

STEPS (SIBLING TECHNIQUES FOR ENHANCED PLAY AND SUPPORT)
FOR STRENGTHENING THE SIBLING BOND
OF CHILDREN WITH AUTISM

by

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DISSERTATION ABSTRACT

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Title: STEPS (Sibling Techniques for Enhanced Play and Support) for Strengthening the Sibling Bond of Children with Autism

Sibling relationships are a unique and special bond throughout the life span. Having a sibling with autism may present extra difficulties to form a close and meaningful relationship. While siblings play an important role in the child with Autism Spectrum Disorder (ASD) life, there is no consistent method for involving siblings in treatment for individuals with ASD. This current study evaluated a novel treatment package including training siblings on play strategies (called play tips when communicating with the participants) in combination with a sibling support group to increase positive sibling play and perceived relationship quality. Using two concurrent multiple baseline designs, nine sibling dyads participated in the online STEPS program. Specifically, the intervention package included an online implementation of behavior skills training on simple play strategies and participation in a sibling support group. The intervention package improved quality of sibling play and increased the perceived quality of the sibling relationship.

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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

This chapter will provide the statement of purpose of the study and a review of the literature around the research on (a) autism symptomatology in young children, (b) the impact of autism on family well-being and specifically sibling quality of life, (c) interventions addressing social communication and play for young children with autism, (d) peer and sibling mediated interventions for young children with autism, and (e) intervention considerations for sibling involvement. The chapter concludes with the study's purpose and research questions.

Statement of Purpose

Siblings take an important role in a family with a child with Autism Spectrum Disorder (ASD) because they spend a significant amount of time with each other across a variety of settings. Neurotypical (NT) siblings can also serve as successful role models for social communication skills for their brother or sister with ASD (Baker, 2000) and may even be expected to help take care of their sibling well into adulthood (Kaminsky & Dewey, 2001). Thus, sibling relationships are essential to well-being and can be ideally one of the longest lasting friendships (Cicerelli, 1994). Complementary and reciprocal interactions are a defining feature of sibling relationships for young children (Bontinck et al., 2018). Furthermore, play is an instrumental part of relationship building in young children (Vygotsky, 1993). The social and communication difficulties of children with ASD can make play more difficult (Orsmond & Fulford, 2018) and play between siblings can be less rewarding for siblings who have a brother or sister with ASD (Baker, 2000; McHale et al., 2016). The core social difficulties encompassing an ASD diagnosis are unique

when compared to other neurodevelopmental disabilities in that social impairments may specifically affect relationships with siblings (Orsmond & Fulford, 2018). Specifically, young children with ASD are more likely to engage in repetitive and inflexible play behaviors (Lin & Koegel, 2018), display lower levels of functional and sociodramatic play (Jarrold, 2003), and requests for flexible play can often lead to challenging behaviors (Rispoli et al., 2014). However, one way of increasing appropriate sibling play is teaching NT siblings play and environmental strategies to support their sibling with ASD (Kryzak & Jones, 2017). Improvement in joint engagement, turn-taking, and communicative actions were detected for children with ASD when the NT sibling incorporated the child with ASD interest into games (Baker, 2000), stayed in close proximity (Kryzak & Jones, 2017), invited their brother or sister to play or share (Oppenheimer-Leaf et al., 2012), and provided positive reinforcement (Colletti & Harris, 1977). Sibling-mediated strategies can be a preferred intervention method because siblings are around the child with ASD for a significant amount of time across home and community settings; therefore, sibling mediated interventions can potentially enhance skill generalization and maintenance of the skills for the child with ASD. Although studies have indicated that sibling-mediated interventions have produced positive outcomes for the child with ASD, most studies have failed to report outcomes for the sibling (Banda, 2015).

Siblings of children with ASD may face unique challenges including feelings of embarrassment from negative reactions from the public and learn how to navigate assisting their brother or sister with ASD in the domains of adaptive skills, behavioral difficulties, and social impairments (Roeyers & Mckye, 1995). Siblings of children with

ASD compared to siblings of NT children or children with Down syndrome are at higher risk of poorer outcomes such as social and behavioral difficulties (Gialloa & Gavidia-Payne, 2006), negative psychosocial outcomes, and higher rates of depression (Gold, 1993). Conversely, other studies have reported siblings of children with ASD having high levels of social competence, positive self-concepts, and healthy behavioral adjustment (Ferraioli et al., 2012). Recent evidence suggests that even when one sibling has autism, the quality of relationship between siblings can be positive and, with the right supports, can have positively affect personality characteristics of the NT sibling (Macks & Reeve, 2007). While the findings of sibling well-being have been inconsistent, siblings of individuals with ASD are more at risk for behavioral and emotional problems as well as poor sibling relationships (Petalas et al., 2009). The broader research on siblings of children with ASD indicates there is some evidence of negative effects but also evidence of positive effects suggesting siblings may need extra supports in place (Hastings, 2003; Tsao et al., 2012). Siblings of children with ASD may benefit from meeting others with a similar family background and experiences. Formal (e.g., doctor, counselor) and informal social supports (e.g., friends, family members) have been found to moderate the impact of severity of challenging behavior for the child with ASD and NT sibling behavioral outcomes (Hastings, 2003).

The current proposal will expand on the research on sibling-mediated interventions for children with ASD and include a focus on NT sibling outcomes. NT children will be taught to use simple play and behavior management strategies with their brother or sister with ASD and will participate in a sibling support group. The researcher will coach NT siblings to deliver a treatment package (i.e., offering choices of play

activities and following the child's lead, narrating play, obtaining sibling with ASD attention before providing simple instructions, and delivering praise to the sibling with ASD) during shared play with their brother or sister with ASD. Furthermore, a support group will be provided to offer opportunities for NT siblings to express their feelings, to normalize and validate their experiences as a sibling of a child with ASD, and to learn about autism characteristics in a supportive space with similar aged peers. The intervention approach of this project is unique in the dual focus on improving NT sibling discrete play facilitation skills, but also addressing the NT sibling knowledge, perceptions and behavior related to having a sibling with autism in an emotionally supportive context of a support group.

Literature Review

Autism Symptomatology in Young Children

ASD is a neurodevelopmental disorder that is defined by persistent deficits in social communication and restricted or repetitive behaviors and interests (RRBIs) (American Psychiatric Association, 2013). Social communication delays in young children include the following: (a) social-emotional reciprocity, (b) nonverbal communicative acts used for social interaction (e.g., pointing, showing), and (c) developing, maintaining, and understanding relationships (American Psychiatric Association [APA], 2013). Young children with ASD can also display restricted and repetitive behaviors including (a) stereotyped or repetitive motor movements, use of objects or speech, (b) insistence on sameness and inflexible adherence to routines, (c) highly restricted interests that are abnormal in intensity or focus, and (d) hyper/hypo-reactivity to sensory input (APA, 2013).

The DSM-5 spectrum of support consists of three different support levels from Level 1 (requiring support), Level 2 (requiring substantial support), and Level 3 (requiring very substantial support) (APA, 2013). The classifications of support needs are grounded in social communication skills and RRBI. Children in Level 1 support category may be able to speak in full sentences, but have noticeable impairments initiating and maintaining social interactions and display inflexible behaviors (Sanchack & Thomas, 2016). Level 2 support is marked by deficits in verbal and nonverbal communication including speaking in simple sentences, having narrow special interests, and difficulty coping with change (Sanchack & Thomas, 2016). Children with Level 2 support needs usually have RRBI that consistently interfere with functioning across contexts. Individuals with ASD that require a substantial level of support have severe deficits in verbal and nonverbal communication skills and display RRBI that markedly interfere with functioning globally. Children with Level 3 support may have few intelligible words, use communication to solely mand (i.e., request), and have extreme difficulty coping with change in routines (Sanchack & Thomas, 2016). However, it is unclear where cognitive level and adaptive level fits into these support categories (Weitlauf et al., 2014). While the support levels are relatively broad and lack specificity, differences in support needs may be a helpful starting part for treatment recommendations addressing social communication skills and RRBI.

Autism treatment recommendations may also need to consider gender. Historically, ASD has been a male dominated diagnosis with most of the empirical research and diagnostic criteria largely focused on the male population (Ormond et al., 2018). However, ASD may be more common among females than previously accepted

and diagnosed because of the differences in autism behavior based on gender and society's perception of gender (Harrop et al., 2019; Zwaigenbaum et al., 2012). Ormond and colleagues (2018) investigated the differences of presenting autism symptomology in children and adolescents diagnosed with ASD-Level 1 and females on the spectrum used social masking, imitation, and imagination more frequently than males. Females with ASD have reported lower levels of social and communication deficits (Rynkiewicz & Lucka, 2015) and increased levels of social motivation (Harrop et al., 2019) compared to males with ASD. Furthermore, anecdotal reports suggest females with ASD have fewer RRBI symptoms than males, have a greater desire to interact with others, and can have a tendency to imitate others social interactions thus masking social difficulties (Lai et al., 2015). Overall, children with ASD exhibit a wide range of behavioral repertoires with a varying level of difficulties in social communication skills and challenging behaviors.

Impact of Autism on Family Well-Being

Young children with ASD may have limited verbal communication, difficulties with social interactions, and display a higher level of aggressive or self-injurious behaviors compared to NT peers which in turn can impact immediate and extended family members (Meadan et al., 2010). The difficulties in social communication and adaptive skills in children with ASD have been associated with decreased parenting efficacy, increased stress and other mental health problems, and worsened physical health problems (Karst & Van Hecke, 2012). Specifically, mothers of children with ASD have reported significantly higher stress levels and lower levels of well-being compared to parents of children with other developmental disabilities and NT children (Baker-Ericzen et al., 2005; Bromley et al., 2004; Paynter et al., 2013). Furthermore, the roles and

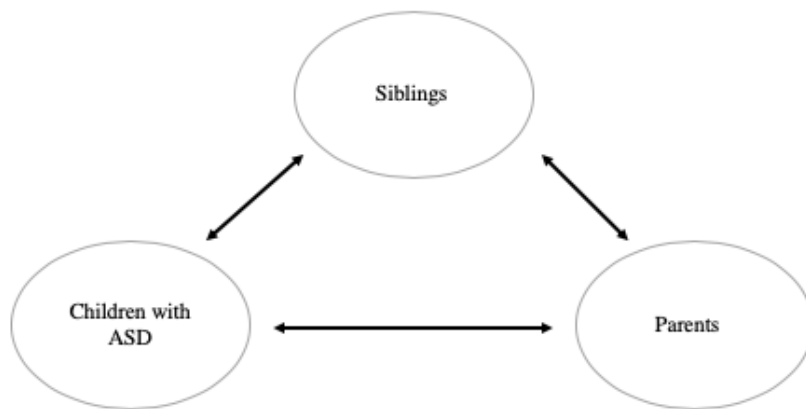
responsibilities of families can be influenced by autism severity levels with increases in the amount of time required for basic caregiving duties (e.g., toileting, preparing meals, hygiene routines) (Cridland et al., 2016). Family Quality of Life (FQOL) is a popular measure to indicate the impact of physical or mental illness or disability on the family system as a whole (Brown & Schippers, 2016). Previous research has indicated that families of children with ASD have higher negative impact scores when compared to families of children with ADD/ADHD or NT children (Lee et al. 2008; Mugno et al. 2007). However, not all family members experience similar effects of having a child with ASD in the family (Hastings et al., 2005). Including parents and other family members in intervention and goal setting may benefit the whole family system (Dunlap, 1999; Schertz & Odom, 2007) and these improvements can have collateral effects on the marital relationship, parent-child relationship, and sibling relationships (Karst & Van Hecke, 2012). It appears that the overall family environment or FQOL can have positive or negative effects on sibling relationships; negative family environments can produce higher levels of parental criticism which can then place siblings at risk for poorer sibling relationships (Petalas et al., 2012).

The Family Systems Model (FST) proposes to look at the family as a whole unit and understand family patterns of interactions in order to understand well-being of any individual family member (Turnbull et al., 2006). In this model there are multiple major subsystems in a family including (a) the marital subsystem, (b) the parental subsystem, and (c) the sibling subsystem. Within this framework, relationship and reciprocal interaction patterns on family members would thus influence the psychological adjustment of siblings of children with ASD (Cebula, 2012). It is important to consider

the dyadic relationships in the family unit in order to understand how to impact sibling relationships and well-being. Each family has unique characteristics that influence the well-being of each family member and moving towards a model of family-centered treatment of children with ASD will be beneficial (Meadan et al. 2010; Wright & Benigno, 2019).

Figure 1

Possible Interactions Between Three of the Family Subsystems (Meadan et al., 2010)



Sibling Well-Being

While the research on sibling well-being across the lifespan is much more limited, findings indicate there is substantial variability in sibling outcomes (Orsmond & Seltzer, 2007). Overall, literature reviews and a meta-analysis have found that siblings of children with ASD are at an elevated risk for negative well-being outcomes and siblings have significantly more negative QOL outcomes than comparison groups (Orsmond & Seltzer, 2007; Shivers et al., 2019). Specifically, Shivers and colleagues (2019) found siblings of

children with ASD had increased levels of internalizing behaviors, impaired psychological functioning, social functioning, and poorer sibling relationships. Higher rates of depression and poor adjustment have also been associated with siblings of children with ASD (Gold, 1993). While NT siblings have reported living with a child with a disability (e.g., intellectual disability or Down syndrome) can be stressful, there may be something unique to living with a child with ASD that contributes to poorer psychosocial outcomes compared to other groups (Tomeny et al., 2017). NT siblings have described unique challenges including embarrassment, dealing with negative reactions in public (Roeyers & Mckye, 1995), advocating for their brother or sister with teachers or peers, protecting their sibling from bullies, and being responsible for a greater amount of general household duties compared to their brother or sister with ASD (Cridland et al., 2016). In addition, early experiences in their family may negatively impact later sibling relationships. When compared to adult NT siblings of Down syndrome, adult NT siblings of individuals with ASD reported lower levels of nurturance, intimacy, and prosocial behaviors toward their sibling (Tomeny et al., 2017). Furthermore, adult siblings of ASD reported an increased level of internalizing problems compared to the Down syndrome group.

Similar to NT sibling well-being, sibling relationships of children with ASD are at risk of poorer outcomes (Karst & Van Hecke, 2012; Orsmond & Seltzer, 2007; Shivers et al., 2019). Specifically, in a meta-analysis by Shivers and colleagues (2019), they found ASD siblings are significantly more likely to have poorer relationships with their brother or sister than children with a NT sibling. Since sibling relationships during childhood are characterized by complementary and reciprocal interactions (Bontinck et al. 2018), social

and communications deficits in children with ASD can damage the sibling relationship. A lack of closeness or a pattern of strained interactions in the sibling relationship during childhood are likely to continue on during adolescence and adulthood (Tomeny et al. 2017).

However, NT siblings have also reported positive outcomes and traits of being a sibling of a child with ASD (Ferraioli et al., 2012). Shivers and colleagues (2019) found no significant differences in ASD siblings and the control group in adjustment, attention/hyperactivity, externalizing behaviors, coping skills, or family functioning. Furthermore, siblings of individuals with ASD have reported positive effects on personality including compassion, empathy, and problem solving skills (Macks & Reeve, 2007). A small sample of adult siblings of individuals of ASD reported more positive attitudes to providing support and aid to their brother or sister, having higher levels of general satisfaction, and lower levels of stress (Tomeny et al. 2017). Sibling relationships between a NT sibling and their brother or sister can also be positive (Orsmond & Seltzer, 2007). Increased positive interactions between siblings during childhood can facilitate more social behavior for the child with ASD and encourage a positive sibling relationship (Bontinck et al. 2018). Braconnier and colleagues (2018) found that NT siblings of children with ASD reported more positive characteristics than negative characteristics within the sibling relationship. Having a brother or sister with ASD affects siblings differently across different families and within the same family (Shivers et al. 2019).

While the research indicates more negative outcomes for siblings with ASD as a group, there is likely potential differences within the group based on moderating factors including autism symptomatology (Ross & Cuskelly, 2006), demographic factors

(Braconnier et al., 2018), Applied Behavior Analysis (ABA) treatment for child with ASD (Cebula, 2012), social support (Cebula, 2012; Hastings, 2003), parental relations (Jensen & Orsmond, 2019), and sibling relationships (Petalas et al. 2012). Since the literature is limited in size, there is also a possibility for biased samples in that the NT siblings who have voluntarily participated in studies may be more likely to report negative experiences.

NT sibling adjustment was associated with the level of autism symptomatology (Petalas et al. 2012). Higher levels of problem behaviors in the child with ASD were related to poorer adjustment and negative sibling relationships. Ross and Cuskelly (2006) found that aggression was reported as the most common stressor in sibling interactions. Out of 25 families of children with ASD, 84% percent of siblings and mothers reported it as a major concern. Adaptive functioning levels for the child with ASD can also affect the sibling relationship (McHale et al., 2016). Demographic factors such as birth order or gender may also impact NT sibling outcomes and sibling relationships. Birth order is associated with the frequency of negative conflicts between siblings (Braconnier et al. 2018). Sibling relationships were rated with more positive characteristics when the NT sibling is older than the child with ASD (Braconnier et al. 2018; Petalas et al. 2012). Males and females had no significant differences in reporting relationship characteristics or levels of providing emotional and physical support to their brother or sister with ASD (Jensen & Orsmond, 2019).

ASD treatment quality and dosage may also affect sibling relationships. Cebula (2012) compared 132 families of children with ASD receiving ABA services and a group not receiving any behavioral services on NT sibling adjustment and relationships.

Siblings in the ABA group reported significant decreases in the frequency of negative interactions with their brother or sister with ASD. Furthermore, parents in the ABA group reported significant increases in the frequency of positive interactions between siblings and also increases in the number of visitors to their home. However, there were no significant differences between the two groups in behavioral adjustment, self-concept, or the quality of the relationship with their brother or sister with ASD. Thus, while ABA services for the child with ASD may reduce challenging behaviors leading to more frequent positive interactions, ABA treatment alone does not increase the quality of the sibling relationship or well-being.

Social support has been found to moderate the role of stressful life events and behavioral and emotional outcomes (Pryor-Brown & Cowen, 1989). Social support includes perceived global support from parents, teachers, classmates, and close friends (Jackson & Warren, 2000). High levels of perceived social support for NT siblings has been related to numerous positive outcomes (Rivers & Stoneman, 2003; Hastings, 2003). Specifically, NT siblings that had higher levels of social support also had higher levels of self-concept (Cebula, 2012). Formal social support also moderates the impact of autism severity levels on sibling adjustment (Hastings, 2003) and adaptive coping skills (Tsao et al., 2012). Greater perceived social support frequency and social support importance were found to be negatively associated with NT sibling emotional and behavioral difficulties (Tomeny et al. 2019). Support groups for NT siblings of children with ASD and parental support groups of children with ASD have both had positive effects for siblings and mothers (Hastings, 2003).

Family relationships can also moderate sibling adjustment and well-being (Petalas et al. 2012). Petalas and colleagues (2012) found sibling relationships were rated more negative when critical expressed emotions (i.e., use of highly critical feedback) were found in the family environment. Additionally, parent support has been found to foster more positive relationships between siblings during adulthood (Orsmond & Fulford, 2018). Parent support and positive relationships with their children may play a part in encouraging sibling connections throughout the lifespan (Jensen & Orsmond, 2019). The quality of the sibling relationship can also impact NT sibling's well-being and adjustment. Increased positivity and affection in sibling relationships is related to more favorable sibling adjustment outcomes (Petalas et al. 2012). Tomeny and colleagues (2017) found that improvements in the sibling relationship led to reductions in NT sibling depression and stress. Improvements in the sibling relationship between the child with ASD and NT sibling not only are important for the well-being of both siblings, but also impacts the family as a whole (Braconnier et al., 2018). Braconnier et al. (2018) found that parents perceived sibling relationships worse than the NT sibling reported and parents attributed heightened stress levels to strained sibling relationships. Addressing sibling relationships for children with autism is important for the family's well-being as a whole. Overall, NT siblings of children with ASD may need more support than other groups of siblings in the areas of social functioning, emotional functioning, and the sibling relationship (Shivers et al., 2019).

Interventions Addressing Social Communication and Play

Difficulties in play flexibility, spontaneity of language and play skills, and functional use of objects in children with ASD have led to a large amount of social and

play intervention research to increase social communication and play skills (Lang et al. 2009; Fuller & Kaiser, 2019; Kamps et al., 2017; Stahmer et al., 2003). The most common interventions to address social communication and play are behavioral interventions and developmental, social, and pragmatic interventions (Ingersoll, 2010). Naturalistic behavioral approaches include teaching the skills in the natural environment, following the child's lead, modeling the desired behaviors, prompting to produce the desired behaviors, and contingent reinforcement (Ingersoll, 2010). A number of behavioral interventions including incidental teaching, mand model, video modeling, milieu teaching, and pivotal response training (PRT) fall under the umbrella of naturalistic behavioral approaches. (Ingersoll, 2010; Lang et al. 2009). Developmental, social, and pragmatic (DSP) interventions have similar features to naturalistic approaches, however, DSP approaches do not include prompting hierarchies and emphasize facilitative adult strategies (Ingersoll, 2010). The most popular DSP interventions include DIR/Floortime, Denver Model, Hanen model, and SCERTS (Ingersoll, 2010). While both of these approaches contain similar strategies, they differ in their philosophies, research base, and traditions. Behavioral approaches often use single-case methodology (Kazdin, 2011), while DSP interventions commonly use non-experimental research methods (Mercer, 2017; Wieder & Greenspan, 2003). The research surrounding developmental interventions to facilitate play and encourage social communication is less developed and has a weaker evidence base compared to behavioral approaches (Ingersoll, 2010; Odom et al., 2010; Simpson, 2005).

Recently, these two approaches have been combined and coined as Naturalistic Developmental Behavioral Interventions (NDBI) (Schreibman et al. 2015). NDBIS are

described as interventions “implemented in natural settings, involve shared control between child and therapist, utilize natural contingencies, and use a variety of behavioral strategies to teach developmentally appropriate and prerequisite skills”. NDBIs are increasing in prevalence and popularity to teach social-communication and play skills to young children with ASD (Smith & Iadarola, 2015). This may be a promising approach to increase functional and symbolic play. Lang and colleagues (2009) conducted a literature review on increasing play skills and found that three components including modeling, prompting with contingent reinforcement, and child directed instruction appeared to be related to more successful play outcomes. Furthermore, pretend play can be improved by the systematic use of prompting strategies and teaching with multiple exemplars of behaviors and materials (Barton & Wolery, 2008).

