality and interaction for sibling pairs with and without a developmental disability. *American Journal on Intellectual and Developmental Disabilities, 118*(5), 394-409.

Strain, P. (1990). LRE for preschool children with handicaps. *Journal of Early Intervention, 14*, 291-296.

*Strain, P. & Danko, C. (1995). Caregivers' encouragement of positive interaction between preschoolers with autism and their siblings. *Journal of Emotional and Behavioral Disorders, 3(*1), 2-12.

Travis, L. & Sigman, M. (1998). Social deficits and interpersonal relationships in autism. *Mental Retardation and Developmental Disabilities, 4*, 65-72.

Trottier, N., Kamp, L. & Mirenda, P. (2011). Effects of peer-mediated instruction to teach use of speech-generating devices to students with autism in social game routines. *Augmentative and Alternative Communication, 27*(1), 26-39.

*Tsao, L., & Odom, S. (2006). Sibling-mediated social interaction intervention for young children with autism. *Topics in Early Childhood Special Education, 26*(2), 106-123.

*Walton, K., & Ingersoll, B. (2012). Evaluation of a sibling mediated imitation intervention for young children with autism. *Journal of Positive Behavior Intervention, 14*(4), 241-253.

*denotes articles used in review