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Programming generalization : the use of sufficient exemplars within a discrete trial training early intervention program for children with autism spectrum disorder

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PROGRAMMING GENERALIZATION: THE USE OF SUFFICIENT EXEMPLARS WITHIN A DISCRETE TRIAL TRAINING EARLY INTERVENTION PROGRAM FOR CHILDREN WITH AUTISM SPECTRUM DISORDER

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I am dedicating this journey to my family who has supported me throughout this process. To my mother: Thank you for reading to us every night, teaching us how to pray and love God with all of our hearts, and to be strong and determined individuals. To my father: You have worked extremely hard all of your life to support our family and provide them a better life than you could ever dream for yourself. Thank you for all that you do! To my big brother: You say that I inspire you, but really you inspire me. Thank you for reminding me that giving up is never an option. To my "god-father" John: Thank you for guiding me and believing in me throughout this adventure. You taught me the importance of education and opened the doors for me to see a whole new life. To my step-father: Thank you for all of your positive encouragement and for listening to me when all I needed was an ear.

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ABSTRACT

Discrete Trial Training (DTT), a skill acquisition paradigm using Applied Behavioral Analysis (ABA) principles, is an empirically validated early intervention method for children with ASD. However, one disadvantage of this treatment is its highly structured method that hinders generalization. Since generalization is essential for independence and overall functioning in children with ASD, programming for generalized behavior change is an important treatment component. Training sufficient exemplars is one generalization programming technique that has led to the transfer of skills across several stimulus contexts. Very few scientific investigations have evaluated the use of sufficient exemplars within a DTT format. Experiment 1 evaluated multiple therapist and setting exemplars using DTT to produce generalized responding in children with ASD within a multidisciplinary clinic. One participant was unable to acquire the target skill during standard DTT sessions, while the other two participants acquired the skill and showed moderate generalized responding. Programming multiple therapist exemplars within DTT sessions produced over selective responding in the second participant; whereas, generalized behavior change was observed in the third participant. Experiment 2 investigated two procedural methods of programming sufficient exemplars during DTT sessions: Sequential and concurrent presentations. Differential results of acquisition and generalization efficiency were observed in children with ASD. All participants acquired responses in fewer sessions with concurrent presentations, though more errors were produced. Generalization occurred for both concurrent and sequential presentations with minimal differential effects. Results for both studies suggest that DTT may promote stimulus generalization in some children; however, programming for generalization using sufficient exemplars within DTT sessions may generate acquisition and generalized results more efficiently.

CHAPTER I:
REVIEW OF THE LITERATURE

Autism Spectrum Disorder (ASD) is becoming increasingly mainstreamed as evidenced by prominent public awareness, research funding of over 100 million dollars, and rising prevalence rates in the United States (Bristol et al., 1996; Boyle et al., 2011; Newschaffer, Falb, & Gurney, 2005; Noland & Gabriels, 2004; Wadman, 2007; Wolff, 2004). Recently, the Diagnostic and Statistical Manual of Mental Disorders [5th ed.; *DSM-5*; American Psychiatric Association (APA), 2013] has re-classified previous neurodevelopmental disorders, such as Pervasive Developmental Disorder-Not Otherwise Specified and Asperger's Disorder, into one disability known as ASD. Diagnostic criteria for ASD currently center on two general areas of impairment that vary in severity based on individual differences: (1) deficiencies in social-emotional interactions and communication, including verbal and nonverbal communicative disturbances; and (2) behavioral abnormalities that include repetitive behaviors, restricted interests, and/or sensory deficits (APA, 2013). For children with ASD, these pervasive impairments continue until adulthood—impacting their ability to communicate, function independently, and develop social relationships (Howlin, Goode, Hutton, & Rutter, 2004; Seltzer, Shattuck, Abbeduto, & Greenberg, 2004). To date, no cause for these disorders has been identified (Herbert, Sharp, & Guadiano, 2002); however, current etiological explanations of ASD are best summarized under genetic and environmental factors.

Etiological Explanations and Prevalence of Autism

Several etiological studies have investigated the relationship of genetics and ASD. Current genetic studies primarily focus on twin concordance rates, the broader autism phenotype, and genetic linkages (Klinger, Dawson, & Renner, 2003; Scheeren & Stauder, 2008; Trottier, Srivastava, & Walker, 1999). High concordance rates in monozygotic twins and mild forms of autistic qualities in close relatives of diagnosed children (i.e., broader autism phenotype) suggest that genetics play a role in ASD (Klinger et al., 2003; Schereen & Stauder, 2008; Trottier et al., 1999). Furthermore, multiple chromosomes, as well as certain genetic disorders such as fragile X syndrome, have been identified as possible factors that increase the risk of a predisposition to ASD (Herbert et al., 2002; Rutter, 2005; Trottier et al., 1999).