Pivotal Response Treatment (PRT) is a naturalistic behavioral approach that targets specific skills and core pivotal areas (e.g., motivation and initiations) which can result in collateral gains in non-targeted areas (Koegel et al., 1999). Variables related to increasing motivation such as child choice, task variation, interspersal of maintenance tasks, reinforcement of response attempts, and the use of natural and direct reinforcers appear to increase rate and latency of responding, correct responses, response attempts, and positive affect (Koegel et al., 2003). PRT has been used to increase symbolic and complexity of play (Stahmer, 1995), increase functional language utterances (Coolican et al., 2010), and encourage turn taking (Harper et al. 2008). Research suggests PRT may be a promising approach to target social and play domains as this intervention package results in collateral improvements in communication and play skills for the majority of children with ASD (Verschuur et al., 2014).

Other NDBIs primarily use joint attention strategies to increase social communication and play skills. Kasari and colleagues (2008) implemented a joint attention intervention to 58 children with autism. The joint attention intervention consisted of discrete trial training (DTT) to prime the targeted play goals and used naturalistic strategies during play times including following the child's lead, imitating the child's actions, and expanding on language or play. The children who received the packaged joint attention intervention maintained greater language growth over the following year compared to the control group. Joint Attention Symbolic Play Engagement and Regulation (JASPER) is another packaged intervention for young children with ASD that has been shown to increase engagement outcomes and improve play (Goods et al., 2013). Previous research has also indicated JASPER is a promising approach to increase joint engagement skills in minimally verbal children with ASD (Shire et al. 2015). JASPER and environmental milieu teaching were packed together to increase joint engagement communication bids with strategies including mirroring and mapping, expanding language and play routines, noticing and responding, and prompting for communication. After intervention, there were improvements in the duration spent jointly engaged with the caregiver. NDBIs have been effective in improving social communication and play across various settings including homes (Shire et al. 2015), clinics (Koegel et al., 1997), community settings (Koegel et al., 2019), and in schools (Dykstra et al. 2012).

Peer and Sibling-Mediated Interventions

Peer-mediated strategies have been a successful model to increase social skills for children with ASD (Weiss & Harris, 2001). Peer-mediated approaches include teaching a

NT peer to initiate, reinforce, and maintain social and play interactions with the child with ASD. Lord and Hopkins (1986) provided evidence that same-aged peers can successfully implement interventions to children with autism. After the play intervention, all students with ASD and their NT peers showed increases in proximity and responsiveness to play their partner. The study also reported generalization gains for the children with ASD in social and play skills to unfamiliar trained peers. Furthermore, Pierce and Schreibman (1997) trained eight NT peers to use PRT techniques using didactic instruction, modeling, and role-playing with feedback to include two children with ASD during toy-play periods. Results indicated that each child made rapid increases in maintaining social interaction across all trained peers and different types of toys. Overall, peer-mediated interventions can be a flexible and effective intervention approach for children with ASD to target social, communication, or academic domains (Chan et al., 2009).

Far less research has been devoted to training siblings as intervention providers (Banda, 2015). Sibling relationships are very important and can be ideally one of the longest lasting friendships (Cicerelli, 1994). Siblings spend a significant amount of time with each other across a variety of settings and can serve as successful role-models. NT siblings have been involved in ASD intervention in the following ways: siblings as instructors, siblings as models, or as co-recipients of the intervention (Shivers & Plavnick, 2015).

Siblings as Instructors

Siblings have been successful intervention agents in language and social communication interventions and in play interventions (Banda, 2015). Spector and

Charlop (2018) trained three NT siblings in Natural Language Paradigm (NLP) to increase spontaneous verbalizations. NT siblings were taught to use environmental arrangement, provide choices, model and expand on language, and provide contingent reinforcement to their brother or sister with ASD. All siblings were able to successfully use the strategies during play and increased their verbalizations to their brother or sister with ASD. Furthermore, most of the children with ASD also increased in verbalizations and joint attention responses. Child affect levels for both children were higher during intervention, however, reciprocal play did not increase. Thus, increasing language does not increase play suggesting that play skills may need to specifically be taught in addition to language intervention. NT siblings have also been trained to increase joint attention during play using a combination of PRT and DTT (Ferraioli & Harris, 2011). Four siblings were trained to use prompting procedures and provide reinforcement to their brother or sister with ASD. After a brief interactive instruction and modeling and role plays with feedback before each play session, siblings appropriately used prompting procedures and fading to increase joint attention. Rates of imitation and behavioral requests both increased in frequency in the child with ASD.

Sibling-mediated interventions are also effective in increasing social skills and positive play with young children with ASD (Oppenheimer-Leaf et al., 2012). This study investigated the effects of sibling one-on-one social skills instruction for three children with ASD. Specifically, siblings were taught via role-playing to use appropriate invitations to play, provide simple instructions, and use requests to share. Results demonstrated that siblings met fidelity of implementation measures and all three children with ASD increased their social behaviors. Furthermore, NT siblings more frequently

invited their sibling with ASD to play, requested to share, and gave simple instructions outside intervention sessions. Young children can also be effective intervention agents if adequate supports are in place (Neff et al., 2017). Three NT siblings aged 4-6 years old were trained via video modeling to use least to most prompting and positive reinforcement directed towards their brother or sister with ASD. Some of the NT siblings needed additional prompting during the sessions and reinforcement systems in place to correctly use all the strategies with their brother or sister. All siblings increased the level of cooperative play during intervention. Commonly, siblings were taught to invite their brother or sister with ASD to play (Kyzak & Jones, 2017), narrate their actions and talk about play (Ferraioli & Harris, 2011), and provide reinforcement (Colletti & Harris, 1977).

Siblings as Models

Siblings have also been used as models to increase the desired behaviors in their brother or sister with ASD. Reagon and colleagues (2006) used a NT sibling as a model during video modeling training to their brother or sister with ASD. After video modeling intervention, the child with ASD increased the frequency of scripted conversation and spontaneous speech. Similarly, Taylor and colleagues (1999) used NT siblings to model play related statements to use for video modeling. After the children with ASD watched the videos, play statements increased during play times with their sibling. Using NT siblings during video modeling may be a successful and a feasible strategy to increase language for children with ASD.

Siblings as Co-Recipients

Another method of including NT siblings is having both children receive intervention together. For example, Baker (2000) prompted each child with ASD and sibling partner to play in the intervention game. The game consisted of using the child with ASD ritualistic interests in a Bingo game format. The interventionist taught both children how to play the game and how to play fair. All siblings dyads increased their engagement in play, joint attention, and were rated with higher affect scores during intervention. NT siblings were also incorporated as generalization agents in a 8 weeks social skills training (SST) program (Castorina & Negri, 2011). They were expected to participate in the SST program and complete homework assignments just like their brother or sister with ASD and were not given any other specific directions. However, the inclusion of NT siblings in the social skills group had little effect on generalization and maintenance. Simply including siblings in social skills groups may not be enough to generalize the skills of the children with ASD; stimulus transfer of skills may need to be systematically programmed. While there is research indicating that siblings may be optimal individuals to act as behavior change agents in the natural home setting (Banda, 2015), there is a gap in the literature about the possible benefits for the siblings implementing or being involved in intervention and limited findings on the positive effects on sibling relationships.

Sibling Support Groups

Along with intervention taking a more family centered approach, siblings of children with ASD may also benefit from meeting others with a similar family background and experiences. Experiencing social support has been found to moderate the

role of stressful life events and behavioral and emotional outcomes (Pryor-Brown & Cowen, 1989; Hastings, 2003). While most research has been focused on the particular impact on parents and parent support groups, some studies have focused on sibling support groups (Lobato, 1985; Smith & Perry, 2005, Summers et al., 1991). Similar to parent support groups, sibling support groups might be a successful method for siblings to connect with others and discuss their feelings (Banach et al., 2010). Smith and Perry (2005) created the TRE-ADD program for siblings of children with autism where siblings met for eight consecutive weeks to increase knowledge of autism, discuss feelings in an accepting space, share ways of coping through difficult situations, role play different strategies, enhance siblings' self-concepts, and encourage siblings to have fun. Results indicated siblings reported an increased knowledge and understanding of ASD and more positive feelings about themselves.

Other sibling support groups have combined recreational activities and discussion based activities to encourage children to discuss feelings and enhance self-concepts (Christopher & Shakila, 2013). Twenty-five siblings of children with ASD ages 7-16 participated in the support group. The goals of the support group included increasing knowledge about ASD, creating a safe place for siblings to discuss emotions, helping siblings cope, and enhancing their self-concepts. At the end of the support group, results indicated that siblings increased knowledge and self-concept. Kryzak and colleagues (2015) provided an extensive community intervention package that included a sibling support group, a skills intervention for the child with ASD, and recreation time. The seven week support group included NT siblings ages 4-14. Themes of the support group included sharing information, how siblings make them feel, sharing good and bad

feelings, coping strategies, and autism knowledge. The effects of the community program were mostly positive; NT siblings reported significant decreases in depression and anxiety and rated improvements in their peer network. Results demonstrated that autism knowledge did not significantly increase and there were no significant increases in reciprocal interactions between siblings. When specifically looking at the effect of sibling relationships using the SRQ (Sibling Relationship Questionnaire), findings were mixed; some studies reported higher positive siblings relationships after the conclusion of the sibling support group, while other studies found no significant differences in relationships (Tudor & Lerner, 2015). Sibling support groups may provide siblings a way to connect and share experiences with others, however, these groups have not taught specific play and communication strategies for siblings to use with their brothers or sisters with ASD.

Intervention Considerations for Sibling Involvement

Play is a pivotal part of relationship building for young children (Vygotsky, 1993) and the development of play skills for children with autism can improve other areas of development including language development, decreases in socially inappropriate behaviors, and improving interactions with NT peers (Sautter et al., 2007). Knott and colleagues (1995) found that NT siblings spend about 40 minutes out of every hour together when observed in home settings. However, siblings of children with ASD spend significantly less time together compared to NT siblings and siblings of children with Down syndrome (Orsmond & Setzler, 2007). Siblings of individuals with ASD when compared to siblings of individuals with Down's syndrome reported less intimacy and less nurturance during social interactions and play with their brother or sister (Kaminsky & Dewey, 2001). Furthermore, Baker (2000) interviewed neurotypical (NT) siblings and

found that these siblings reported not liking playing with their brother or sister with autism before intervention. Often, NT siblings lack motivation to play and initiate to their brother or sister with autism due to a long learning history of unsuccessful interactions (Ferraioli et al., 2012). Cycles of coercion may affect the sibling relationship in which the brother or sister with ASD may scream or aggress towards the NT sibling and in turn the sibling inadvertently reinforces the child with ASD challenging behaviors by withdrawing or giving up access to a toy (Patterson, 2002; Smith et al., 2014). This pattern may either escalate with more anger and hostility or the NT sibling may engage in a pattern of avoidant behavior (McHale et al., 2016). However, if NT siblings learn specific play skills, it may lead to increases in the number of opportunities that the child with ASD can practice social skills and thus increase the amount of positive time spent together (Oppenheimer-Leaf et al., 2012). Increasing successful and appropriate play for siblings and children with ASD has been an important area that clinicians and researchers are beginning to target that may also combat the development of coercive cycles of interactions and worsened relationship quality (Lucyshyn et al., 2004).

Play Materials

Finding activities and toys that both siblings enjoy during play interventions can provide opportunities for both siblings to practice prosocial behaviors and build a more positive relationship (Wright & Benigno, 2019). It may be important to move towards a more family-centered approach of treatment by creating interventions based on shared activities and interests of family members. Types of toys and preferred items should also be planned for during structured play times. Sautter and colleagues (2007) investigated toy preference (i.e., highly preferred, low-moderately preferred) and type of toy (i.e.,

sensory stimulating, developmentally oriented toys) during free play observations with children with ASD and their brother or sister. Results indicated that highly preferred sensory stimulating toys were more associated with problem behavior and isolated play. Moderately preferred and developmentally appropriate toys for children with ASD may increase rates of initiations and quality of appropriate cooperative play. There is also evidence that incorporating thematic ritualistic behaviors of children with ASD into game play can facilitate social play between siblings (Baker, 2000). Restricted or perseverative interests may be reinforcing agents for children with ASD (Vismara & Lyons, 2007) and promote positive change and play if incorporated thoughtfully. Preference assessments and reinforcer inventories can be utilized to discover shared interests and activities that both children could enjoy together.

Training NT Siblings

Behavior Skills Training (BST) is one of the most extensively used training methods for behavioral interventions (Dart et al., 2017) and has been effective in training teachers, caregivers, and support staff (Ward-Horner & Sturmey, 2010). BST includes (a) describing the skill, (b) providing a written description, (c) modeling, (d) rehearsal (e) feedback, and (f) repeating the rehearsal and feedback until the trainee has reached mastery (Parsons et al., 2012). Another common training approach is video modeling which includes (a) recording the target behaviors, (b) playing back the video models, (c) providing differential reinforcement and feedback for appropriate and inappropriate responses, and (d) fading the video model (Cardon et al., 2015). Video modeling is more cost and time effective than live modeling and has had positive results including peers, siblings, and adults as video models (Charlop-Christy et al., 2000). Both of these methods

of training have been promising in increasing siblings' use of intervention strategies with their brother or sister with ASD (Kryzak & Jones, 2017; Spector & Charlop, 2018). Furthermore, intervention in the home settings could benefit from incorporating parent training on how to provide feedback and track data of successful play to increase maintenance (Tsao & McCabe, 2010).

Behavior Skills Training. BST has been found to be effective in training NT siblings to use modified ABA strategies to increase positive play with their sibling. Kryzak and Jones (2017) taught four typically developing siblings to self-manage their usage of a social skills curriculum using BST. The combination of BST and self-management was effective in increasing the correct use of staying, playing, and talking during the play session. A reward system was in place during intervention to reinforce self-management recording and meeting sessions goals. If self-management responses or fidelity of implementation fell below mastery levels, a training session would take place. Half of the siblings needed retraining sessions during the intervention due to a drop in fidelity of implementation. Interestingly, both of the siblings that needed a booster training were younger siblings and around the age of 6.

Similar to BST, Oppenheim-Leaf and colleagues (2012) used the teaching interaction procedure to train young NT siblings (i.e., 4-6 years old) to use the targeted play skills. The teaching interaction procedure consisted of didactic teaching, modeling, role plays with feedback, and priming before play sessions. All three siblings learned the targeted skills during role plays with a clinician and generalized the skills during play with their brothers with ASD. A motivational system was also put in place where NT siblings could earn stickers to exchange for a small prize for using the play strategies.

Younger children may need priming sessions and reward systems in place to successfully learn and use behavioral strategies with their brothers or sisters with ASD. In addition to teaching the skills, reviewing and practicing the strategies with the NT sibling alone before a play probe may also be helpful (Ferraioli & Harris, 2011). Before starting the play sessions with the child with ASD, the sibling was required to provide the correct responses of DTT + PRT intervention during a role play with the experimenter. In addition, prompts were delivered during the session and feedback was delivered after the play session. The NT siblings in this study implemented most intervention components with high fidelity, however, all of the siblings had difficulty remembering all the components without prompts. Thus, it may be important to limit the number of strategies and rather focus on the critical components of an intervention.

Video Modeling. Video modeling has also been extensively used for social skills training (Wang et al., 2011). Spector and Charlop (2018) taught NT siblings nine steps of Natural Language Paradigm by pausing the training video after each step to check for understanding. During the check for understanding, the therapist would role play the procedures that were in the video with the NT sibling. All siblings maintained high levels of fidelity of implementation throughout the intervention sessions. Video modeling can also be used to train NT siblings in prompting procedures (Neff et al., 2017). Videos contained multiple exemplars of the researcher modeling physical, gestural, modeling, and verbal prompting. The videos also included scenarios where the child with ASD would walk away from the activity and the researcher would have to use modeling to bring the child back. Some of the children were successfully able to transfer the skills to play sessions, while one child needed extra teaching and a reward system to meet high

levels of fidelity of implementation. Overall, it appears that modeling, role playing, and providing feedback are important elements of training children to use behavioral strategies with their brother or sister with ASD.

Sibling Benefits

While the literature has demonstrated that sibling-mediated interventions have produced positive outcomes for the child with ASD, most studies have limited reported outcomes for the NT sibling (Shivers & Plavnick, 2015). Shivers & Plavnick (2015) conducted a literature review on the available studies on sibling involvement in intervention for individuals with ASD. Of the seventeen studies included in the review, ten of the studies measured sibling outcomes; however, only two of these articles reported indicators of sibling relationship measures. One study reported increased positive affect with their brother or sister with ASD during play observations (Baker, 2000). The second study reported sibling confidence, the pleasure in interacting with their brother or sister with ASD, and their overall frustration towards their sibling per parent report (Celiberti & Harris, 1993). Overall, findings indicated siblings could learn intervention procedures and implement the strategies to meet fidelity. Likewise, the children with ASD exhibited prominent gains in skill acquisition in social, academic, and functional domains. Although there is literature indicating that siblings can provide effective intervention for their brother or sister with ASD (Banda, 2015), there is a gap in the literature about the possible benefits for the siblings implementing the intervention and limited findings on the positive effects on sibling relationships.

Sibling Support Groups

Support groups for siblings of children with ASD are often valued because of the opportunities to share experiences with others in a similar situation (Smith & Perry, 2004). Siblings have found support groups beneficial when they are based on fun activities rather than discussion based activities (Carter et al., 2016; Petalas et al., 2009). Lock and Finstein (2009) found that sibling enthusiasm increased when relationship building activities were through entertaining child centered games. Support groups may be valued the most when they include both a safe space to share experiences and also fun group activities.

Qualitative and survey research highlights common themes that would be beneficial to include in sibling support groups (Christopher & Shakila, 2013; Lock & Finstein, 2009; Petalas et al., 2009). Petalas and colleagues (2012) found that NT siblings commented on their frustration regarding peer reactions, having difficulty explaining their siblings to peers, and avoidance of talking about autism with peers. Furthermore, a majority of NT siblings have reported being bullied or teased at school because of their brother or sister's disability and perceived that their popularity dwindled because of it (Christopher & Shakila, 2013). Thus, support groups should address feelings of frustration and embarrassment and have siblings practice these types of conversations with each other.

Intervention Delivery Modality

While the majority of sibling mediated interventions have been delivered in person (Banda, 2015), the COVID-19 pandemic has largely transitioned in-person ABA service delivery to a remote service delivery model (Cox et al., 2020). The first reported

death related to the coronavirus in the United States was on February 29, 2020 and by the end of March the US led the world in confirmed cases (Taylor, 2020). On March 23, 2020 the state of Oregon released an executive order mandating Oregonians stay at home, closing specified retail stores, and placing social distancing measures in public and private institutions (FINRA,2021). Thus, following government ordered stay at home mandates and social distancing policies, a telehealth delivery model is the safest option to deliver the intervention package to NT siblings. Currently, there is not any available research on peer or sibling-mediated interventions for young children with ASD via telehealth. However, there is a large body of research on parent-mediated interventions via telehealth for young children with ASD indicating positive child outcomes (Ferguson et al., 2019; Sutherland et al., 2018). Specifically, parents have been successfully trained in play based and naturalistic interventions for younger children with ASD (McGarry et al., 2019; Wainer & Ingersoll, 2015). Wainer and Ingersoll (2015) combined self-directed internet-based instruction and remote coaching to train parents of children with ASD in a naturalistic imitation intervention. Most parents were able to demonstrate high levels of fidelity after just internet based instruction. Coaching either maintained high levels of parent fidelity or increased fidelity of implementation. As levels of parent fidelity increased, children also demonstrated concurrent increases in spontaneous acts of imitation. BST has also been used via telehealth to train parents and teachers in conducting preference assessments (Higgins et al., 2017; Machalicek et al., 2009), functional communication training (Machalicek et al., 2016), and DTT (Sump et al., 2018). Telehealth can be a preferred service delivery mode for increasing accessibility of interventions, overcoming geographic barriers, and reducing travel times for both

families and interventionists (Simacek et al., 2020). Synchronous telehealth intervention allows for immediate instructions, modeling, and feedback which is advantageous for training siblings. Video models, visuals of intervention strategies, priming, and immediate feedback should be used to provide more intensive support and training to NT siblings providing intervention.

Pilot Study

The purpose of the pilot study was to assess whether *STEPS for Strengthening the Sibling Bond of Children with Autism* would increase sibling reciprocal play and the use of appropriate play strategies (Glugatch & Machalicek, 2021). STEPS is a novel intervention package including training siblings on play strategies in combination with a sibling support group to increase positive sibling play and perceived relationship quality. A concurrent multiple-baseline design across six dyads was used to assess NT sibling play behavior and fidelity of implementation of the naturalistic play strategies. After behavior skills training, all NT siblings increased the amount of strategies they used, increased the frequency of initiations towards their brother or sister with ASD, and the percentage of reciprocal play between siblings increased. Generalization probes and follow-up probes were above baseline levels, indicating that the skills learned generalized across other toys and maintained over time. NT siblings participated in three out of eight weeks of the sibling support group due to the COVID-19 pandemic. While the effectiveness of the sibling support group cannot be determined, social validity questionnaires suggest siblings and parents valued and liked the support group.

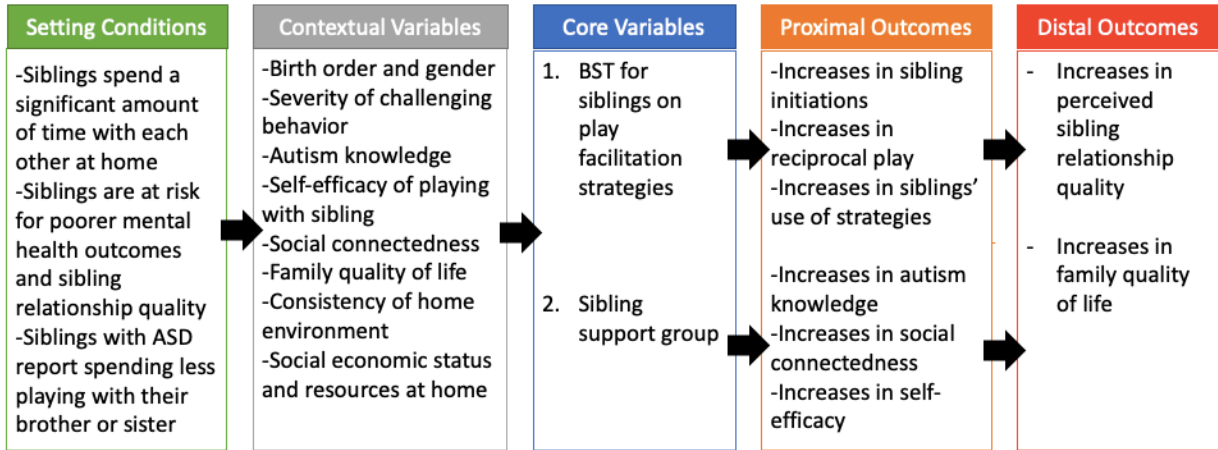
Study Purpose and Research Questions

This study aimed to determine if there was a functional relation between sibling BST for play and increases in (a) sibling fidelity of intervention implementation , (b) percentage of time spent in reciprocal play, and (c) frequency of NT sibling initiations. Furthermore, this study aimed to determine the preliminary feasibility and likability of the sibling support group.

The logic model for this study is illustrated in Figure 2. It begins with the setting conditions of the study including the rationale for sibling training and providing a support group. The contextual variables describe individual characteristics that may vary with each sibling dyad and influence the effectiveness of the intervention on their acquisition and implementation of targeted play strategies. The core variables describe the intervention components for which impact the targeted dependent variables. The theory of change incorporates BST and a social support group of siblings with ASD to increase positive sibling play and improve the quality of the sibling relationship. These two interventions are hypothesized to contribute to proximal and distal outcomes. The proximal outcomes in the logic model were measured by using behavioral coding and standardized assessment scales. Changes in autism knowledge, increases in positive play, and use of targeted play skills were anticipated to improve the relationship quality of family quality of life.

Figure 2

Logic Model for Sibling Training and Sibling Support Group



The current study addressed the following research questions:

Experimental Research Questions

1. Is there a functional relation between BST for play and increases in the use of play strategies by the NT sibling?
2. Is there a functional relation between BST for play and increases in percentage of time spent in reciprocal play?
3. Is there a functional relation between BST for play and increases in frequency of NT sibling initiations?

Non-Experimental Research Questions

4. Do the NT siblings and parents perceive the intervention as feasible, acceptable, and effective?

CHAPTER II

METHODS

A description of the methodology used in this study is provided in this chapter. First, inclusion criteria, recruitment procedures, and response to attrition are discussed. Next, participants, settings, materials, and researcher information is described. The procedures for each experimental phase are discussed in detail including data collection procedures, assessment instruments, and implementation fidelity and interobserver agreement. Finally, results and a description of the data analysis (i.e., visual analysis, descriptive statistics, and effect size estimates) used for each research question is discussed.

Inclusion Criteria, Recruitment Procedures, Attrition

Inclusion Criteria

Up to ten sibling dyads could participate in this study as well as one caregiver for each dyad. Each sibling dyad included a NT sibling and the child's brother or sister with ASD. Inclusion criteria for siblings included falling in the age range of 7-13, displaying strong conversational speech, exhibiting play skills, and vocalizing their desire to increase their interactions with their sibling with ASD. Inclusion criteria for the child with ASD included falling in the age range of 3-10, having a medical diagnosis of ASD by an outside agency or an educational classification, and exhibiting symptoms of autism including delays in communication, restricted interests, and difficulty socializing. Sibling dyads were selected due to parent reports of difficulty during play or unstructured times. Twelve sibling dyads were screened and the first ten dyads and caregiver who met the inclusion criteria were selected for this study.

Recruitment Procedures

Multiple recruitment methods were used including recruiting through the HEDCO Clinic, printed flyers, paid advertisement of the study on social media, and a recruitment website. Previous clients from the HEDCO Autism Assessment Clinic were contacted via email. Flyers were sent via email around the University of Oregon Campus and around the community (e.g., public schools, doctor offices, local disability organizations, education service districts). A website for the study was listed on flyers and published on social media including Facebook and Twitter. Recruitment materials can be found in Appendix A: Recruitment Flyer and Website Link.

Families interested in the study contacted the primary investigator (PI) via email, website contact form, or phone. After initial contact from a family, the PI emailed or called the family and read the recruitment script. The recruitment process took up to 3 months to recruit 10 participants. If the family was interested in participating, a consent meeting via videoconferencing was scheduled.

Attrition

One family dropped out of the study after the consent and intake meeting, but before baseline due to schedule constraints where both children were available to play. Another sibling dyad dropped out of the study during the completion of the baseline phase. Since this sibling dyad had an increasing trend during baseline and the NT sibling met treatment goals during baseline, the parents decided to drop out instead of staying in baseline for the remainder of the study.

Participants and Settings

Participants

Nine dyads participated in this study. Inclusion criteria for siblings are described above. Siblings included biological siblings, step-siblings, foster siblings, or half-siblings. Only one NT sibling could participate in the study, so if families had more than one NT sibling, parents were asked to nominate the sibling they wished to participate. All participants are referred to using pseudonyms. See Table 1 for participant demographics.

Table 1

Sibling dyad characteristics

	NT Sibling				ASD Sibling				
	Age	Gender	Race		Age	Gender	Race	CARS	Vineland
Angela	9	Female	White	Nate	8	Male	White	47	35
Amy	7	Female	Multi-ethnic	Sheldon	8.5	Male	Multi-ethnic	39.5	74
Sally	11	Female	Multi-ethnic	Buster	5	Male	Multi-ethnic	23.5	90
Steve	9	Male	White	Emily	4.5	Female	White	28.5	88
Apu	10	Male	Asian	Milhouse	3	Male	Asian	30	76
Doug	7.5	Male	white	Charles	6	Male	White	26.5	73
Ron	8	Male	White	Wyatt	4.5	Male	White	43	64
Karla	10	Female	White	Perry	5.5	Male	White	24	85
Oscar	7.5	Male	Asian, Multi-ethnic	Stanley	8.5	Male	Asian, Multi-ethnic	42.5	61

Participant Characteristics

Angela and Nate. Angela had strong conversational skills and continuously modeled play acts for her brother to engage in (e.g., roll the ball, stack blocks). Nate received an ASD diagnosis at the age of 3 and received intensive ABA treatment. Nate did not have any vocal verbal language and engaged in a high frequency of RRBIs including hand flapping, vocal stereotypy, and running. He also frequently threw play

materials (e.g., ball, pieces from board games) at his sister or his mother. He scored a 35 on the Vineland and a 47 on the CARS indicating very low adaptive behaviors and ASD symptoms in the severe range. Similarly, Nate's play level during the SPACE assessment was a simple play level (i.e., dropping balls in a tube, putting 3 piece puzzle pieces in). Angela and Nate lived in a two parent household in the Midwest with an income above \$60,000. English was the primary spoken language at the home. The parents' highest reported education level was a high school degree.

Amy and Sheldon. Amy had strong conversational and play skills and could engage in high level play (e.g., sociodramatic play and board games). Amy struggled with staying calm during play times with her brother and would often engage in tantrums (e.g., screaming, whining, crying, knocking down toys, or leaving the play area). Sheldon received an educational placement of ASD at the age of 4 and medical diagnosis at 7. He scored 74 on the Vineland and 39.5 on the CARS indicating borderline adaptive skills and severe ASD symptomology. During the SPACE assessment, Sheldon demonstrated symbolic play (e.g., playing house with Roblox characters). Sheldon had strong conversational skills and could engage in a conversation about a preferred topic. He would also frequently engage in aggression (e.g., hitting, hair pulling, pushing) towards his sister when presented with an undesired outcome. Sheldon had very rigid behaviors including how toys should be used and would perseverate when technology was not working or glitching. At the time of the study, Sheldon did not receive any services outside of school. Amy and Sheldon live in a two parent household in the Pacific Northwest with an income between \$30,000- \$39,999. The parents' highest reported education level was an associate's degree.

Sally and Buster. Sally had strong conversational skills and was very hesitant to participate in this study because she reported not enjoying spending time with her brother. Sally frequently directed negative comments towards her younger brother (e.g., “you are not smart enough to understand” and “why are you so annoying”). Buster scored 90 on the Vineland and 23.5 on the CARS indicating average adaptive skills and minimal to no ASD symptomology. Buster also demonstrated symbolic levels of play during the SPACE assessment. He likes math and science and would often tell his sister math or space facts (e.g., $4 \times 4 = 16$). Buster would get frustrated easily during play times and knock down his sister’s towers and call her names (e.g., “meanie face” or “stupid”). He received an ASD diagnosis at the age of 3. Buster did not receive any services outside of school. Sally and Buster lived in a two parent household in the Midwest with an income above \$60,000. The parents’ highest reported education level was a doctorate.

Steve and Emily. Steve had strong conversational skills and reported loving spending time with his sister. Emily had a large vocabulary and could speak with 2-5 word utterances. She would engage in object play and had a difficult time responding to others when she was playing. Emily scored a 88 on the Vineland and 28.5 on the CARS indicating average adaptive skills and minimal symptoms of ASD. Emily’s highest level of observed play during the SPACE assessment was pre-symbolic play (e.g., setting the table for mom with pretend food). She received an ASD diagnosis at 3 years-old and received intensive ABA treatment. Steve and Emily live in a two parent household on the West Coast with an income above \$60,000. The parents’ highest reported level of education was a doctorate.

Apu and Milhouse. Apu had strong conversational skills, modeled simple play acts for his younger brother, and would expand on his brother's language during play. English and Hindi were both spoken in the house. Milhouse spoke in 1-2 word utterances and could model his brother during play. He had a difficult time taking turns or would engage in whining when his repetitive play (e.g., lining up trucks or scripting) was interrupted. Milhouse scored a 76 on the Vineland and a 30 on the CARS indicating borderline adaptive skills and mild to moderate symptoms of ASD. The highest play level observed during the SPACE assessment was a combination level (e.g., putting blocks in a dump truck, stacking cookies). Milhouse received a medical diagnosis at the age of 3 and received some ABA treatment. Apu and Milhouse lived in a two parent household on the West Coast with an income above \$60,000. The parents' highest reported level of education was a Bachelor's degree.

Doug and Charles. Doug had strong conversational skills and often negotiated with his brother. He loved to engage in sociodramatic play with Mario toys and stuffed animals. Charles scored 73 on the Vineland and 26.5 on the CARS indicating borderline adaptive skills and minimal symptoms of ASD. The highest play level observed during the SPACE assessment was combination play (e.g., building with blocks). Charles could engage in conversations about highly preferred topics and loved to play active games such as hide and seek and chase games. Charles had difficulty playing with toys his brother liked and engaging in sociodramatic play without explicit instructions. He received a medical diagnosis of ASD at 3 years-old and has received intensive ABA services in the home setting. Doug and Charles live in a two parent household in the

Rocky Mountains with an income above \$60,000. The parents' highest reported education level was a doctorate.

Ron and Wyatt. Ron could engage in conversations of interest, but was easily distracted and needed prompts from his mother to stay near the computer. Ron loved to play with Minecraft characters and bounce on exercise balls with his younger brother. Wyatt scored 64 on the Vineland and 43 on the CARS indicating very low adaptive scores and severe autism symptomology. During the SPACE assessment, Wyatt engaged in one simple play act; pushing the cars/trucks. Wyatt did not have any vocal verbal words and engaged in frequent RRBI's including bouncing, flapping, and teething on his mother's hair. He often engaged in tantrums and needed to be held by his mother to calm down. Wyatt loved to bounce on an exercise ball, but did not engage with other toys without modeling and prompting. Wyatt received a medical diagnosis at the age of 2 and has received intensive ABA services. Ron and Wyatt live in a two parent household in the Pacific Northwest with an income above \$60,000. The parents' highest reported education level was a Master's degree.

Karla and Perry. Karla had strong conversational skills and frequently asked questions about what she could do differently to help her brother. Karla loved to make arts and crafts and build things. She reported that she rarely played with her brother and they would often fight. English was the primary language in the household, however, Karla and her sister, and parents also spoke Russian. Perry scored 85 on the Vineland and 24 on the CARS indicating average adaptive skills and minimal to no ASD symptomology. The highest level of play observed during the SPACE assessment was symbolic play. Perry could engage in full conversations and negotiate with his sister

about the rules of the game. He loved to play board games and go to the playground with his sisters. Perry received a medical diagnosis of ASD when he was 2.5 years-old. Karla and Perry live in a two parent household with another sister on the West Coast with an income above \$60,000. Parents nominated Karla to be included in this study because she more frequently fought with Peter compared to the younger sister. The highest education level reported was a doctorate.

Oscar and Stanley. Oscar loved to build and construct with blocks, magnet tiles, and tubes from the marble run. Oscar voiced his hesitation to play with his brother because he thought his brother needed to learn how to listen better first. Oscar would frequently get frustrated when his brother did not listen and would throw materials or aggress (e.g., hit with open hand) towards him. English and Mandarin were both spoken at the home. Stanley scored a 61 on the Vineland and 42.5 on the CARS indicating very low adaptive behaviors and severe symptoms of ASD. Stanley could mand (e.g., “I want green” or “car”) but his language was not consistent. Stanley liked to copy what his brother was building and loved to race cars. He would frequently scream when frustrated or when he wanted a turn. Stanley received a medical diagnosis at 2 years-old and received some ABA services. Oscar and Stanley live in a two parent household on the West Coast with an income above \$60,000. The parents’ highest reported education level was a doctorate.

Settings

The intervention was delivered via telehealth (i.e. synchronous, two-way audio visual videoconference). The consent meeting, pre/post sessions and intervention were delivered in the participants’ homes via telehealth. All experimental play sessions

including baseline, Behavior Skills Training, intervention sessions, and generalization probes took place in the participants' homes where indoor play usually occurs (e.g., table, play room, child bedroom) via telehealth. The sibling support sessions also occurred via telehealth. The PI was located in Oregon and families were located across the United States. The mean distance between the researcher and families was 719 miles (range: 5 – 1860 miles).

Researcher Roles

Interventionist. The PI fulfilled the role of lead interventionist and met with each family during the consent, intake, and post intervention sessions to complete assessments. Specifically, the PI roles included: (a) consent meeting with each family, (b) conducting assessments for pre and post intervention sessions, (c) managing schedules, (d) designing intervention plans for each sibling dyad, (e) conducting all behavior skills training sessions, (e) leading the sibling support group, (f) reviewing intervention session videos daily and graphing the data, training research assistants in data collection procedures and play intervention structure and (g) coaching NT siblings to use sibling-mediated play strategies. The PI has a Master's in Special Education with an emphasis in low incidence disabilities and is a board-certified behavior analyst (BCBA). The PI has over 7 years of experience working with children with ASD and their families.

Research assistants. Trained undergraduate and graduate research assistants (n = 3) from the Special Education program assisted with data collection procedures including coding target behavior from videos, coding procedural fidelity and coaching fidelity, and coding for reliability. Research assistants were trained by the PI on methods of behavioral data and fidelity data collection. Videos of play sessions from the pilot study were used

for training. The training sessions took 2 hours and was conducted via Zoom. Training took place before the study started and each research assistant needed to reach a minimum of 90% agreement across three different videos for each behavior coded using practice videos from the pilot study. If agreement fell below 80% agreement for 2 consecutive sessions during the present study, the PI provided a brief retraining. Retraining sessions consisted of reviewing the video with agreement below 80% and clarifying discrepancies. After clarifying discrepancies, the research assistant coded another video from the pilot study and needed to have 90% agreement before resuming to coding other videos.

Materials

Intervention Materials

Play materials were provided for each family and based on the preference of the children determined by the information from the reinforcer inventory and the paired choice video preference assessments (see measurement section for paired choice procedures). All play sets included four toys and have one turn taking game (e.g., Kerplunk™ or Pop the Pig™), one set of pretend play materials (e.g., play food set, castle and dolls), and one set of manipulative toys (e.g., blocks or Magna-Tiles®). The same individualized play sets for each dyad were used during baseline, training, and intervention. Families were allowed to keep the play materials after the study was completed. Play materials were dropped off at houses for families that live in the area or mailed to families if they reside out of the Eugene area. See Table 2 for play materials.

Table 2*Sibling dyad toy sets*

Dyad	ASD play level	Toy set
Angela/Nate	Simple	Jumping Jack© Dentist Play-Doh set® Marble run Ball ramp
Amy/Sheldon	Symbolic	Pop the Pig™ Play food Magna tiles® Farm bristle blocks™
Sally/Buster	Symbolic	Bowling Play food Magna tiles® Rocket balloons
Steve/Emily	Pre-symbolic	Floor is Lava Mario Kart set™ Magna tiles® Rocket balloons
Apu/Milhouse	Combination	Bowling Legos set ® Magna tiles® Marble run
Doug/Charles	Combination	Pop Up Pirate© Car set Bowling Floor is Lava
Ron/Wyatt	Simple	Pop the Pig™ Garbage truck set Ball ramp Pogo jumpers
Karla/Perry	Symbolic	Pop the Pig™ Magnativity™ Magna Tiles® Sequence for Kids®

Table 2 (cont.)

Dyad	ASD play level	Toy set
Oscar/Stanley	Simple	Ball ramp Legos set ® Magna tiles® Marble run

BST materials included a PowerPoint presentation on play strategies, a visual play strategy sheet (see Appendix M), four stickers, and a choice of a small prize (e.g., one container of slime, one container of playdough, or one 12 page coloring book). During intervention, the visual play strategy sheet, stickers, and small prizes were also used as a reinforcement system. In addition, some dyads were given a laminated choice wheel (see Appendix N) with pictures of the toys and a Chef Craft Digital Timer 99 Minute stopwatch timer. If children with ASD had a symbolic play level or had a combination play level above the age 5, the choice wheel was used as a play strategy.

Hardware. The interventionist used a 13 inch, 2015, 1.6 GHz Intel Core i5, running macOS El Capitan version 10.11.6, MacBook Air laptop with an internal video camera and speakers. The caregiver used their personal tablet, laptop, or smartphone with an internal video camera and internal speaker. Three parents used personal tablets, four parents used laptops, and two parents used smartphones. Each device used PHIPA compliance with data in motion encrypted at the application layer using Advanced Encryption Standard (AES) through university provided, Health Insurance Portability and Accountability Act (HIPAA) compliant Zoom using wireless access. Each Internet enabled tablet or smartphone was connected to local password protected wireless Internet

networks provided by the family. Audio communication was achieved using the internal speakers of the device used at home. Training on how to use this equipment was provided at the time of issue, during the pre-intervention meeting. Both the NT sibling and parent were trained on how to use the technology. The parent was trained in how to set up the telehealth equipment and how to problem solve connection and other technology issues. Training included modeling how to open Zoom, join a meeting, turn on the sound and camera, and modeling some common solutions to problems with audio or cameras.

Software. Zoom for Healthcare is a HIPAA covered entity and a HIPAA business associate (BA). The contract protects personal health information (PHI) in accordance with HIPAA guidelines. The University of Oregon Zoom for Healthcare account was used for completing assessments, conducting training and play sessions, and hosting the sibling support group. Zoom offers the ability to securely record sessions and host private meetings that are password protected (Zoom Video Conferencing Inc., 2016). All communication was password secured and the waitlist function was utilized to ensure privacy. Furthermore, Zoom includes security features including user-specific authentication and real time encryption of meetings.

Response Measurement, Inter-Observer Agreement, Fidelity of Implementation, and Social Validity

Sibling Fidelity of Implementation

Sibling fidelity of implementation was used to establish if NT siblings learned to implement the strategies taught during the BST phase, fidelity of implementation was coded from videotaped play sessions. A four-item checklist with the operational definitions of the play skills was used to calculate fidelity. See Appendix H. Use of skills

in the procedure were scored by recording if the sibling independently (a) followed the child's lead or used the provided choice wheel, (b) obtained sibling's attention before providing play directions, (c) shared information and persisted during play, (d) and provided praise. A one minute partial interval recording procedure was used to indicate if the sibling used each of the strategies during a one minute interval. If a strategy was used at least one time during the minute interval, the strategy was marked as a plus. If a strategy was not used during the entire one minute interval, it was marked as a minus. The total number of intervals with strategies utilized was divided by the total number of intervals and multiplied by 100.

Reciprocal Play

Reciprocal play was defined as the child being within 3 feet of the sibling and engaged in the same activity in interdependent or shared play. Reciprocal play included handing materials to the peer (e.g., giving the dice during a board game or pretending to feed the stuffed animals) or talking about the same activity (e.g., "*Look, my car is red too!*") (MacDonald et al., 2009). Reciprocal play was counted if initiation to play is done by the sibling or the child with ASD. A 10-second whole interval procedure was used to record reciprocal play. The percentage of reciprocal play was calculated by dividing the number of intervals with play by the total number of intervals and then multiplying that number by 100 to obtain a percentage. See Appendix H.

Frequency of Initiations

Initiations was defined as the NT sibling spontaneously asking a question (e.g., "*Is it my turn?*" "*Do you like the ball?*"), making a comment, verbally requesting an item, or providing an invitation to play (e.g., "*Come play*" "*Look at this*"). Initiations needed to

be directed at the child with ASD. Nonverbal initiations including pointing, handing materials, or high fives were not included. Responding to a question did not count as an initiation, but did indicate reciprocal interaction. Furthermore, negative initiations (e.g., *Stop that!*) were not counted as an initiation. The frequency of positive initiations was tallied for each minute throughout a ten-minute sample. The total frequency of NT initiations in the session was graphed.

Clinician Fidelity of Implementation

Procedural integrity was measured to ensure the accuracy of implementation of the behavior skills procedure via videotapes for all sessions across all participants. The fidelity measures were calculated by taking the number of appropriate teaching behaviors divided by the number of behaviors listed in the BST protocol. The main steps of BST protocol include providing instructions about each skill, modeling the skill, letting participants practice the skill, and then providing feedback. See Appendix L. Procedural integrity was measured to ensure the accuracy of implementation of the support group session procedure via in vivo data collection for all sessions. The fidelity measures were calculated by taking the number of appropriate teaching behaviors divided by the number of behaviors listed in the support group protocol.

Clinician treatment fidelity data were collected for 100% of the behavior skills training sessions and 80% of the sibling support group sessions. These data indicated an average of 96% (range: 87.5% - 100%) for clinician procedural integrity for behavior skills training sessions. Clinician treatment fidelity was 100% for the implementation of the sibling support group sessions.

Interobserver Agreement (IOA)

Data were collected by two trained research assistants. Prior to the study, the research assistants were trained to reach a 90% agreement criterion on whole interval, partial interval, frequency recording, and fidelity procedures. Training included directions on the dependent measures and practice opportunities to record with the different measurement systems. Percentage of IOA was recorded during a minimum of 33% of all sessions in baseline, intervention, and follow-up across all sibling dyads. The percentage of IOA for the percentage of reciprocal play and percentage of sibling strategy use was calculated for each sibling dyad by using total agreement calculation; that is adding the number of agreements and dividing by the total number of intervals, and then multiplying by 100%. The more conservative block by block method (Page & Iwata, 1986) will be used to calculate IOA for frequency of initiations. Each minute interval will be scored and compared to obtain IOA. Intervals that have exact agreement will be scored a 1. When intervals have disagreements, the smaller coefficient is divided by the larger coefficient to obtain a score (i.e., $2/4 = 0.5$). The interval scores will be added and divided by the total number of intervals. These scores are presented in Table 3.

Social validity

Social validity was assessed through parent and NT sibling surveys and interviews. Parents and siblings were asked to rate the acceptability, effectiveness, and feasibility of the intervention goals, procedures, and outcomes using an adapted version of the treatment acceptability rating form-revised (TARF-R) (Reimers et al., 1991). See Appendix O. The TARF-R is 20 item questionnaire typically used with parents in clinical settings and targets concerns about treatment procedures and understanding of treatment.

Table 3*IOA for sibling participants*

Participants		<i>M</i>	Range
Angela/Nate	Reciprocal play	85	75-88
	Fidelity	89	83-93
	Initiations	92	83-100
Amy/Sheldon	Reciprocal play	88	82-100
	Fidelity	86	78-93
	Initiations	83	70-93
Sally/Buster	Reciprocal play	87	78-95
	Fidelity	84	75-87.5
	Initiations	87	70-100
Steve/Emily	Reciprocal play	87	73-98
	Fidelity	85	75-90
	Initiations	84	71-100
Apu/Milhouse	Reciprocal play	85	75-98
	Fidelity	81	78-90
	Initiations	87	77-97
Doug/Charles	Reciprocal play	91	88-98
	Fidelity	87	85-88
	Initiations	88	68-100
Ron/Wyatt	Reciprocal play	93	83-100
	Fidelity	87	80-98
	Initiations	89	73-100
Karla/Perry	Reciprocal play	84	72-90
	Fidelity	90	83-93
	Initiations	83	81-91

Table 3 (cont.)

Participants	<i>M</i>	Range
Oscar/Stanley		
Reciprocal play	90	83-98
Fidelity	86	80-95
Initiations	83	68-100

It has fairly high internal consistency with a score of 0.92 (Wilczynski, 2017). Siblings received an adapted version of the parent social validity questionnaire and it was presented via PowerPoint slides. See Appendix O. The PI or a research assistant read aloud the questions and explained the scales to the children. The open ended questions that are answered by the children were written down by the PI or research assistant. Parents and NT siblings that received the sibling support group had additional questions specifically about the acceptability and likability of the support group. The play skills intervention and sibling support group were separated in the questionnaires in order to determine the appropriateness and likability of both intervention parts.

Pre-baseline assessments

Reinforcer Inventory and Preference Assessment. A reinforcer inventory was used to get a better idea about each sibling dyad likes, dislikes, and interests. The reinforcer inventory is a quick and simple checklist for the caregiver to fill out for each child. See Appendix C. This information was used to select child prizes, stickers, and toys to include for the preference assessment. A paired choice video preference assessment was used for a set of 6 toys for each child (Huntington & Higbee, 2018). The child was shown a brief 5 second, looped video of each toy in action. After, the interventionist presented the videos on a PowerPoint slide show with the videos next to

each other on each slide. The interventionist asked the child to pick a toy and then moved to the next slide with a different set of toys. A hierarchy of preferred toys was created based on the results of the paired choice preference assessment. If the child with ASD was not able to attend to the videos or point to a video, the parent was asked to take their best guess on what the child would like. Parents selected the toys for Nate, Stanley, and Wyatt. The results of the preference assessments from the child with ASD and the NT sibling informed which toys were selected for the toy set.

Childhood Autism Rating Scale-2nd Edition. The CARS-2 parent interview was used to describe child ASD symptoms in the sample. It is an empirically validated ASD assessment and is effective for mild-moderate autism and “high-functioning” ASD (Schopler et al., 2010). It includes items on relating to people, imitation, social understanding, body and object use, adaptation to change, verbal and nonverbal communication, visual and listening response, and fear or nervousness. The responses from the caregiver interview and a general impression observation were used to calculate a raw score. The raw score indicates the severity group from minimal to no symptoms of ASD, mild to moderate symptoms of ASD, and severe symptoms of ASD.

Vineland Adaptive Behavior Scale-3rd Edition. All parents completed the Domain Level Parent forms to assess the level of adaptive functioning of the child with ASD. The Vineland-3 is an individually administered measure of adaptive behavior and has been widely used in the assessment of individuals with intellectual and developmental disabilities (Sparrow et al., 2016). The domains include communication, daily living skills, socialization, and motor skills. The raw scores are calculated from each domain and converted to norm referenced scores to determine strengths and

weaknesses. The overall adaptive behavior composite (ABC) score was reported to indicate adaptive levels ranging from low, moderately low, adequate, moderately high, and high.

Short Play and Communication Evaluation (SPACE). The interventionist conducted a modified version of the SPACE assessment with each child with ASD. The SPACE is a brief assessment where children are presented with toys and opportunities are contrived to assess communication, joint attention, and developmental play level (Shire et al., 2018). The interventionist sent a list of possible toys for parents to bring out during the play observation including a ball or car, bubbles or a balloon, a social game, puzzles or blocks, and pretend play items (i.e., pretend food and dolls, barn yard set, superhero action figure set). Parents were coached to follow the child's lead and not prompt any communication or play skills. During the observation, the interventionist recorded different types of play skills observed to assess the child's developmental play level including simple play, combination play, pre-symbolic play, and symbolic play.

Pretest-posttest measures

The following measures were completed for each of the nine NT siblings before random assignment to treatment group and following follow-up data of the MBD.

Sibling Relationship Quality (SRQ). Sibling relationship quality was measured through the Sibling Relationship Questionnaire. This survey rates how well a particular characteristic described their relationship with their sibling on a Likert scale (Buhrmester & Furman, 1990). The measure has good reliability and has been used to measure relationship quality for siblings with ASD (Buhrmester & Furman, 1990). See Appendix D.

Sibling Self-Efficacy. Sibling self-efficacy was measured using an adapted version of Self-Efficacy Questionnaire for Children (SEQ-C) (Muris, 2001; Muris, 2002). The SEQ-C has high internal consistency (Muris, 2001). The questionnaire was adapted to reflect sibling confidence in interactions with the sibling with ASD. Questions were rated on a Likert scale ranging from not at all to very well. See Appendix E.

Autism Knowledge. Autism knowledge was assessed via an adapted version of the Autism Awareness Scale (Gillespie-Lynch et al., 2015). The measure has 13 items that assess basic knowledge on the characteristics and causes of autism. The scale has been previously used with college students so the language and scales have been adapted for children. Children can respond true or false for each item. The correct items were summed up to produce a total score. See Appendix F.

General Procedures

This study consisted of pre-baseline assessment collection (Phase 1), baseline condition (Phase 2), behavior skills training session for typically developing sibling (Phase 3), sibling implemented play intervention and sibling support group (Phase 4), and generalization and maintenance sessions (Phase 5). Baseline and intervention sessions occurred bi-weekly for 30 minutes. During all sessions, ten minute video recorded probes were coded for NT sibling behavior and play. Generalization probes of siblings skill use and percentage of reciprocal were taken during all experimental phases in the family home.

The independent variable for the multiple baseline design was BST on targeted play skills for the sibling. All coaching was done by the interventionist. The target skills included strategies based on Pivotal Response Treatment (PRT; Koegel et al., 1999) such

as 1) following the child's lead or using a choice wheel, 2) obtaining sibling's attention before providing simple play instructions, 3) sharing information and persisting through play, and 4) providing praise for all attempts or successful turn taking. BST occurred in an individualized format with NT siblings for the four targeted skills.

Experimental Design and Analysis

Experimental Design

The primary research design was a concurrent multiple-baseline design (MBD) across sibling groups (n = 2 groups of 4-5 siblings in each group) (Kazdin, 2011; Kratochwill, 2015) to assess the effectiveness of the sibling play implemented intervention. A randomized pretest posttest group design was used to determine the preliminary feasibility and likability of the sibling support group. See Table 1. In MBD each dyad served as their own control by collecting baseline data, repeated measures were taken across all phases, and the staggering of baseline lengths across sibling dyads controlled for internal validity threats such as maturation, history, and multi-treatment interference. The proposed SCD design met pilot WWC standards for MBD in single case research by systematically manipulating the independent variable, including 5 data points in each phase, and meeting the minimum requirement of 3 opportunities for demonstration of basic effect (Kratochwill, et al., 2013). Although the group design component of this study was underpowered, this combined design allowed (a) testing of the preliminary feasibility and likability of the addition of a support group to traditional BST in sibling mediated intervention, and (b) examining whether a functional relation exists between BST and improved child outcomes.

Allocation and Masking Procedures

Prior to pretest, participants were randomly assigned to one of two treatment groups (5 sibling dyads participate in BST + support group and 5 sibling dyads participate in BST alone). A virtual coin flip was done by an outside researcher to randomly assign dyads to treatment group. The results were delivered via email. IOA data collectors were masked to group assignment; however, the researcher who served as interventionist, participating children, and parents, were not masked to group assignment. Pretest measures were collected and two independent MBDs were implemented for all nine sibling dyads. Following conclusion of the MBD (baseline, intervention, maintenance phases), posttest measures were administered. Behavioral assessment was collected throughout the MBD to generate baseline and intervention data. Generalization probes of sibling skill use were taken during all experimental phases in the family home. The order in which participants enter the intervention (1st, 2nd, 3rd, 4th) was randomized prior to the onset of the baseline phase of the MBD.

Analysis

Dyad data were graphed on separate line graphs for visual analysis of within and between phase data. Specifically, the PI conducted a formal visual analysis as the study progressed on the level, trend, variability, immediacy effect, and overlap of data points between phases to evaluate basic relations between the dependent variables on sibling behavior and the intervention for each participant and whether a functional relation between the intervention and the dependent variables existed at the study level (Kazdin, 2011; Ledford & Gast, 2018). Vertical analysis was also conducted across the dyads to look for behavioral covariation. Convention in single case research maintains that, to

confidently make an inference about a causal or functional relation between the intervention and the dependent variables, a basic effect must be documented in at least three different points in time (Ledford & Gast, 2018). This design offered the opportunity to demonstrate whether a basic effect existed between implementation of the BST intervention and the dependent variables 8 different times. Determination of whether a basic effect exists when comparing the A (baseline phase) to the B (intervention phase) is based on visual analysis as described above.

If visual analysis determined a clinically significant change, Tau-U was used to determine effect sizes. Tau-U is a nonparametric quantitative approach for SCD that analyzes nonoverlap between baseline and intervention phases (Parker et al., 2011). Tau-U controls for within phase trend, controls for serial dependence in the data, and can provide p-values and confidence intervals. The between-case standardized mean difference (BC-SMD) was also calculated to determine effect sizes between cases. This is a parametric approach to determine the magnitude of the functional relation by calculating the difference in mean outcomes and scaling it by the cross sectional standard deviation of the outcome. Cohen's d was used to interpret the findings where a small effect is 0.2 or below, a medium effect is 0.5 or above, and a large effect is 0.8 or above (Cohen, 1988). The use of a design comparable effect size can facilitate the inclusion of the results in meta-analyses. To calculate Tau-U and the BC-SMD effect size, the Single-Case effect size online calculator (Version 0.5) was used from <https://jepusto.shinyapps.io/SCD-effect-sizes/> (Pustejovsky & Swan 2018).

Descriptive statistics reported analyze the changes in autism knowledge, self-efficacy, and perceived relationship quality. This information provided results on preliminary effectiveness for the sibling support group.

Phase 1 (Pre-Baseline Assessments)

Assessments and measures during Phase 1 were carried out by the interventionist and a research assistant. The assessments included the CARS-2 parent interview (Schopler et al, 2010), forced choice preference assessments for both children, and NT sibling questionnaires (refer to pre-post measures). The interventionist interviewed the parent using the CARS. After the interview with the parent was completed, the interventionist finished the NT sibling pretests. Information from the reinforcer inventory was used to determine the six toys for the preference assessment for each child. Different types of toys (e.g., pretend play, cooperative, building) were included in the preference assessments. After the NT sibling finished the questionnaires, he or she completed the preference assessment. A small, preferred snack was provided by the parent to each child following completion of all assessments.

Phase 2 (Baseline)

Baseline data were collected during Phase 2 for all sibling dyads. During the first ten minutes, the individualized toy set was set up in a playroom, living room, or designated play space and children freely interacted with the toys and the video camera will be set up. After, the interventionist said *“It is now time to play with your brother or sister by yourselves for 10 minutes. I can play and talk with you after.”* During this time, adults did not interact with the children and responded to their initiations with *“I can talk to you after you are done playing”*.

Table 4*Research Questions, Measurement, Intervention Component, and Time Point*

Research question	Area of measurement	Intervention component	Methodology	Time point of measurement
1. Is there a functional relation between intervention and increases in sibling initiations?	Frequency of NT sibling initiations	Behavior skills training	Visual analysis	Baseline, intervention, follow up
2. Is there a functional relation between intervention and increases in time spent in reciprocal play?	Percentage of intervals with reciprocal play (10 second whole interval)	Behavior skills training	Visual analysis	Baseline, intervention, follow up
3. Is there a functional relation between intervention and increased sibling fidelity of implementation?	Percentage of play steps used	Behavior skills training + priming and feedback	Visual analysis	Baseline, intervention, follow up
4. Is there a difference between intervention groups and autism knowledge?	Autism Awareness Scale (Gillespie-Lynch et al., 2015)	Sibling support group	Descriptive statistics	Pre and post intervention
5. Is there a difference between intervention groups and perceived siblings relationship?	Sibling Relationship Questionnaire (Buhrmester & Furman, 1990)	Sibling support group	Descriptive statistics	Pre and post intervention
6. Is there a difference between intervention group and sibling self-efficacy?	Adapted from Self-Efficacy Questionnaire for Children (Muris, 2001)	Sibling support group + behavior skills training	Descriptive statistics	Pre and post intervention

If parents reported aggressive behavior for either of the children during intake, a behavior management/safety plan was put in place to keep children safe including prompting children to take turns, reminding children to use their words, and leading a child from the area if in harm's way. Prior to baseline, three of the parents were given a behavior management/safety plan to use as needed; however, the safety plan was only implemented for two of the sibling dyads during baseline and intervention sessions. During the last ten minutes of the baseline sessions, adults could play and interact with the children using the toy set or other toys around the house. Generalization probes took the same format, however, parents set up toys they had from home including one turn taking game, one set of pretend play items, and one manipulative toy.

Phase 3 (Behavior Skills Training)

BST took place during Phase 3 for NT siblings. BST for the four different play strategies included: (a) following the child's lead or using a choice wheel, (b) obtaining attention before providing simple directions, (c) sharing information and persisting through play, and (d) providing praise. The skills were taught through Behavior Skills Training (BST) to practice and acquire each new social skill (Parsons et al., 2012). The training sessions provided the siblings with a definition of the new skill, the interventionists modeled the skill, and allowed the sibling to practice the skill with feedback from the interventionist. All siblings needed to reach 100% fidelity during the role play probes with the interventionist before practicing these skills their siblings with ASD. The following sibling dyads used the choice wheel as a play strategy: Amy and Sheldon, Sally and Buster and Doug and Charles. To increase motivation during teaching phases, siblings were provided with a laminated play strategy sheet in which they

collected small stickers as rewards on the back of the sheet. Sticker themes (e.g., animals, Disney characters, food) were individualized based on the reinforcer inventory. From the provided 3 sticker sheets (about 10 per page), the child choose which stickers they wanted. Stickers were earned during teaching sessions by sitting nicely, answering questions, and correctly role playing the skill. The stickers were delivered on a variable interval schedule of about every minutes (VI-5); on the average of 5 minutes the child can earn a sticker for appropriate behaviors. At the end of the teaching session, the siblings redeemed their stickers for a small prize (e.g. one small container of slime, one small Hatchimal). They needed to earn a minimum of four stickers to receive a prize.

Phase 4 (Intervention + support group)

Phase 4 consisted of the play intervention and the sibling support group. All sibling dyads received the sibling mediated play intervention. However, only half the NT siblings received the sibling support group during the time of this study. For the dyads who had the sibling support group, all BST sessions across dyads were completed before the sibling support group beings or during the first week of the sibling support group. During the first ten minutes of the play intervention, the NT sibling was reminded of each of the play strategies using a visual sheet and asked by interventionist if they have any questions. The visual sheet had a list of the four bulleted strategies. See Appendix N. The NT sibling was reminded that they can earn stickers and a prize at the end for using the play strategies. The child with ASD was reminded that they can also earn stickers or a prize if they stay in the room and play with their brother or sister. Sheldon, Buster, and Doug also needed to keep safe bodies and display no aggression towards their NT siblings to earn prizes.

Table 5*Intervention Strategies*

Intervention Strategy	Definition	Examples
Following the child's lead and giving choices OR using a choice wheel	Following the child's lead: playing with what the child is already playing with or interested in.	Example: the child with ASD is playing with playdough so the NT sibling grabs some playdough to build.
	Giving choices: offering two different activities or materials to play with	Example: NT sibling asks " <i>Do you want to play the slinky or magna-tiles?</i> "
	*Choice wheel: each child takes turns picking the activity on the choice wheel for both children to play with (*The choice wheel will only be used for dyads where the child with ASD can engage in activities that are picked by the brother or sister)	Example: Child 1 is the leader first and picks the dollhouse on the choice wheel for the first 4 minutes. Both children engage with the dollhouse for that time. Next, Child 2 picks blocks on the choice wheel and both children play with the blocks for the next 4 minutes.
Obtaining attention before providing simple instructions	Getting attention: sibling must have the child's attention on either the stimulus or the sibling prior to presenting directions or a prompts	Example: NT sibling says their brother or sister's name, taps them on the shoulder, or positions their body across from the child
	Simple instructions: sibling questions or instructions must be simple, clear, and appropriate to the activity	Example: NT siblings waits for attention before saying " <i>Put the piece on</i> " or " <i>Roll the car here</i> "
Sharing information and persisting through play	Sharing information: talking about what they are doing or narrating what the child with ASD is doing	Example: NT sibling narrates play including " <i>I am building a garage for the cars</i> " or " <i>The slinky is coming to get you</i> ".
	Persisting through play: the NT sibling continues to provide prompts and plays even with rejections and tries presenting toys in multiple ways	Example: NT sibling gives brother a coin for the cash register and he puts it down. The sibling models putting the coin in the cash register and gives another coin to his brother.
Providing praise	Providing praise: reinforcing positive play, turn taking, and sharing materials with verbal statements, high-fives, or *paring with edible treats	Examples: NT sibling asks her brother to put the pink piece on top of the house. After her brother puts the pink piece on top, she says " <i>Good job!</i> ". The children are playing with play food and the child with ASD hands her sister the cake. The NT sibling says " <i>Thanks. I love the cake!</i> "
	*Small edible treats will be paired with verbal statements for children with ASD who need an extra reinforcement schedule	

Priming and set up of materials took place for the first ten minutes of the session and then the directions of *“It is now time to play with your brother or sister by yourselves for 10 minutes. I can play and talk with you after.”* After the 10-minute probe was completed, the interventionist gave the NT sibling feedback on each skill and then directed the parent to hand out prizes to the children. The interventionist went through each skill and asked the child if they displayed the skill. If the child displayed the play skill, the interventionist provided behavior specific praise and gave an example of a time they used the skill. If the child did not use the skill, the interventionist told them they forgot to use this skill and gave them an example of how they can use it next time. If fidelity of the NT sibling fell below 75% for 2 consecutive sessions, the interventionist provided prompts every minute to remind the NT sibling of the play skill(s) they needed to use.

Five randomly selected NT siblings also met weekly for a separate, 30 minute structured sibling support group that coincided with the intervention phase of the MBD (See Appendix J for support group lessons). The interventionist introduced topics using a written curriculum, facilitated discussions for NT siblings, led group activities, and encouraged them to share experiences (Smith & Perry, 2005). The sessions topics included Welcome Session (week 1), Autism Characteristics (Week 2), Attention and Fairness (Week 3), Sibling Experiences (Week 4), Listening to Feelings (Week 5), Coping Strategies (Week 6, 7), and Wrap up (Week 8) activities. Each session topic had a short take home activity for children (with their parent supporting as needed) to complete outside of the session. The take home activities were reviewed at the start of the next

session. The structure of each support group lesson included an ice breaker (1-3 minutes), review of the take home activity in break out rooms (5 minutes), presentation of the leading question and group reading of the comic strip addressing topic (3 minutes), group activity surrounding topic (10-15 minutes), discussion time (5-10 minutes), wrap up and present the take home activity for the following week (3 minutes). Each week a visual comic strip was made to present information about the weekly topic in a fun way. The comics were an exciting way to get children to engage with the material. See Appendix K for an example comic. Some weeks had more discussion time, while other weeks spent more time on activities. The activities were researcher led and included activities linked to the presented content such as making stress balls or super hero cuffs. The discussions were guided by the leading question and the PI facilitated a group discussion among the siblings. Sessions were concluded by the PI presenting a bulleted summary of what was talked about, time for responses from the siblings, and an introduction of the take-home activity.

Phase 5 (Follow up)

During Phase 5, follow-up play probes were recorded. During this time, there were no priming sessions before the play probe and no reward system was offered. Toys from the home were also utilized during follow up. After follow-up probes were conducted, the interventionist collected social validity forms from parents and NT siblings. NT siblings also completed the same pre-test questions from Phase 1.

CHAPTER III

RESULTS

This chapter describes the results of the study and details (a) results of the NT siblings' treatment fidelity (b) results of percentage of reciprocal play, (c) results of the NT siblings' frequency of initiations, (d) results of the Tau-U, non-overlap index for single-case data at the case level, (e) results of the BC-SMD, a parametric between case effect size indicator for single case data at the study level, (f) descriptive statistics of NT siblings' pre/post assessments, and (g) social validity ratings of parents and NT siblings. Sibling treatment fidelity and percentage of reciprocal play for MBD 1 are presented in Figure 3. Sibling treatment fidelity and percentage of reciprocal play for MBD 2 are presented in Figure 4. The frequency of initiations for MBD 1 and 2 are presented in Figures 5-6, respectively.

Results of NT Siblings' Treatment Fidelity

Angela/Nate

During baseline, Angela was using some of the strategies consistently. Mean percentage of strategies used was 33.72% with a range of 20% - 40%. During intervention, Angela immediately increased her use of the targeted play strategies. There was minimal variability and an increasing trend. The mean percentage of strategies of used was 73.57% with a range of 62.5% - 90%. Angela maintained a large percentage of the play strategies during generalization probes. During the follow up probe, this percentage decreased, but remained at a higher level than baseline.

Amy/Sheldon

Amy used some of the play strategies during baseline. However, there was a decreasing trend in the percentage of play strategies used. The mean percentage of strategies used was 24.29% with a range of 10% - 37.5%. During intervention, there was an immediate increase in the level of fidelity. There were no overlapping points between baseline and intervention and there was an increasing trend in the percentage of strategies she used. The mean level of strategy use during intervention was 56% with a range of 45% - 70%. Generalization and follow up data did decrease, but remained above baseline levels.

Sally/Buster

Sally used some strategies during baseline; however, data were variable and had a decreasing trend. Mean levels of strategy use were 33.4% with a range of 17.5% - 47.5%. During intervention, fidelity of implementation had an increasing trend. While there was some overlap from baseline, strategy use remained high and stable for the last three intervention points. The average percentage of play strategies used was 59% with a range from 37.5% - 70%. Higher level of fidelity of implementation generalized to their own toy set as well. The percentage of strategies used remained at a high level during the three week follow up probe.

Steve/Emily

Steve was able to utilize some of play strategies during baseline; however, his use of strategies was highly variable. The mean percentage of strategy use was 24.5% with a range of zero strategies used to 37.5%. During intervention, there was an increasing trend for the use of play strategies. While there was some overlap, fidelity of implementation

during intervention did generalize to a different toy set. The average percentage of use of play strategies was 54.17% with a range of 30% - 77.5%. The percentage of fidelity of implementation did decrease during the four week follow up probe.

Apu/Milhouse

Apu used some of the play strategies consistently during baseline. The mean percentage of sibling strategy use was 33.18% with a range of 17.5% - 45%. During intervention, there was an immediate increase in the level of fidelity of implementation. Apu's use of play strategies remained stable with no overlap from baseline. Apu generalized the use of play strategies with his own set of toys as well. The mean level of strategy use was 64.2% with a range of 62.5% - 70%. His use of the play strategies did drop in level during follow up, but fidelity remained above baseline levels.

Doug/Charles

Doug utilized some of the play strategies during baseline at a stable level. The mean percentage of play strategies used was 28.5% with a range of 22.5% - 33%. During intervention, Doug immediately increased the level of play strategies he used. There were no overlapping data between baseline and intervention. The mean percentage of play strategies used in intervention was 53.44% with a range of 42.% - 60%. Doug used the play strategies at a high level during generalization probes. His use of the targeted strategies decreased during the one month follow up probe, but it remained at a higher level than baseline.

Ron/Wyatt

Ron had a very low percentage of strategy use during baseline. The mean percentage of play strategies used was 7.5% with a range of no strategies used to 20%.

After the training, Ron increased the level of play strategies used with his brother. There were no overlapping data points between baseline and intervention. The mean percentage of play strategies used in intervention was 43.75% with a range of 30% - 60%.

Generalization and follow up probes were higher than baseline levels.

Karla/Perry

Karla used an increasing amount of play strategies during baseline. There was an increasing baseline trend for Karla's fidelity of implementation. The mean percentage of strategy use was 55.95% with a range of 37.5% - 80%. Due to the increasing baseline trend and high percentage of strategy use, BST was not implemented.

Oscar/Stanley

Oscar was able to use some of the play strategies with moderate variability during baseline. The mean percentage of strategies used 27% with a range of 5% - 37.5%.

During intervention, there was an increasing trend for percentage of strategies used.

There was no overlap between baseline and intervention phases. The average percentage of play strategies used was 60.41% with a range of 40% - 82.5%. However, fidelity of implementation did not generalize or maintain for the follow up probe; strategy use dropped to baseline levels.

Figure 3

Percentage of Play Strategies Used and Percentage of Reciprocal Play for MBD 1

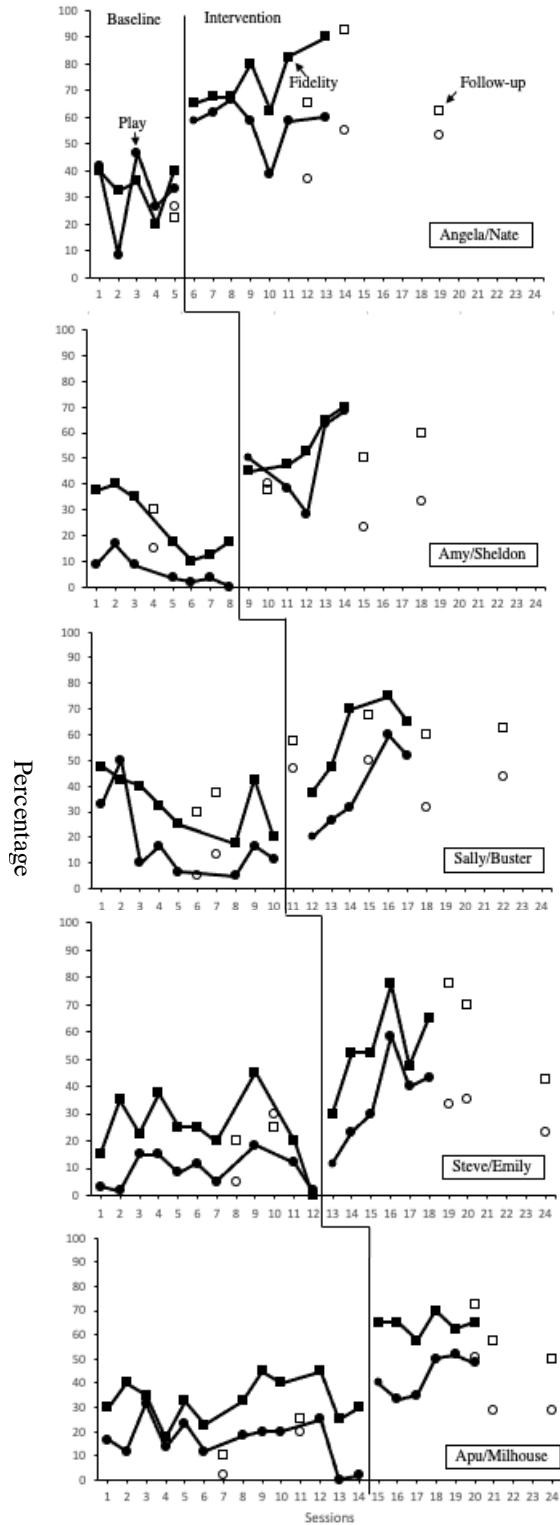
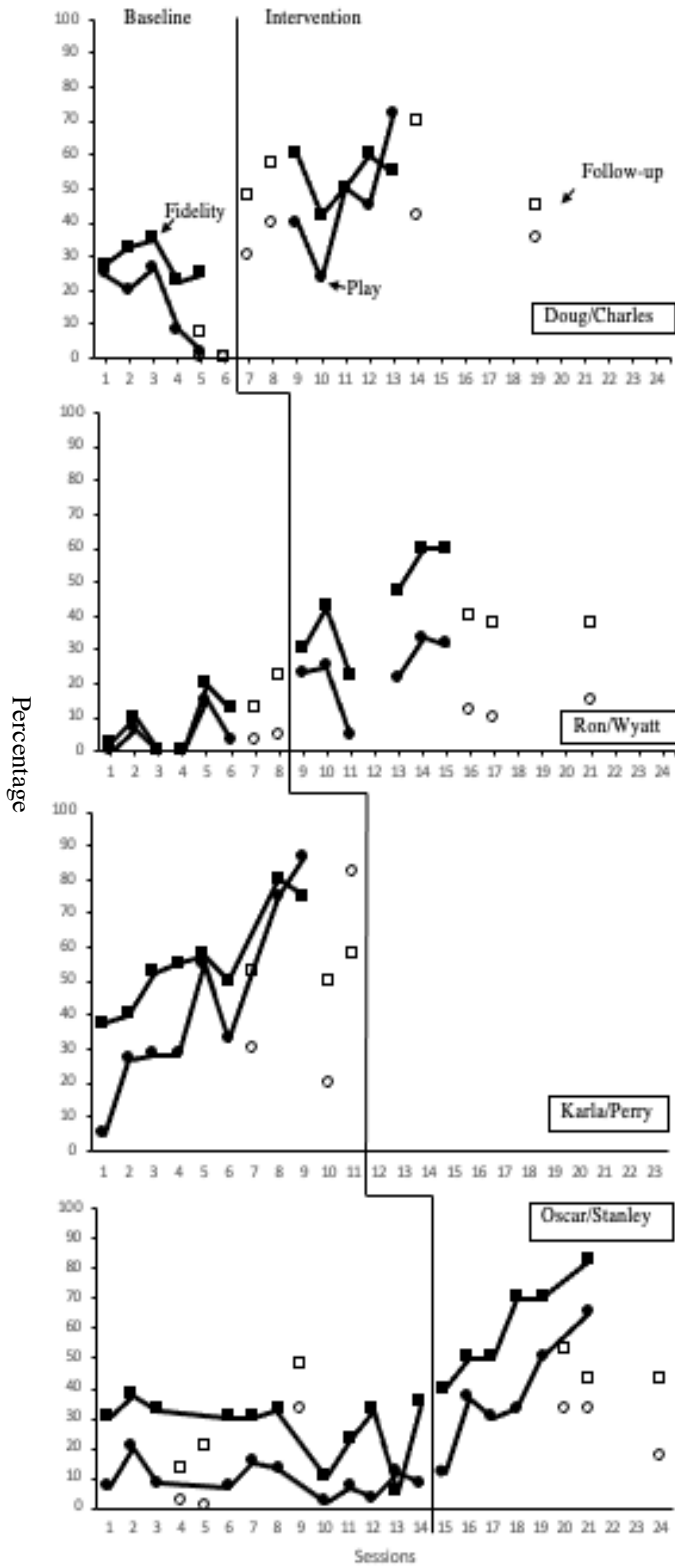


Figure 4

Percentage of Play Strategies Used and Percentage of Reciprocal Play for MBD 2



Results of Percentage of Reciprocal Play

Angela/Nate

During baseline, Angela and Nate's reciprocal play was variable. On average, they played together 31.33% of the intervals with a range 8.33% - 46.67%. Once in intervention, the percentage of intervals with reciprocal play immediately increased in level. The mean level of reciprocal play was 57.38% with a range of 38.33% - 66.67%. There was minimal overlap between baseline and intervention data. Generalization probes during intervention remained at a higher level compared to baseline. The percentage of reciprocal play during the 3-week follow up probe maintained within the range of intervention data and above baseline levels.

Amy/Sheldon

During baseline, Amy and Sheldon had low levels of reciprocal play with a decreasing trend. The mean percentage of intervals with reciprocal play in baseline was 5.95% with a range of 0% - 16.67%. During intervention, there was an immediate effect on the level of play. Reciprocal play was highly variable during intervention; however, there was an increasing trend. Mean levels of reciprocal play were 49.66% with a range of 28.33 - 68.33%. Furthermore, there were no overlapping data points between baseline and intervention phases. Reciprocal play was at higher levels during generalization probes in intervention compared to baseline. Percentage of intervals with reciprocal play in the two-week follow up data decreased, but remained at higher levels compared to baseline.

Sally/Buster

Sally and Buster's percentage of intervals with reciprocal play was moderately variable and had a decreasing trend in the baseline condition. The average percentage of intervals with reciprocal play was 20.22% with a range of 5% - 50%. During intervention, there was an increasing trend for percentage of reciprocal play. However, the first three data points in intervention overlapped considerably with the first two baseline points. Mean levels of reciprocal play in intervention were 31.19% with a range of 11.67% - 60%. The level of reciprocal play in generalization probes was higher in the intervention compared to the baseline condition. Furthermore, three-week follow up data for reciprocal play decreased in level; however, reciprocal play remained higher than a majority of the data in baseline.

Steve/Emily

Steve and Emily had a low and stable level of reciprocal play during baseline. The average level of reciprocal play was 9.22% with a range of 1.67 - 18.33%. With the introduction of intervention, there was moderate variability and an increasing trend for percentage of reciprocal play. Mean levels of reciprocal play increased to 34.44% with a range of 11.67% - 58.33% in intervention. Generalization probes during intervention were at a lower level, but still above baseline levels. Furthermore, reciprocal play during the one-month follow up probe dropped but was still above baseline data.

Apu/Milhouse

Apu and Milhouse had a low and relatively stable level of reciprocal play during baseline. The average level of reciprocal play was 16.11% with a range of zero percent of intervals with reciprocal play to 31.67%. Once intervention was introduced, there was an

immediacy effect with an increase in the level of reciprocal play. Furthermore, there was an increasing trend and minimal variability. Mean level of reciprocal play during intervention was 43.1% with a range of 33.33% - 51.67%. Generalization probes had less reciprocal play during the intervention condition, but remained higher than baseline generalization probes. Furthermore, the two-week follow up probe for reciprocal play dropped in level from intervention to baseline levels.

Doug/Charles

In baseline, Doug and Charles had a decreasing baseline trend for percentage of reciprocal play. The mean level of reciprocal play was 16.34% of intervals with a range of 1.67% - 26.67%. During intervention, there was an immediate increase in the level of reciprocal play. Although there was some overlap in the data, there was also an increasing trend with minimal variability. The mean percent of intervals with reciprocal was 46% with a range of 23.33% - 71.67%. Generalization probes during intervention remained higher than baseline levels. The one month follow up probe had a decrease in the level of reciprocal play, but was still above baseline levels.

Ron/Wyatt

Ron and Wyatt had very low levels of reciprocal play during baseline. The mean percent of intervals with reciprocal play was 4.17% with a range of zero to 15%. During intervention, there was an increase in the level of reciprocal play. Intervention was highly variable for reciprocal play. The mean level of reciprocal play was 23.33% with a range of 5% - 33.33%. The higher percentage of reciprocal play did not generalize to their own toy set, but remained at a higher level compared to generalization probes during baseline.

Three week follow up data for reciprocal play also decreased, but remained higher than baseline levels.

Karla/Perry

Karla and Perry had an increasing baseline trend for percentage of intervals with reciprocal play. The mean percent of intervals with reciprocal play was 42.3% with a range of 5% - 86.67%. Intervention was not implemented for Karla and Perry due to the increasing baseline trend. High levels of reciprocal play did generalize to their own toys during baseline.

Oscar/Stanley

Oscar and Stanley had a low and stable level of reciprocal play during baseline. The mean percentage of intervals with reciprocal play was 9.24% with a range of 1.67% to 20%. During intervention, there was an increasing trend for percentage of reciprocal play. Although the effect was not immediate, play consistently increased with minimal variability. The average level of reciprocal play during intervention was 37.77% with a range of 11.67% - 50%. Generalization probes remained lower than other intervention data, but remained higher than the majority of generalization probes during baseline. Reciprocal play dropped to baseline levels during the one month follow up probe.

Results of NT Siblings' Frequency of Initiations

Angela/Nate

During baseline, Angela had a low level of initiations towards her brother. The mean level of initiations were 12.5 with a range of 6 - 20. There was an immediate increase in the level of initiations during intervention. The frequency of initiations during intervention was variable with no overlapping data from baseline. The average frequency

of initiations during intervention was 41.85 with a range of 34 - 56. The frequency of initiations in generalization probes remained higher than baseline levels. Furthermore, initiations dropped in level during the follow up probe, but remained higher than baseline.

Amy/Sheldon

Amy rarely initiated towards her brother during baseline. Baseline data had a very low and stable level of initiations. The mean frequency of initiations was 6.14 with a range of 3 - 9. During intervention, the frequency of initiations immediately increased. There was an increasing trend for initiations during intervention and no overlapping data with baseline. The average number of initiations during intervention was 23.6 with a range of 15 - 34. The frequency of initiations was variable during generalization probes. Follow up data for frequency of initiations dropped in level, but remained higher than baseline.

Sally/Buster

Sally initiated towards her brother at a relatively low level during baseline. There was a slight decreasing trend for frequency of initiations in baseline. The mean of baseline initiations was 11.25 with a range of 4 - 18. During intervention, there was an increasing trend for frequency of initiations. While there was some overlap between the two adjacent phases, Sally initiated to her brother at higher levels during the last three intervention points. The average number of initiations in intervention was 24.2 with a range of 13 - 34. Generalization probes and follow up data demonstrated higher levels of initiations than baseline.

Steve/Emily

Steve's baseline level of initiations was relatively low and stable. The mean frequency of initiations during baseline was 7.7 with a range of 1 - 14. During one of the generalizations probes in baseline, Steve had an outlier data point of 26 initiations. Once intervention was implemented, there was an increase in the level of initiations with minimal overlap between adjacent phases. The mean level of initiations in intervention was 22 with a range of 13 - 28. The frequency of Steve's initiations in generalization probes had overlap with the baseline phase. The frequency of initiations dropped in the follow-up probe, but remained higher than the mean in baseline.

Apu/Milhouse

Apu initiated towards his brother during baseline, however, the baseline data was highly variable. The average number of initiations in baseline was 14.58 with a range of 0 - 33. During intervention, there was an increase in the level and a decrease in the variability. The mean level of initiations in intervention was 33 with a range of 25 - 46. Generalization probes for frequency of initiations were higher in the intervention compared to generalization probes in baseline. Frequency of initiations at the follow up probe did decrease in level, but remained above baseline levels.

Doug/Charles

There was a decreasing trend for frequency of Doug's initiations during baseline. The average number of initiations was 11.8 with a range of 3 - 18. There was an immediate increase in initiations during the intervention phase. Data remained stable with minimal overlap. The mean level of initiations during intervention was 23.4 with a range of 17 - 48. Frequency of initiations remained at high level during generalization probes

with zero overlap from the baseline condition. Doug's initiations did decrease during the follow up, but remained higher than baseline levels.

Ron/Wyatt

Ron rarely initiated towards his brother during the baseline phase. The mean frequency of initiations was 1.67 with a range of 0 - 4. There was an immediate increase in level during intervention, however, initiations were variable and had a slight decreasing trend. The mean initiations in intervention was 16.5 with a range of 6 - 9. Frequency of initiations remained higher than baseline during generalization probes. Furthermore, there was a decrease in frequency of initiations during the follow up, but the frequency remained higher than baseline.

Karla/Perry

Karla initiated to her brother during the baseline quite frequently. There was an increasing baseline trend for the frequency of initiations. Mean levels of initiations during baseline were 29.5 with a range of 8 - 49. Intervention was not delivered to Karla because of the high number of initiations towards her brother during the baseline phase and the increasing baseline trend.

Oscar/Stanley

Oscar initiated towards his brother during baseline at relatively low levels. The mean frequency of initiations in baseline was 5.27 with a range of 2 - 14. During one of the generalization probes in baseline, Oscar had an outlier data point of 27 initiations. Once intervention was implemented, there was an immediate increase in level. The average number of initiations during intervention was 23.8 with a range of 20 - 29. There was overlap between the generalization probes in baseline and intervention. Furthermore,

the frequency of initiations did not maintain over time for Oscar; initiations dropped to baseline levels during the follow up probe.

Results of Tau-U

The non-overlapping data points for adjacent A-B baseline and intervention phases for sibling dyads were determined for each dependent variable using an online calculator (i.e. <https://jepusto.shinyapps.io/SCD-effect-sizes/>). Parker and Vannest (2009) suggests that Tau-U scores with ranges from 0 to .65 indicates weak effects; .66 to .92 indicates medium effects; and .93 to 1.00 indicates large effects of intervention. For Angela and Nate's reciprocal play, Tau-U was 0.89, indicating a large effect. Angela had strong effects for both fidelity of implementation (Tau-U= 1.00) and frequency of initiations (Tau-U= 1.00). Amy and Sheldon had a large effect for reciprocal play (Tau-U= 1.00). For Amy, the same Tau-U score of 1.00 was found for both fidelity of implementation and frequency of initiations. Sally and Buster had a Tau-U score of 0.98 for reciprocal play; indicating a strong effect. For Sally, Tau-U scores were 1.00 for fidelity of implementation and 1.00 for frequency of initiations. Steve and Emily had a Tau-U score of 0.78 for reciprocal play. This score indicates a medium effect. Steve had a strong effect for fidelity of implementation (Tau-U= 1.00) and a medium effect for frequency of initiations (Tau-U= 0.92). For Apu and Milhouse's reciprocal play, Tau-U was 1.00, indicating a large effect. Apu had a medium effect for fidelity of implementation (Tau-U= 0.92) and a large effect for frequency of initiations (Tau-U= 1.00). Doug and Charles had a large effect for reciprocal play (Tau-U= 1.00). For Doug, Tau-U scores were 1.00 for fidelity of implementation and 1.00 for frequency of initiations.

Figure 5

Frequency of NT Sibling Initiations in MBD 1

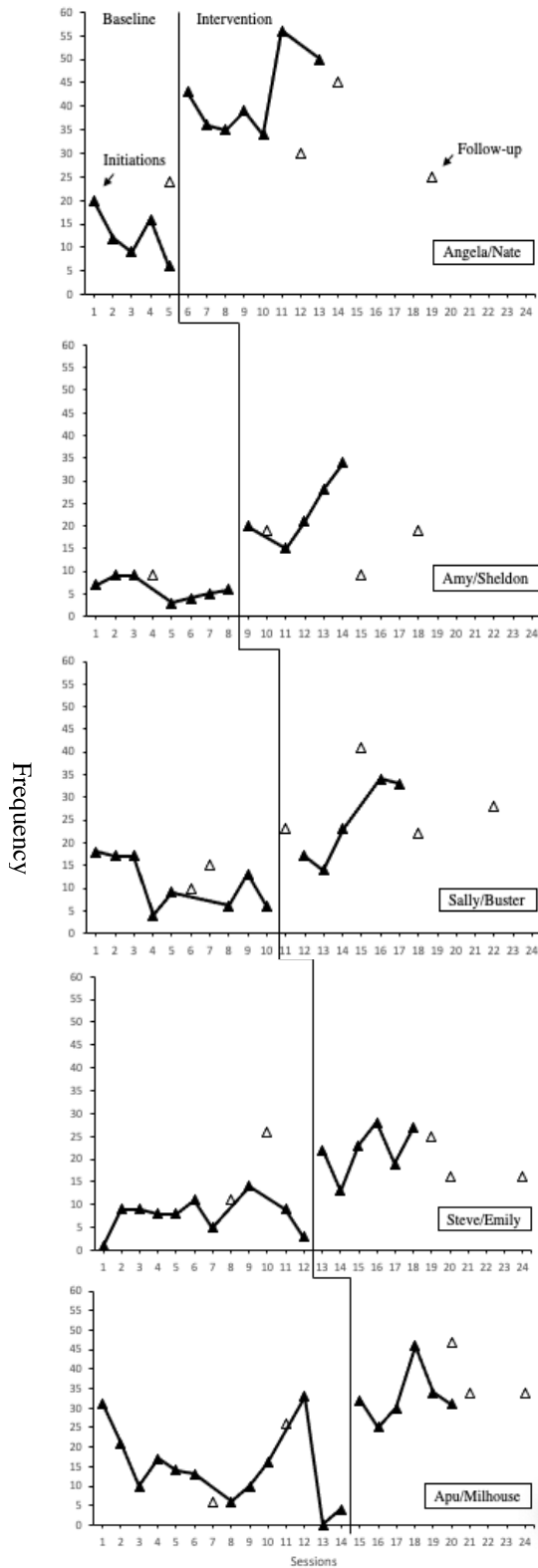
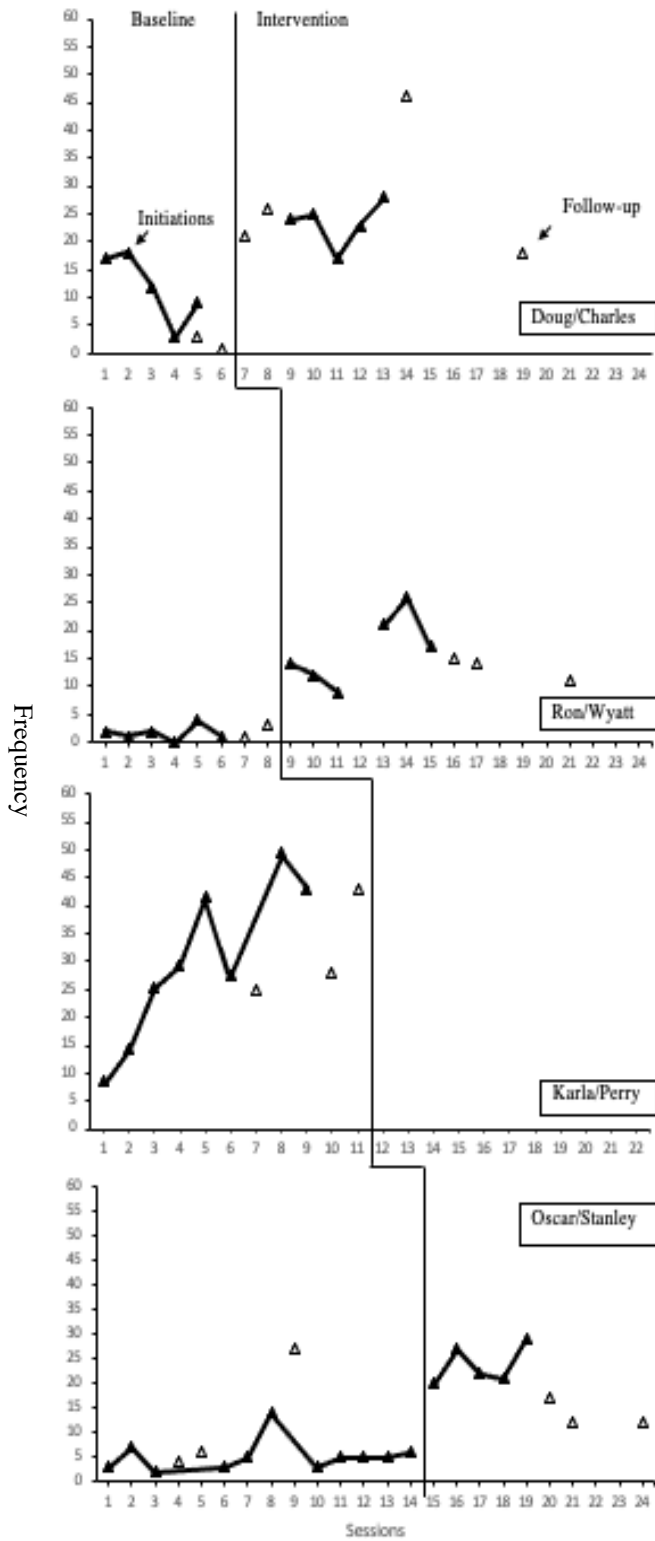


Figure 6

Frequency of NT Sibling Initiations in MBD 2



Both scores indicate a strong effect. Ron and Wyatt had a medium effect size for reciprocal play (Tau-U= 0.78). For Ron, Tau-U scores were 0.78 for fidelity of implementation and 0.89 for frequency of initiations. Both of these scores indicate a medium effect size. Lastly, Oscar and Stanley had a Tau-U score of 1.00 for reciprocal play. For Oscar, Tau-U scores were 1.00 for fidelity of implementation and 0.71 for frequency of initiations. There was a large effect for fidelity of implementation and a medium effect for frequency of initiations. See Table 6.

Table 6

Tau-U Results

Dyads	Tau-U		
	Reciprocal play	Fidelity	Initiations
Angela/Nate	0.89	1.00	1.00
Amy/Sheldon	1.00	1.00	1.00
Sally/Buster	0.98	1.00	1.00
Steve/Emily	0.78	1.00	0.92
Apu/Milhouse	1.00	0.92	1.00
Doug/Charles	1.00	1.00	1.00
Ron/Wyatt	0.78	0.89	1.00
Oscar/ Stanley	1.00	1.00	0.71

Results of BC-SMD

SMD is a between case effect size appropriate for single case designs (Valentine et al., 2016). SMD was calculated at the study level using an online calculator (<https://jepusto.shinyapps.io/scdhlm/>). Cohen's d was used to interpret the findings where a small effect is 0.2 or below, a medium effect is 0.5 or above, and a large effect is 0.8 or above (Cohen, 1988). There was a large effect size for sibling fidelity of implementation ($d = 2.21$ [1.54, 2.87]). Reciprocal play also had a large effect size ($d =$

1.89 [1.27, 2.5]). The frequency of initiations had a large effect size ($d = 1.98$ [1.28, 2.67]).

Pre and Post Assessments

Pre and post assessments of the NT siblings in both the BST plus sibling support group and BST only group were compared. Both groups had increased scores in the post assessment for the Sibling Relationship Questionnaire and the Self-Efficacy Questionnaire. The BST plus social skills group increased their knowledge about ASD, while there was no change ASD knowledge in the BST only group. The comparison of the pre and post assessments for both treatment groups are presented in Table 7.

Social Validity Ratings

Self-evaluations of social validity of this study were collected from NT siblings and parents at the end of the study. Overall, the ratings on effectiveness, feasibility, and likability were generally high for both the play intervention and the sibling support group. The self-evaluation form had questions from the least acceptable (rated 1) to the most acceptable (rated 5). The overall rating for the play intervention from NT siblings was 3.8 and the overall parent rating was 4.3. The highest rated questions from siblings on the play intervention were “The play tips helped me play with my sibling better” and “I feel closer towards my sibling after the intervention”. Some of the NT sibling comments included “*We really built up our friendship... we had to play together and got to play with new toys*” and “*We can be normal brothers and connect with each other... I got to bond with my brother and it was a way to squeeze in time with him.*” See Table 8.

Table 7***Pre and post assessments for MBD 1 and MBD 2***

Participant	MBD 1		Participant	MBD 2			
	Pre-assessment	Post-assessment		Pre-assessment	Post-assessment		
Angela	SRQ	28	36	Doug	SRQ	23	35
	Self-efficacy	23	25		Self-efficacy	16	16
	ASD knowledge	10	11		ASD knowledge	10	11
Amy	SRQ	36	34	Ron	SRQ	36	33
	Self-efficacy	14	26		Self-efficacy	24	21
	ASD knowledge	5	8		ASD knowledge	10	10
Sally	SRQ	12	20	Karla	SRQ	26	36
	Self-efficacy	13	19		Self-efficacy	14	28
	ASD knowledge	8	13		ASD knowledge	10	7
Steve	SRQ	38	42	Oscar	SRQ	20	24
	Self-efficacy	23	31		Self-efficacy	20	23
	ASD knowledge	8	9		ASD knowledge	10	12

Table 7 (Cont)

Participant		Pre- assessment	Post- assessment			Pre- assessment	Post- assessment
Apu	SRQ	20	26				
	Self-efficacy	22	23				
	ASD knowledge	8	12				
MBL 1 mean	SRQ	26.8	31.6	MBL 2 mean	SRQ	26.25	32
	Self-efficacy	19	24.8		Self-efficacy	18.5	22
	ASD knowledge	7.8	10.60		ASD knowledge	10	10

Table 8*NT Sibling Evaluation of the Play Intervention*

Item		Mean	Range
1	Did you like learning about and using the play tips?	3.9	1-5
2	The play tips helped me play with my sibling better.	4.3	3-5
3	After learning the play tips, I play with my sibling more.	3.1	2-5
4	I feel closer to my sibling after the intervention.	4.5	4-5
5	I still use the play tips with my sibling when we play.	2.9	1-4
6	I would recommend the play tips to others.	3.9	2-5

Note. The self-evaluation form had questions from the least acceptable (rated 1) to the most acceptable (rated 5).

The highest rated questions from parents included “I would recommend the play intervention to other parents of children with ASD” and “The training sessions were helpful for my child to accurately implement the play strategies”. Some of the parents comments included “*The sibling program is important and would greatly benefit our community. I do wish there was some type of parent training as part of this because I think there would be more success with continued practice outside the research sessions. Overall, I felt and my kids said that this has been a success for more positive play interactions.*” and “*Since participating in this study, both my children are enjoying each other a whole lot more. My NT child now has some power to get my autistic child engaged and I have seen their relationship grow.*” See Table 9.

Table 9*Parent Evaluation of the Play Intervention*

Item		Mean	Range
1	The play intervention was effective for increasing the play behaviors of my NT child.	4.4	4-5
2	The play intervention was effective for increasing the play behaviors of my with ASD.	3.75	1-5
3	The play intervention was effective for increasing my children's' play outside of the research sessions.	3.6	3-5
4	The procedures were easy for my child to implement.	4.4	3-5
5	the training sessions were helpful for my child to accurately implement the play strategies.	4.6	4-5
6	The duration of each session was appropriate.	4.4	2-5
7	My child is able to use the strategies outside the research sessions.	3.6	3-5
8	I recommend the play intervention to other parents of children with ASD.	4.9	4-5
9	The play intervention was useful in enhancing my children's relationship.	4.4	4-5
10	Both of my children enjoyed being a part of this study.	4.5	4-5

The overall NT sibling rating for the sibling support group was 4.25 and the overall parent rating was 4.08. The NT siblings rated the following questions the highest, “I would recommend the sibling group to others” and “I liked going to the sibling support group”. Some of the NT siblings comments included “*I liked that I got to share some things and saw I felt the same way as others*” and “*I liked being able to hang out and talk, but I wish the sibling group was separated by ages... it would have been better to have only older kids with me.*” The overall NT sibling rating for the sibling support group was 4.25 and the overall parent rating was 4.08. The NT siblings rated the following questions

the highest, “I would recommend the sibling group to others” and “I liked going to the sibling support group”. Some of the NT siblings comments included “*I liked that I got to share some things and saw I felt the same way as others*” and “*I liked being able to hang out and talk, but I wish the sibling group was separated by ages... it would have been better to have only older kids with me*. Parents rated “The support group was beneficial for my child” and “I would recommend the support group to others.” Some of the parent comments included “*I loved the idea of the support group and noticed my daughter became much more aware of what ASD is*” and “*The sibling group was great for my daughter because it showed her she wasn’t the only one and what things might look like in the future for her brother.*” The questions on the social validity form and mean ratings are presented in Table 10-11.

Table 10

NT Sibling Evaluation of the Support Group

Item	Mean	Range
1 I liked going to the sibling support group.	4.4	3-5
2 I learned more about what is autism is in the sibling group.	3.8	3-5
3 I liked being around other kids with siblings with ASD.	4.2	4-5
4 I would recommend the sibling group to others.	4.6	4-5

Note. The self-evaluation form had questions from the least acceptable (rated 1) to the most acceptable (rated 5).

Table 11

Parent Evaluation of Sibling Support Group

Item		Mean	Range
1	The support group was beneficial for my child.	4.4	4-5
2	The take home activities were helpful and feasible.	4.4	3-5
3	My child made connections with other children in the sibling group.	3.0	2-4
4	The duration of each the sibling group was appropriate.	4.0	3-5
5	I would recommend the support group to others.	4.6	4-5

Note. The self-evaluation form had questions from the least acceptable (rated 1) to the most acceptable (rated 5).

Summary of Findings

Research Question One

Is there a functional relation between the sibling training and coaching on the STEPS intervention and an increase in the NT sibling fidelity of implementation? To answer this research question, data were collected on NT siblings use of the play strategies during the ten minute play probe. Siblings needed to use each play strategy at least once during a one minute interval to indicate use of the strategies during that minute. The data of percentage of play strategies used were graphed, visually, analyzed, and further analyzed through non-parametric and parametric analyses. Visual analysis of the first multiple baseline graph suggested a strong basic effect for Angela, Amy, and Apu. Moderate basic effects were found for Sally and Steve. The visual analysis for the second multiple baseline graph indicated strong basic effects for Doug, Ron, and Oscar. There was an increasing baseline trend for Karla, therefore, no training occurred for this dyad. Overall, there was a functional relation between the sibling training and coaching

on the STEPS intervention and an increase in the level of NT siblings' use of strategies. Non-parametric and parametric results confirmed similar results to visual analysis. The omnibus Tau-U effect size for fidelity of implementation was 0.98 which indicated a large effect. The BC-SMD also indicated a strong effect ($d = 2.21$).

Research Question Two

Is there a functional relation between the sibling training and coaching on the STEPS intervention and an increase in the level of reciprocal play? To answer this research question, data were collected on the percentage of reciprocal play between siblings. The data collected were graphed, visually analyzed (i.e., level, trend, variability, overlap, immediacy of effect, consistency of effect across dyads, and vertical analysis), and also analyzed through non-parametric and parametric analyses. Visual analysis of both concurrent multiple baselines designs indicated positive results on reciprocal play for all the dyads. The first multiple baseline graph indicated a strong basic effect for Angela/Nate, Amy/Sheldon, Steve/Emily, and Apu/Milhouse. There was a moderate basic effect for Sally/Buster. The second multiple baseline graph indicated a strong basic effect for Doug/Charles and Oscar/Stanley. There was a moderate basic effect for Ron/Wyatt. However, there was an increasing baseline trend for Karla/Perry and no intervention was implemented for this dyad due to the inability to demonstrate a need for the intervention. Overall, at the study level there was a functional relation between the sibling training and coaching on the STEPS intervention and an increase in the level of reciprocal play. Non-parametric and parametric results confirmed similar results to visual analysis. The omnibus Tau-U effect size for fidelity of implementation was 0.93 which indicated a large effect. The BC-SMD also indicated a strong effect ($d = 1.89$).

Research Question Three

Is there a functional relation between the sibling training and coaching on the STEPS intervention and an increase in the NT sibling frequency of initiations? This research question was answered by collecting frequency data on NT sibling initiations. The data were graphed, visually analyzed, and further analyzed using non-parametric and parametric approaches. Visual analysis for the first multiple baseline graph suggests a strong basic effect for Angela, Amy, and Steve. There were moderate basic effects for Sally and Apu. The second multiple baseline graph indicated a strong basic effect for Ron and Oscar. Doug had a moderate basic effect for frequency of initiations. There was an increasing baseline trend for Karla, thus, no intervention was completed with that sibling dyad. Overall, there was a functional relation between the sibling training and coaching on the STEPS intervention and an increase in the frequency of NT siblings' initiations. Non-parametric and parametric results confirmed similar results to visual analysis. The omnibus Tau-U effect size for fidelity of implementation was 0.95 which indicated a large effect. The BC-SMD also indicated a strong effect ($d = 1.98$).

Research Question Four

Do the NT siblings and parents perceive the intervention as feasible, acceptable, and effective? To answer this research question, the NT siblings and parents rated a Likert scale for the intervention components they completed (i.e., play intervention, sibling support group). The findings from these ratings were overall positive from both siblings and parents in the direction of acceptable, effective, and feasible ratings. NT siblings felt that the play intervention helped them play with their sibling with ASD better ($M = 4.3$) and reported feeling closer with their sibling after the intervention ($M = 4.5$).

However, two of the NT siblings reported that they did not like learning about and using play strategies. Both of these siblings presented their concerns and hesitation about wanting to participate during the intake meetings, but still assented to the study. They NT siblings commented that *“I wish the intervention was not about play. My brother needs to talk and listen better before we can play”*, and *“My mom would always get mad at me and give me looks... she thinks everything is my fault.”* However, parents’ ratings indicated they perceived that both children enjoyed being in the intervention ($M = 4.5$). NT siblings rated using the play strategies outside of play sessions ($M = 2.9$) and playing more with their siblings after the intervention ($M = 3.1$) the lowest. It appears that although the play strategies did help NT siblings play better and more effectively with their siblings with ASD, they did not perceive they were using the play strategies after the final intervention session. Parents’ ratings also confirmed that NT siblings were not using the play strategies as much outside the research sessions ($M = 3.6$) and the amount of play did not increase (3.6). One parent reported, *“I didn’t facilitate any play between my kids before the play sessions. I am hoping to get them together more in the future and I believe the strategies will help.”* Parents agreed that the play intervention increased the positive play behaviors of the NT siblings ($M = 4.4$) and the strategies were easy for their NT child to implement ($M = 4.4$). Specifically, one father reported, *“We saw several instances of our kids employing strategies learned from the sessions in later play.”*

NT siblings rated the sibling support as acceptable and feasible. The five NT siblings enjoyed participating in the sibling support group ($M = 4.4$) and liked being around other children with brothers and sisters with ASD ($M = 4.2$). Siblings reported liking the activities, *“The crafts were really fun.”*, however, a couple of siblings reported

that they wished they had “*Some more time for the group activities*”, and “*Wished the support group was longer.*” While some of the NT siblings perceived they did not learn a lot more about ASD ($M = 3.8$), all of the NT siblings scored higher on the post assessment of the Autism Knowledge Questionnaire (Gillespie-Lynch et al., 2015). Parents also rated the support group as acceptable and feasible. Parents felt the support group was beneficial for their child ($M = 4.4$) and believed the take home activities were helpful ($M = 4.3$). One parent reported that their son “...*was able to articulate things he learned each session, and would repeat the fun facts (such as famous people with ASD) to us later.*” The lowest rated question was “My child made connections with other children in the sibling support group.” The online modality of the support group may have hindered the ability of NT siblings to make stronger connections with one another.

CHAPTER IV

DISCUSSION

In this chapter, the major findings of the current study are interpreted. The results of each research question and findings of interest are discussed. Next, implications for practice, limitations of the current study, and recommendations for future research are addressed.

Play skills are crucial to build positive relationships between NT siblings and their brother or sister with ASD (Dunn et al., 1994). During the novel coronavirus (COVID-19) pandemic of 2020-2021, siblings spent an accumulating amount of time together inside the home. Thus, improving positive social interactions between siblings may have had increased value for families during this time period. Within the Family-Systems Model, sibling relationships play an important and unique role in the overall family quality of life (Cebula, 2012). When sibling conflict arises, not only can it hinder the quality of the sibling relationship, but it can also have collateral effects on the parents' relationship as well as the parent-child relationships. Family-centered intervention approaches are considered best practice within the fields of ABA and early intervention (Antill, 2020; Dunst, 1985). This includes involving parents in goal and treatment planning in addition to training and empowering parents to implement interventions (Antill, 2020). However, there is currently no best practice for how to include siblings within the scope of ABA service delivery even though they are an integral piece of the Family-Systems Model. The current study aimed to empower NT siblings by giving them tools to play with their brother or sister with ASD in a more positive way as well as providing them a space to voice their concerns and future goals.

Limited research exists in the area of peer and sibling-mediated interventions via telehealth. With the reduced availability of professional and educational supports because of circumstances related to the COVID-19 pandemic, delivery of services via telehealth to families of children with ASD have made interventions more accessible. The pandemic resulted in a challenging period for over 90% of families surveyed with a majority of parents reporting increases in challenging behaviors during both free times and structured times (Colizzi et al., 2020). Additionally, only a small number of the families were receiving any services. A recommended pathway to maintain services is through telehealth care delivered to and mediated by parents or other family members (Ameis et al., 2020). While some parents may need to work full time at home, it is important for other family members including siblings to be comfortable and confident supporting the delivery of modified services to their brother or sister with ASD. This study is the first study to investigate the effectiveness of a sibling-mediated intervention via telehealth.

Findings of Interest and Future Research Directions

Effectiveness, Feasibility, and Acceptability of the Intervention

The STEPS intervention was effective at increasing NT siblings' ability to use play strategies with their brother or sister with ASD. Fidelity of implementation results are similar to other sibling-mediated interventions (Shivers & Plavnick, 2015). Spector and Charlop (2018) trained three NT siblings to use a naturalistic based approach to increase children with ASD spontaneous vocalizations. All siblings were able to use the strategies appropriately during intervention. Furthermore, siblings have also been effective intervention agents to increase social behaviors of their brothers or sisters with ASD (Oppenheimer-Leaf et al., 2012). Modeling and role playing may be the best

approach to train children in using simple ABA strategies to use with their siblings with ASD. In past research, both video modeling and BST have been effective methods to increase sibling fidelity of implementation (Kryzak & Jones, 2017; Spector & Charlop, 2018). However, younger children (i.e., ages 7 and under) have needed additional support in place including supplementary prompting and reinforcement to correctly use all strategies with their brother or sister with ASD (Neff et al., 2017). The younger siblings in this study also needed additional supports including prompting the sibling to use the strategies at least every minute. Based on these findings, scaffolding training and coaching approaches based on sibling age is encouraged.

In this current study, the intervention package was effective in increasing reciprocal play between siblings. These findings are similar to other sibling-mediated interventions that have targeted social and play skills (Oppenheimer-Leaf et al., 2012; Baker, 2000). Specifically, Bene & Lapina (2020) conducted a meta-analysis on sibling-mediated interventions and found a medium effect size ($NAP = 0.80$) for studies that targeted play and social skills. While social skills increased during intervention across sibling-mediated studies, results on maintenance and generalization have been variable. Baker (2000) incorporated ritualistic interests of children with ASD into the intervention and social play between siblings maintained for 1 month and 3 months across the sibling dyads. However, joint engagement between siblings during play only maintained for some of the sibling dyads during follow-up probes after reciprocal imitation training (Walton & Ingersoll, 2012). This current study had high levels of reciprocal play during intervention, however, the percentage of intervals with reciprocal play decreased over time.

The frequency of sibling initiations towards their brother or sister with ASD increased during the intervention phase in this study. While this dependent variable for NT siblings is limited in previous research, Watkins et al (2020) had similar positive results in increasing initiations after training siblings in a naturalistic behavioral intervention. NT siblings had increases in the frequency of initiations directed towards their brother or sister; however, initiations were quite variable during intervention and only generalized across settings for some siblings. This current study also confirms training siblings in naturalistic behavioral strategies increases their frequency of initiations directed towards their siblings. Frequency of NT sibling initiations towards their brother or sister with ASD was found to be associated with the frequency of ASD child prosocial behaviors (Rum et al., 2020). As NT siblings provide more social opportunities for their brother or sister, they are both able to practice more prosocial behaviors. It is important for future studies to continue to track prosocial sibling behaviors apart from fidelity of implementation.

Pre-post assessments for NT siblings indicated positive results for both groups (i.e. those receiving BST only and those receiving BST and a sibling support group). A majority of NT siblings in both groups reported increases in sibling relationship quality and self-efficacy. Siblings in the support group demonstrated increases in ASD knowledge. Pre-assessment results for sibling relationship quality and self-efficacy were similar across both groups. However, the mean of siblings in the BST only group scored about 2 points higher on the autism knowledge assessment in the pre-assessment. Increases in the sibling relationship quality were similar across both groups ($M= 31.6$, $M= 32$). This suggests that the play intervention alone is enough to increase the perceived

relationship quality between siblings. Positive sibling play and interactions concurrent with adult reinforcement for positive sibling interactions could act as the driving force to increase perceived relationship quality for NT siblings (Hastings, 2003; Tsao et al., 2012). Two of the NT siblings (e.g., Amy and Ron) reported small decreases in quality of their relationship with their sibling with ASD via the SRQ during the post assessment. Amy's brother, Sheldon, had increasing rates of cursing at her throughout the study. Amy would start crying or elope the play area after instances of cursing; these negative interactions certainly could have affected her perceived relationship quality with her brother. Ron and Wyatt had the least amount of reciprocal play compared to all other dyads. While there was an increase in reciprocal play during intervention, play was occurring less than a third of time during play probes. This amount of reciprocal play may have been too low for Ron to perceive any differences in relationship quality with his brother. It is also interesting to note that Karla reported a 10 point increase in perceived relationship quality with her brother even without the implementation of any intervention. Increased positive time playing between siblings paired with adult reinforcement for playing together nicely could increase perceived sibling relationship quality.

Increases in the self-efficacy assessment were similar across both groups ($M = 24.8$, $M = 22$) during the post assessment. Even though both groups received BST, siblings in the support group had higher scores in self-efficacy during the post assessment. The support group may have had an additive effect on self-efficacy for playing with their brother or sister with ASD. As siblings shared their experiences with one another, they may have learned their struggles with their brother or sister were not as

unique as previously thought (Petalas et al. 2012). This shared experience could have increased self-efficacy for siblings in the support group. Ron was the only sibling who reported a small decrease in self efficacy for playing with his brother during the post assessment. Again, this could be due to the fact of the low level of reciprocal play during intervention for these two siblings. Even with the increasing amount of strategies used, the percentage of reciprocal play may have been too low for Ron to feel confident playing with his brother. In contrast, Karla reported a large increase in her self-efficacy of playing with her brother even in the absence of BST. Because Karla and Perry had an increasing level of play during baseline, Karla may have felt more confident with her skills to play with him and did not need extra support after experiencing initial success during baseline.

Siblings in the support group increased their knowledge of ASD while siblings in the BST only group maintained the same mean score in ASD knowledge. However, NT siblings in the support group scored a mean of 7.8 on the ASD knowledge while NT siblings in the BST only group scored a 10 on the pre-assessment. The mean ASD knowledge score for the NT siblings in the support group increased to 10.6 at the post-assessment and the BST only group remained at 10. Consistent with previous support group literature, ASD knowledge increased for those in the support group in this current study (Christopher & Shakila, 2013). Providing psychoeducation on ASD symptomology was effective in increasing ASD knowledge for the siblings participating in the support group.

Differing Levels of Sibling Support

While not surprising, it is interesting to note that the sibling dyads in this study needed differing levels of support throughout the intervention. The consistent structure, clear expectations, and novel toys that facilitated play may act as the first level of support needed to increase positive play between siblings. For example, Karla and Perry had an increasing baseline trend and a high level of reciprocal play at the end of baseline. Karla reported not trying to play with her brother before the study because they did not know what to play. The addition of developmentally appropriate turn taking games like Pop the Pig and Animal Sequence facilitated reciprocal play between them. As the baseline sessions continued, it appeared that Karla and Perry were clear about the expectations of staying and playing with each other for 10 minutes and did not need any reminders or prompts to stay in the area to play. The included structure of providing times to play with expectations as well as having appropriate toys to facilitate turn taking may act as the first level of play support for families and could be sufficient for increasing reciprocal play for some siblings.

There were also families in the study who may have needed additional supports. For example, Ron had trouble attending to the camera and listening to prompts. He often wanted to hide under the bed or out of sight of the video camera because he reported he was feeling shy. Face to face delivery of the intervention may have been more beneficial for this sibling as the researcher may have more easily built rapport and modeled the play strategies. Also, the selected play strategies for this study did not address siblings arguing or fighting with one another. Sally and Buster as well as Amy and Sheldon would engage in verbal and physical altercations quite frequently throughout baseline and intervention

sessions. Both of these dyads (i.e., NT siblings and children with ASD) engaged in name calling, destroying materials, and pushing one another. While the researcher would remind the sibling dyads to use nice words and have a safe body, the play strategies did not target or significantly reduce the negative interactions. Other interventions including differential reinforcement of lower rates (DRL; Dietz & Repp, 1973) of these types of behaviors would also be necessary.

Based on these findings, researchers should consider determining variables associated with the need for individualized behavior intervention plans prior to sibling intervention based off screening questions and observational assessments. Aggression can be a significant problem for families of children with ASD. Out of a sample of 1584 children enrolled in the Autism Treatment Network, over half of the sample reported experiencing significant levels of aggression (Mazurek et al., 2013). Aggression directed towards a sibling can have lasting detrimental effects on emotional well-being and relationship quality (Koegel et al., 1998). Screening questionnaires including topography and functions of challenging behaviors such as the Question about Function (QBF; Paclawskyj et al., 2000) or the Functional Analysis Screening Tool (FAST; Iwata et al., 2013) will be crucial in developing effective behavior intervention plans. It would be beneficial for future research to also track parent fidelity of implementation on the behavior intervention plan as well as tracking the frequency of challenging behaviors during the play sessions. Future directions should also determine which sibling dyads would benefit from the full intervention package and what siblings only need a lower level of support (e.g., structure, novel toys, positive reinforcement). A sequential multiple

assignment randomized trial (SMART) design would be beneficial in determining scaffolding level of supports for sibling dyads.

Sibling Support Group

As a majority of the NT siblings attended school online for the 2020 school year due to COVID-19 pandemic, a majority of the siblings reported being comfortable on Zoom. NT siblings ages 7-11 attended the weekly support group. It was interesting to note that the siblings ages 9 and up reported liking to have more time to discuss and talk about the weekly topics, while the younger siblings reported wanting more time to engage in the activities and projects. This divergence could be due to the developmental differences and abilities of children to reflect on emotion-mood relations. While younger children are able to explain that feeling sad or happy is likely to change someone's behaviors, children 8 and older are able to reason that both anger or sadness can lead to a loss of self-control (Bretherton et al., 1986). Furthermore, the capacity to talk about complex emotions warrants a higher level of intersubjectivity than nonverbal communication of emotions. Future sibling support groups can be structured to fit the age group and needs of the siblings with older groups focusing more on discussion of feelings and emotions while younger groups could incorporate more activities. The online sibling support group was thirty minutes long, however, a longer duration may have allowed time for both longer discussions and enough time for the siblings to complete the activities without feeling rushed.

All of the NT siblings participated in the support group and shared their opinions on the weekly topics. The siblings disclosed personal information to one another as well as offered each other support and compassion. Siblings described times when they felt

embarrassed such as when their brother stole a stranger's food or when their sibling was screaming in the movie theater. Other tough feelings siblings experienced included how it felt like their siblings with ASD got more praise and toys than they did, feeling they had to share their belongings more than they wanted to, and not being appreciated the same because their sibling's successes were more exciting. These findings are congruent with the current literature on sibling experiences (Corsano et al., 2017). Corsano and colleagues (2017) found that siblings identified feeling embarrassed due to challenging behaviors displayed in public and reported an advanced sense of responsibility within the family. NT siblings were also able to describe positive attributes they had learned from being a sibling of a child with ASD such as being better at sharing, learning new things, becoming more patient and responsible, and being kind. Ward (2016) found similar positive experiences described by NT siblings about unconditional love and patience that they learned from their sibling. It appears that the sibling support group was a safe space for NT siblings to share their tough feelings as well as recognize their positive strengths. A majority of the NT siblings reported "*It was nice to know that they were not the only person who had these feelings*" during the social validity assessment. Positive results have also been found in the limited research on sibling support groups (Haukeland et al., 2020; Jones et al., 2020). Jones et al (2020) conducted a RCT comparing a support group to an attention only group for NT siblings and found siblings in the support group improved more in coping skills and parent reported externalizing behaviors. However, this study did not include information on social validity of the support group. SIBS, a manual based group intervention for siblings of children with chronic disorders, was assessed for initial feasibility and likability by both NT siblings and parents (Haukeland

et al., 2020). Siblings indicated high satisfaction with the interventions and parent reports reflected high approval with the intervention as well.

Future research is needed to examine the effectiveness of sibling support groups on NT siblings' internalizing and externalizing behaviors, knowledge of ASD, and perceived sibling relationship quality. NT siblings are at a high risk of internalizing difficulties such as anxiety, depression (Shivers et al., 2019), and poor maladjustment (Benson & Karlof, 2008). Support groups are one way to support NT siblings to improve mental health outcomes (Jones et al., 2020). Future research should utilize a randomized control trial for NT siblings receiving the sibling support group compared to NT siblings receiving a psychoeducational curriculum about ASD symptomology to uncover differences of ASD knowledge alone from the supportive nature of a support group.

Telehealth Delivery of Services

While the delivery of the intervention via telehealth allowed for sibling dyads across the United States to participate, the virtual implementation of sibling-mediated interventions also posed unique challenges. First, collecting reliable and accurate behavioral data for reciprocal play was challenging as it was hard to have both children facing the camera during the observation. Furthermore, it was hard to clearly hear and pick up all the initiations when there was background noise in the house. More sophisticated cameras and microphones will be needed to more accurately capture and reliably code behavioral data on sibling interactions. The following technology is recommended for future research to capture online sibling interactions: Logitech™ web cameras, A Swivl which has the ability to rotate 360 degrees to follow and record interactions, telepresence robots in which a tablet is mounted on a wheel base, and blue

tooth headphones (Zoder-Martell et al., 2020). Brief technology checks prior to the start of the study were helpful to decrease technology glitches, set up play zones, and assist parents in problem solving how to operate Zoom. These findings align with literature on the use of telehealth more broadly in relation to children with ASD. Parents have been able to successfully conduct functional behavioral assessments and treatments while receiving online coaching, however, connectivity issues and reducing hardware costs have been barriers to telehealth interventions (Lee et al., 2015). In order to reduce technological barriers, researchers need to have IT support available in order to provide guidance on troubleshooting video problem or audio problems as well as create task analyses for navigating different platforms (Lee et al., 2015; Lermon et al., 2020).

Interventionists may need to plan ways to build rapport online with both children before the implementation of intervention. Allowing children to pick out small prizes they wanted to earn and engaging their help in choosing future toy purchases were helpful strategies in building initial rapport. Other rapport building strategies included changing Zoom backgrounds to child interests (e.g., Disney themed, space themed, or sports themed), spending a few minutes playing online games or watching short music videos together prior to the study, and providing behavior specific praise. Pairing which involves imitating the child's actions, engaging in preferred activities, and delivering preferred items to the client can build therapist-child rapport (Lugo et al., 2017). Pairing has been shown to reduce challenging behaviors in young children with ASD (McLaughlin & Carr, 2005). Also, interventionists will need to pay special attention when conducting virtual preference assessments to identify putative reinforcing play activities. For this current study, a video based forced choice preference assessment

(Brodhead & Rispoli, 2017) was used for the NT siblings and some of the children with ASD that could attend to a PowerPoint and point to indicate a choice. Four of the children with ASD (Milhouse, Nate, Wyatt, and Stanley) were not able to complete the video based preference assessment, so parents reported their child's preferences. Mailing a set of toys and coaching parents through a multiple stimulus without replacement or free operant preference assessment may be a preferred way of assessing preferences (Tullis et al., 2011), but has an added material and mailing cost.

The use of the video models shared using Zoom's screen share function during BST sessions with NT siblings was helpful in modeling each play skill. The use of video models allowed the researcher to model the play skills and desired play interaction with another person as well as what to do when the play strategy did not work the first time. Some of the challenges with role playing the skills via Zoom included having the NT siblings interact with the researcher via Zoom as if they were in the same room and playing with the same toy. For example, the researcher would say "*Pretend I am your brother and I am really interested in playing with the marble run. What would you do to follow my lead?*" While most of the siblings understood the abstract situation and would pretend to then follow the researcher's lead by also playing with the marble run, not all the siblings were able to do so. Some of the younger NT siblings (Ron and Amy) needed to role play with an adult in the house while the researcher instructed the parents. Utilizing parents for role playing via telehealth may be helpful to increase sibling understanding and practicing of the play skills. Successful role playing of the skills with immediate feedback is the driving force of skill acquisition within BST (Nuernberger et al., 2013).

Randomization Designs

A randomization technique was used to randomly assign sibling dyads to one of the two independent multiple baseline designs and to assign intervention order (e.g. when a dyad entered intervention). This double randomization technique enhances internal validity within a single-case design study (Heyvaert & Onghena, 2014). However, this study also took a response guided approach for intervention start point based on the stability of the baseline data. The response guided approach for start point paired with the randomization technique for deciding intervention order did create issues within the second multiple baseline design. The third dyad (Karla/Perry) was randomized to receive intervention third and dyad four (Oscar/Stanley) received intervention last. However, Karla and Perry had an increasing baseline trend, while Oscar and Stanley had stable baseline data. Since Karla and Perry were randomized to the third dyad to start intervention, Oscar and Stanley were kept in the baseline phase for a longer period of time. If studies are using a randomization approach to intervention order, researchers may also want to use a randomized start point as well to avoid keeping dyads in baseline for extended periods of time. A range bound randomization to approximate the staggers or start point could be used to more easily align with a response guided approach to single-case design (Kratowill & Levin, 2010). Furthermore, a randomization test using ExPRT could not be run without using some version of start point randomization (Levin et al., 2019). While randomization approach to single-case design can reduce threats to internal validity, a response guided approach to intervention may not always be compatible.

Limitations

The current study had several limitations. The first limitation was the lack of an experimental research question for the sibling support group. While this study did examine social validity and pre-post/measures for the two sibling groups, the design precludes conclusions about effectiveness or differences between the two groups. However, the self-evaluations from the NT siblings and parents suggest the support group is acceptable and feasible for NT siblings.

In addition, another limitation of this study is the observed decreases during the follow-up probe in level of NT siblings' behaviors (i.e., fidelity of implementation and frequency of initiations) and the percentage of reciprocal play. Follow-up probes were conducted from 2-4 weeks after the last play sessions and no priming, prompting, or reinforcement for using play strategies were used during the follow up. Furthermore, sibling dyads also used their own toys rather than the toy set provided by the researcher during the follow-up probes. Priming or the availability of the play strategies as a visual prompt may be pertinent for NT siblings to maintain use of the targeted play strategies. Parents and NT siblings also self-reported infrequently using the play outside the research sessions. Little is known about the maintenance of peers or siblings' use of strategies to facilitate play (Katz & Girolametto, 2013; Zagona & Mastergeorge, 2018). There is a unique need for future research to include maintenance of peers' and siblings' fidelity as well as social and behavioral outcomes for children with ASD. Parent training in supporting sibling play may be essential for long term maintenance of increased reciprocal play and sustained use of beneficial play strategies, such as those taught in this study. Caregivers have been effectively trained to provide positive reinforcement for

appropriate social interactions between siblings (Strain & Danko, 1995). However, no information was provided on maintenance or generalization of positive sibling interactions. Specifically, future research should focus on fading out reinforcement and prompting systematically during sibling play (Gunning et al., 2019).

The attrition in this current study is another limitation. The first dyad dropped out of the study before the baseline phase due to scheduling conflicts. This led to the second multiple baseline only having four dyads, rather than five dyads. The second sibling dyad (i.e., Karla/Perry) dropped out of the study after the completion of the baseline phase due to an increasing baseline trend across the dependent variables. The family was given a choice to stay in the baseline phase for the remainder of the study or to drop out of the study, and they chose the latter. The loss of this sibling dyad was due to insufficient demonstration of the target issues during baseline, thus, the exclusion of this dyad from intervention does not affect the study results (Fergusson et al., 2002). Furthermore, the post assessment results for Karla demonstrated 10 point increases on both the SRQ and the Self-Efficacy questionnaire suggesting that the structure of the baseline phase alone changed her perceptions of her relationship and confidence of her interactions with her brother. Future research is needed to identify the level of supports (e.g., structure and expectations or behavior skills training of the play strategies) needed for different types of sibling dyads.

Finally, the inclusion criteria for both NT siblings and children with ASD was fairly wide and NT sibling characteristics (e.g., strong conversational skills, developmentally appropriate play, vocalizing their desire to increase their interactions with their sibling with ASD) were determined by parent report and not directly measured.

Anecdotally, two of the NT siblings, Sally and Oscar, voiced their hesitation to participate in the study during intake but did agree to participate because their parents wanted them to. Both of these NT siblings continuously complained about their sibling during the BST sessions interfering with the successful role play of some of the play strategies. Furthermore, two of the younger NT siblings, Ron and Amy, also displayed conversational skills below their developmental level throughout the study including screaming and crying for up to five minutes instead of calmly asking for a turn or saying they are shy and need their mother's help to answer questions. Some children may require additional supports and some children may not be ready to take on the challenge of following a structured intervention. Autistic traits exist on a continuum and the broader autism phenotype is more likely to be found in siblings, however, it is controlled by sex (Ruzich et al., 2017). Screening tools such as the Autism-Spectrum Quotient (Baron-Cohen et al., 2001) and a tool to measure siblings' willingness and readiness to participate may help identify siblings who meet the desired inclusion criteria and may benefit the most from the intervention. Characteristics like children's age, birth order, gap in siblings' age, and gender could differentiate the effectiveness and appropriateness of the play intervention (Braconnier et al. 2018; Petalas et al. 2012). For these reasons, future research should focus on evaluating differentiating effects for sibling characteristics by narrowing the inclusion criteria to focus on certain groups.

Conclusion

The current study provides preliminary evidence that the STEPS intervention was effectively implemented by NT siblings when coached during the Zoom sessions. Furthermore, the intervention increased positive reciprocal play between siblings as well

as increased NT sibling initiations toward their brother or sister. The findings were positive for the majority of the sibling dyads across all dependent variables. Furthermore, the sibling support group was rated acceptable, feasible, and effective by both parents and NT siblings. The findings from this current study contribute to the body of sibling-mediated intervention and the quality of sibling relationships for families of children with ASD.

APPENDIX A
RECRUITMENT FLYER

NOW RECRUITING FOR:



**STEPS (SIBLING TECHNIQUES FOR
ENHANCING PLAY AND SUPPORT) FOR
STRENGTHENING THE SIBLING BOND
OF CHILDREN WITH AUTISM**

An online intervention.

The University of Oregon HEDCO Autism Research and Teaching Center is offering a free online play intervention for young children with autism and their sibling as part of a research study. Siblings will be trained to use simple play strategies with their brother or sister with autism. An online sibling support group will be offered during the intervention or after the play intervention.

This study is for children with autism ages 3-10 and neurotypical siblings ages 7-11. There will be biweekly 30 minute play sessions. Support group sessions will be offered once a week for 30 mins. You may decide to not participate at any time.

**PLEASE CONTACT LINDSAY GLUGATCH AT LGLUGAT2@UOREGON.EDU
FOR MORE INFORMATION**

APPENDIX B

DEMOGRAPHIC QUESTIONNAIRE

This is a survey to help us better understand our participants' backgrounds. Answering these questions is voluntary, however, your answers will help us understand the results of our study and how they may apply to other families.

After reading the following questions, please answer the questions.

Parent Information:

1. What is your date of birth? ____/____/_____
2. What is gender do you identify as? ___ Male ___ Female ___ Other
3. What is your relationship to the children participating in this study?

4. What is your marital status? _____
5. Annual income:
___ Less than \$10,000
___ \$10,000- \$19,999
___ \$20,000- \$29,999
___ \$30,000- \$39,999
___ \$40,000- \$49,999
___ \$50,000- \$59,999
___ \$60,000 or more
6. What is your highest education level achieved?
___ High school diploma or GED
___ Associate degree
___ Bachelor degree
___ Masters degree
___ Doctorate
___ Other
7. How many people are in your household?

Children: _____ Adults: _____
8. What language is primarily spoken at home?

Child with autism information:

9. What is your child's date of birth? ____/____/_____
10. What gender does your child identify as? ___ Male ___ Female ___
Other
11. What is your child's race/ethnicity?
___ White
___ Latin(X)
___ Black or African American
___ American Indian or Alaska Native
___ Asian
___ Native Hawaiian or Pacific Islander
___ Mixed
___ Other
12. What age did your child get an autism diagnosis or educational placement?

Neurotypical child information:

13. What is your child's date of birth? ____/____/_____
14. What gender does your child identify as? ___ Male ___ Female ___
Other
15. What is your child's race/ethnicity?
___ White
___ Latin(X)
___ Black or African American
___ American Indian or Alaska Native
___ Asian
___ Native Hawaiian or Pacific Islander
___ Mixed
___ Other

APPENDIX C

REINFORCER INVENTORY

REINFORCEMENT INVENTORY

Name: Date:

Completed by:

Items are to be marked with the appropriate code:

3 -Highly preferred 2 - Moderately preferred Specify & code 1 - Non-preferred

Child 1 _____

Edibles

Cookies _____
Chips _____
Pretzels _____
M & Ms _____
Popcorn _____
Chocolate _____
Marshmallows _____
Any allergies ? _____

Favorite treats? _____

Toys/games

Bubbles _____
Glitter objects _____
Spinning objects _____
Cars _____
Trains _____
Play food _____
Blocks _____
Numbers _____
Dinosaurs _____
Play animals _____
Magna-tiles _____
Puzzles _____
Matching games _____
Play dough _____
Stacking objects _____
Board games _____
Balloons _____
Painting _____
Balls _____
Coloring _____

Child 2 _____

Edibles

Cookies _____
Chips _____
Pretzels _____
M & Ms _____
Popcorn _____
Chocolate _____
Marshmallows _____
Any allergies ? _____

Favorite treats? _____

Toys/games

Bubbles _____
Glitter objects _____
Spinning objects _____
Cars _____
Trains _____
Play food _____
Blocks _____
Numbers _____
Dinosaurs _____
Play animals _____
Magna-tiles _____
Puzzles _____
Matching games _____
Play dough _____
Stacking objects _____
Board games _____
Balloons _____
Painting _____
Balls _____
Coloring _____

Favorite toys/items?

Favorite toys/items?

Comments: please list any toys or activities that your children love and common play routines where they can fight.

APPENDIX D

SIBLING RELATIONSHIP QUESTIONNAIRE - REVISED

(Buhrmester & Furman, 1990)

My name is _____ (completed by)

The phrase “this sibling” refers to _____ (completed about)

<p>1. Some siblings do nice things for each other a lot, while other siblings do nice things for each other a little. How much do both you and this sibling do nice things for each other?</p>	<p><input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> All the time</p>
<p>2. How much do you show this sibling how to do things he or she doesn't know how to do?</p>	<p><input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> All the time</p>
<p>3. How much does this sibling show you how to do things you don't know how to do?</p>	<p><input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much</p>

<p>4. Some siblings care about each other a lot while other siblings don't care about each other that much. How much do you and this sibling care about each other?</p>	<p><input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much</p>
<p>5. How much do you and this sibling go places and do things together?</p>	<p><input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much</p>
<p>6. How much do you and this sibling tease each other?</p>	<p><input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much</p>

7. How much do you and this sibling like the same things?	<input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much
8. How much do you admire and respect this sibling?	<input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much
9. How much does this sibling admire and respect you?	<input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much
10. How much do you and this sibling disagree and fight with each other?	<input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much
11. How much do you and this sibling cooperate and work together with other?	<input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much
12. How much do both you and your sibling share with each other?	<input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much
13. How much free time do you and this sibling spend together?	<input type="checkbox"/> Hardly at all <input type="checkbox"/> Not too much <input type="checkbox"/> Somewhat <input type="checkbox"/> Very much <input type="checkbox"/> Extremely much

APPENDIX E

SELF-EFFICACY QUESTIONNAIRE

(Muris, 2001)

Name: _____ Date: _____

Please fill in the circle to best answer each question.

Question	Not at all	Sometimes good	Okay	Good	Very Well
How well can you play games with your brother or sister?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well do you take turns with your brother or sister?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well can you tell your brother or sister to stop doing something you do not like?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well can you tell your brother or sister they did something cool or nice?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well can you prevent fights with your brother or sister?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well can you get your brother or sister to play something that you want to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well do you succeed in not worrying about your brother or sister?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well do you stay calm when your with your brother or sister?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How well can you express negative thoughts about your brother or sister?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How well can you express you positive thoughts about your brother or sister?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

APPENDIX F

AUTISM AWARENESS SCALE

Mark true or false for each item

1. Autism is more frequently diagnosed in males than females.
- 2. Children with autism do not show attachments, even to parents/caregivers.**
- 3. People with autism are deliberately uncooperative.**
4. Children with autism can grow up to go to college and marry.
- 5. There is one intervention that works for all people with autism.**
6. Autism can be diagnosed as early as 15 months of age.
- 7. With the proper treatment, most children diagnosed with autism eventually outgrow the disorder.**
8. People with autism show affection.
- 9. Most people with autism have low intelligence.**
10. Children with autism grow up to be adults with autism.
- 11. People with autism tend to be violent.**
- 12. People with autism are generally disinterested in making friends.**
13. People with autism have empathy.

Note: We added questions 11–13 to the scale. Bolded items are reverse scored.

Gillespie-Lynch K, Brooks PJ, Someki F, et al. (2015) Changing college students' conceptions of autism: an online training to increase knowledge and decrease stigma. *Journal of Autism and Developmental Disorders* 45(8): 2553–2566

APPENDIX G

DATA RECORDING SHEETS

Sibling Dyad:	Date:	Observer:
	Time Start:	Stop Time:
		IOA Observer:

Codes	Codes	Definitions
RP	<i>Reciprocal Play</i> <i>10-s whole interval</i>	<p>Reciprocal play is defined as the child being within 3 feet of the sibling and engagement in the same activity in interdependent or shared play for all 10 seconds.</p> <ul style="list-style-type: none"> - Handing materials (giving dice during board game) - Talking about the same activity (My car is fast too!) - Turn taking - You need the other person to engage in the activity
I	<i>Sibling Initiations</i> <i>Frequency Count</i>	<p>Initiations are defined as the typically developing sibling independently:</p> <ul style="list-style-type: none"> - Asking questions (Do you like the ball?) - Requesting items or actions (Throw it over here!) - Making a comment (Good job building) - Providing an invitation to play (Come play!) - Giving high fives or fist bumps <p>Initiations do NOT include comments/responses that are answering a question.</p> <ul style="list-style-type: none"> - If the ASD sibling asks “What color?” and the TD sibling says “red”. Red would NOT count as an initiation, but does indicate reciprocal play.

Play Activity:	Board Game	Pretend Play	Cooperative Play	Other
Indicate all that apply				

MIN	0-10s	11-20s	21-30s	31-40s	41-50s	51-60s	Frequency of Initiations
1	RP	RP	RP	RP	RP	RP	
2	RP	RP	RP	RP	RP	RP	
3	RP	RP	RP	RP	RP	RP	
4	RP	RP	RP	RP	RP	RP	
5	RP	RP	RP	RP	RP	RP	
6	RP	RP	RP	RP	RP	RP	

7	RP	RP	RP	RP	RP	RP	
8	RP	RP	RP	RP	RP	RP	
9	RP	RP	RP	RP	RP	RP	
10	RP	RP	RP	RP	RP	RP	

Notes: _____

Variables	Total	
Reciprocal Play	/60	%
Total Initiations		

IOA	Total		IOA % Agree
Reciprocal Play	/60	%	%
Initiations Per Minute	/6	%	%

Sibling Use of Play Strategies

FIDELITY SCORING: Angela Date: _____ Observer: _____

+	The play strategy was demonstrated at least one time during the minute.
—	The play strategy was NOT demonstrated the whole minute.

Following the lead/ offering choices	<p>The sibling should follow the child’s choice with toys and activities. The sibling should engage in the toy the child is interested in.</p> <p>The sibling gives choices to encourage turn taking or to choose a new activity (e.g., do you want red piece or blue piece, do you want ball or magnets?)</p>
Get attention before simple directions	<p>The sibling waits for child’s attention before giving instructions. The sibling should say the child’s name, tap them on the shoulder, or wait till they are looking before telling them what to do.</p> <p>*If no instructions were given, the interval will be marked a -</p>
Share information and persist through play	<p>The sibling shares information about what they are doing or what the child is doing (e.g., narrates animals talking, talks about what they are building).</p> <p>The sibling should persist through play even when child is unresponsive (e.g., providing multiple play prompts).</p>
Provide Praise	<p>The sibling provides praise for all attempts or successful turn taking interactions (e.g., thanks for sharing, that is cool, nice job).</p>

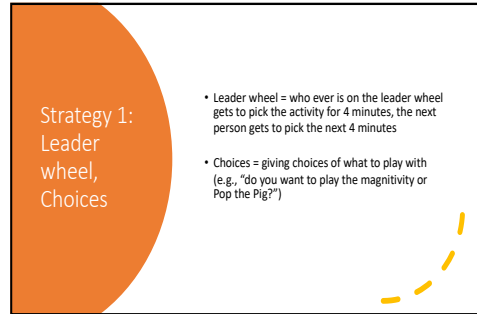
Minute	Following lead/choice	Get attention before instructions	Share information	Provide praise
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

APPENDIX H

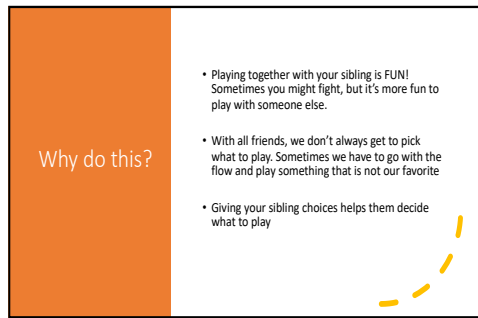
BEHAVIOR SKILLS TRAINING SLIDES



1



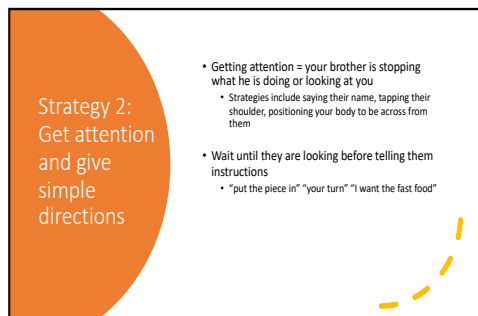
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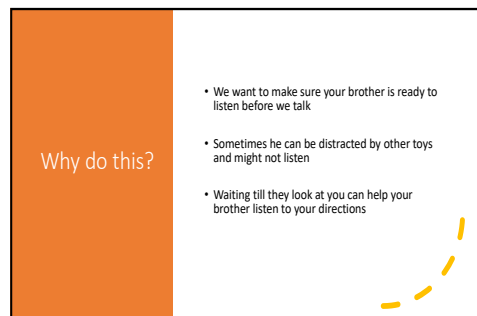
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4



5



6

APPENDIX I

SIBLING SUPPORT GROUP LESSONS

Week 1: Welcome Session

1. Mix and Meet with M&Ms (15 mins)
 - Give each person 5 M&Ms and tell a fact based on the colors
 - Blue= family, green=school, yellow=friends, red=hobbies, brown=music/movies
2. Common ground rules (10 mins)
 - Have the group come up with our rules and write them down
 - Confidentiality – what is talked about here, stays in here
 - Openness – it’s okay to talk about how you feel, we want you to share so you can get the most out of this
 - Respect – this is a safe space
 - Any feeling is an okay feeling, we all have negative feelings with our siblings
3. Take home activity #1 (3 mins)
 - a. 2 truths, 1 tale
 - b. Think of 2 truths and one lie to share with the group next week

Week 2: Autism Characteristics

1. Ice Breaker (5 mins)
 - a. Colored dot
 - b. Find your match without talking
2. HW Review (10 mins)
 - a. 2 truths, 1 tale
3. Leading Question “What is autism to you?” (15 mins) with comic
4. Group Activity (15 mins)
 - a. Make superhero cuffs (toilet paper rolls) or capes (table cloth)
 - b. Make example to show them (my super power is flexibility – have a yoga pose on the cuff)
5. Take home activity 2 (2 mins)
 - a. What is your brother/sister’s superpower? What is your superpower?

Week 3 : Attention and Fairness

1. Ice Breaker (5 mins)
 - a. Name Bingo
 - b. 4x4 grid, each person can only sign 2 boxes
2. Review HW (10 mins)
 - a. Superheros
3. Leading Question “tell me about an unfair time..” (10 mins) with comic
4. Group activity (15 mins)
 - a. Fair not equal doctor visit activity

- b. Supplies: bandaids, cards with injury pictures
- 5. Take home activity (2 mins)
 - a. Plan 1 activity to do with a parent/caretaker this week

Week 4: Sibling experiences

1. Ice breaker (5 mins)
 - a. Pterodactyl game
2. Review HW (5 mins)
 - a. What activity did you plan?
3. Leading question “what is it like to be _____ brother/sister?” “tell me a time you were embarrassed” (15 mins) with comic
4. Group activity (20 mins)
 - a. feelings on a rope activity – pg 128 sibshops
5. Take home activity (2 mins)
 - a. 5 ways to deal with embarrassment

Week 5: Listening to Feelings

1. Ice breaker (5 mins)
 - a. find something in common
 - b. Groups of 3 and find something you all have in common
 - c. Debrief – share out what you have in common, was it hard to find something?
2. Review HW (10 mins)
 - a. Embarrassment
3. Leading question : what kind of “tough feelings” have you experienced? (15 mins) with comic
4. Group activity (15 mins)
 - a. In your control/ out of your control
 - b. Have kids right post it notes of what they can control/ can’t control
 - c. Materials: big poster board with circle template, post its, markers
5. Take home activity (2 mins)
 - a. what are 2-3 things you have in common with your sibling?

Week 6: coping strategies part 1

1. Ice breaker (5 mins)
 - a. Yoga animal poses
2. Review HW (10 mins)
 - a. Things in common
3. Leading question: “what do you like to do for fun?” what are your coping strategies? (15 mins) with comic
4. Group activity (20 mins)
 - a. Make stress balls
 - b. Materials: balloons, sharpies, flour, funnel
5. Take home activity: (2 mins)

- a. take home coping kit

Week 7: Coping strategies part 2

1. Ice breaker (5 mins)
 - a. Would you rather?
2. Review HW (15 mins)
 - a. Coping kits
3. Leading question: “what is your favorite part about being _____ brother or sister?” “why is your brother or sister lucky to have you?” (15 mins) with comic
4. Group activity: (20 mins)
 - a. Pass the string and say one strength about your friend
 - b. Cut the string after to make bracelets
 - c. Materials: string, beads, scissors
5. Take home activity: (2 mins)
 - a. make a list of all the things you have learned to do as a sibling that other don't know about

Week 8: Wrap Up

1. Ice breaker (3 mins)
2. Leading question: (10 mins) with comic
 - a. What have you learned?
 - b. What do you still want to learn?
 - c. Think about the future
3. Group activity: (15 mins)
 - a. Sibling panel- bring in adult siblings with a brother or sister with ASD so they can share experiences and answer questions
4. Party (25 mins)
 - a. Decorate cookies, donuts, OR ice cream bar

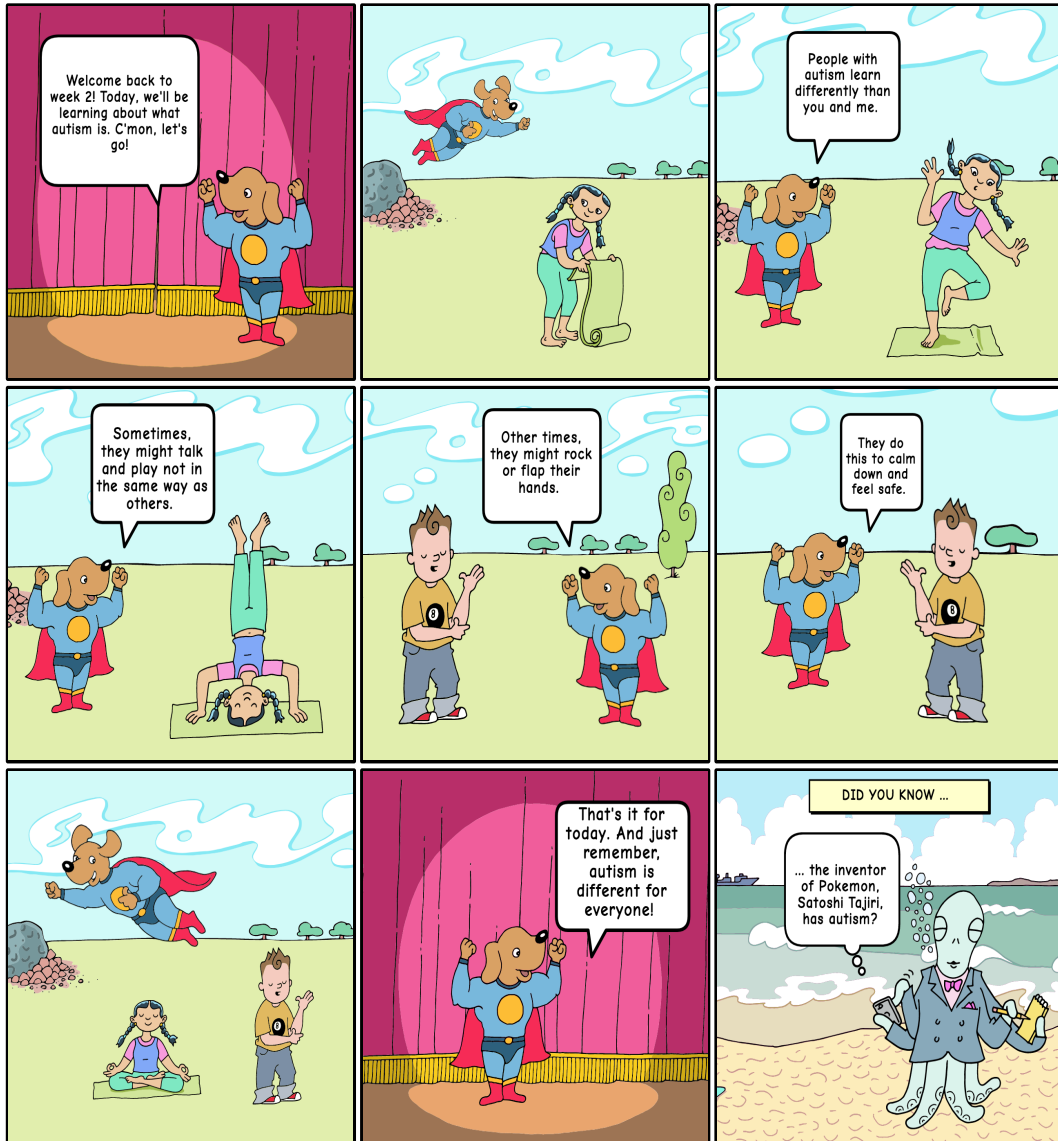
-

APPENDIX J

RESEARCHER DESIGNED EXAMPLE OF THE COMIC LESSONS

NAME YOUR COMIX

AUTHOR'S NAME



APPENDIX K

FIDELITY OF COACHING SESSIONS

Data collector: _____

Date: _____

Interventionist: _____

Coach Behaviors		+	-	N/ A
1	Materials are ready, prepared, and displayed for reference. Materials power point, toys, token economy with stickers, and small prizes.			
2	Introduce training: For the first part of the training we are going over _____ and _____ play strategies and talk about any questions you have. Then we will practice using the play strategies we talked about.			
3	Discuss why play strategies are important and helpful. Stop and ask for any questions.			
4	Modeling (I do).... Think out loud the specific play strategy and have the sibling pretend to be your play partner. This is performed 1-2 times before having the sibling practice.			
5	Rehearsal (We do)... Coach will pretend to be sibling while sibling practices with feedback. Guidance will be implemented in the following order: 1) highly guided (prompt every step), 2) moderately guided (prompt about half the steps), 3) minimal guidance (prompt only when needed)			
6	You do (with feedback)... following a successful practice at minimally guided, sibling will go through who play strategy independently. Feedback is given at the end of the strategy.			
7	Sibling has to perform 100% fidelity for 3 trials on each play strategy.			
8	Tell sibling good job and what will happen next. Sibling can turn stickers in for a small prize at the end.			
Percentage correct implementation by supervisor				

Total minutes:

Notes:

APPENDIX L

FIDELITY OF SIBLING SUPPORT GROUP

Facilitator: _____ **Date:** _____

Coder Initials: _____

Facilitator Behaviors		none	some	most
1	Initiates support group with an ice breaker activity			
2	Reviews previous week homework			
3	Introduces leading question and reads the comic strip as a group			
4	Encourages active participation for discussion and asks for questions			
5	Leads group in an activity related to the theme of the week			
6	Introduces homework for next week			
Percentage correct implementation by facilitator _____				

APPENDIX M

RESEARCHER DESIGNED VISUAL PLAY TIPS



PLAY REWARD SHEET

Use all the play tips to get a prize!

- Choice Wheel
- Get attention before giving directions
- Share information and keep trying
- Provide praise

PICK A PRIZE!

APPENDIX N

RESEARCHER DESIGNED CHOICE WHEEL



APPENDIX O
MODIFIED TARF-R

Social Validity Questionnaire For Sibling (Reimers et al., 1991)

1.	Did you like learning about and using the play tips?	Strongly disliked	Disliked	Neutral	Liked	Really liked
2.	The play tips helped me play with brother or sister better.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3.	After learning the play tips, I play with my brother or sister more.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
4.	I feel closer to my brother or sister after the intervention.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5.	I still use the play tips with my brother or sister when we play.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6.	I would tell my friends who have a brother or sister with autism to learn about the play tips I learned.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
7.	Did you like going to the sibling support group?	Strongly disliked	Disliked	Neutral	Liked	Really liked
8.	I learned more about what autism is the sibling support group.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
9.	I liked being around other kids who have a brother or sister with autism.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
10.	I would recommend the sibling support group to others.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

What was your favorite part of the intervention?

What would you change?

Thank you for your time! ☺

SOCIAL VALIDITY QUESTIONNAIRE

Parent: _____ Date: _____

For each item, please indicate the extent to which you agree or disagree with each statement. Thank you!

1.	The play intervention was effective for increasing the play behaviors of my typically developing child.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2.	The play intervention was effective for increasing the play behaviors of my child with autism.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3.	The play intervention was effective for increasing my children's play outside of the research sessions.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
4.	The procedures of the play intervention were easy for my child to implement.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5.	The training sessions were helpful for my child to accurately implement the play strategies.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6.	The duration of each session was appropriate.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
7.	My child was able to use the strategies involved in the play intervention outside the research sessions.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
8.	I recommend the play intervention to other parents of children with autism.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
9.	The play intervention was useful in enhancing my children's relationship.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
10.	Both of my children enjoyed being a part of this study.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please provide any additional information that might be important for us to know:

Thank you for your time! ☺

Additional Sibling Support Group Questions

1.	The social support group was beneficial for my child.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2.	The take home activities were helpful and feasible.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3.	My child made connections with other children in the sibling support group.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
4.	The duration of the support group was appropriate.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5.	I would recommend the support group to others.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Please provide any additional information that might be important for us to know:

Thank you for your time! ☺

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