In addition to genetic factors, recent environmental determinants have been considered as possible influences to the predisposition of ASD. Complications during the gestational period (e.g., prenatal exposure to rubella) and consuming certain chemicals during pregnancy (e.g., valproic acid and thalidomide) are important areas of research that may explain the origins of ASD (Herbert et al., 2002; Miyazaki, Narita, & Narita, 2005; Rutter, 2005). Deficiencies in Vitamin D during pregnancy (Kocovska, Fernell, Billstedt, Minnis, & Gillberg, 2012) and low birth weight have also been explored in relation to the ASD diagnosis (Losh, Esserman, Anckarsater, Sullivan, & Lichtenstein, 2012). Furthermore, various perinatal and neonatal complications, such as birth-related trauma (e.g., oxygen deprivation) are associated with an increased risk of ASD (Gardener, Spiegelman, & Buka, 2011). Current research suggests that the etiology of autism may be best explained by a combination of environmental elements and a genetic predisposition (Herbert et al., 2002; Rutter, 2005; Trottier et al., 1999).

In the absence of a definitive etiological explanation of ASD, prevalence rates continue to climb (CDC, 2014). Since 2000, the Centers for Disease Control and Prevention (CDC) have closely monitored the prevalence rates of ASD in the United States. The CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network, established in 11 sites across the country during the 2010 surveillance year, evaluated prevalence rates in a sample of 8-year-old children (CDC, 2014). Based on current ADDM reports, prevalence estimates of ASD are currently one in 68 children with the diagnosis predominantly occurring in males (one in 42) versus females (one in 189; CDC, 2014). Prevalence rates have increased in the last decade, measured through surveillance sites within the ADDM network (CDC, 2014), parent surveys from the National Health Interview Surveys [(NHIS); Boyle et al., 2011], and administrative data from the Office of Special Education Programs (Newschaffer, Falb, & Gurney, 2005). The ADDM's last surveillance year documented the highest total number of children diagnosed with ASD to date with a 29% increase from the last CDC estimate in 2008 (CDC, 2014). Moreover, the NHIS disclosed that the increase in ASD prevalence rates was larger than any other developmental disability (Boyle et al., 2011).

As the ASD prevalence rate continues to climb, increased efforts have been made to identify effective treatments (Bristol, McIlvane, & Alexander, 1998; Gresham, Beebe-Frankenberger & MacMillan, 1999; Rogers, 1998). As it stands, there is no cure for the ASD disorder (Bristol et al., 1996); however, multiple remedial treatments have been suggested (Myers & Johnson, 2007; Smith, 2008). Broad examples of treatments for ASD include sensory-motor therapy, complementary and alternative medicine (e.g., special diets), pharmacotherapy, psychotherapy (e.g., holding therapy), and behavioral therapy (Herbert et al., 2002). Currently, only some of these treatments have been scientifically validated as effective interventions for children with ASD, such as Applied Behavior Analysis (ABA) techniques, Pivotal Response Training (PRT), and discrete trial instruction (Bristol et al., 1996; Simpson, 2005; Smith, 2008). Regardless of treatment type, researchers across varying theoretical backgrounds agree that early intervention is the key to positive outcomes in children with ASD (Klinger et al., 2003; Smith, 2010).

The Significance of Early Intervention

According to the National Institute of Child and Human Development (NIHCD), early intervention services produce positive gains (2005), both short- and long-term, in young children with ASD (Dawson, Ashman, & Carver, 2000; Guralnick, 1998). It is postulated that early learning opportunities for children with ASD, during developmental periods in which their brains are still malleable, increases the likelihood that their full aptitude may be attained (Bristol, 1996; Dawson et al., 2000; NICHD, 2005). In fact, increased cognitive abilities as well as positive adaptive behaviors have been documented for children receiving early intervention services (Dawson et al., 2000). Harris and Handleman (2000) provided evidence that intervention services before the age of four increased the likelihood of better educational placements 4-6 years later. Guralnick (1998) argued that without early intervention services for developmentally disabled children, a decline in intellectual abilities would be more likely to occur within the first five years of development. Given the importance of early intervention, pediatricians recommend that children at risk for ASD be identified as soon as possible so that they may benefit from such services (American Academy of Pediatrics, 2001).

Effectiveness of Early Intervention Programs

In *Educating Children with Autism* (2001), the National Research Council (NRC) explored common elements within several effective early intervention programs across the United States. The NRC highlighted shared components that contributed to the overall effectiveness among these preschool programs. These components include: (a) early entry following an ASD diagnosis; (b) intensity of intervention (e.g., five days a week and year-round programming) depending on age and developmental status; (c) individualized and repetitive teaching opportunities within brief time intervals; (d) family involvement and training; (e) low teacher to student ratio; and (f) progress monitoring and evaluation to modify ineffective components. Iovannone, Dunlap, and Huber (2003) conducted a comprehensive review of articles in which many other important components were discussed, namely behavioral principles, functional methodology to problem behaviors, routines or predictability of environment, and programming generalization (Dawson & Osterling, 1997; Powers, 1992).

In addition to successful program components, treatment goals within early intervention programs have also been identified as important factors within early intervention programs (Myers & Johnson, 2007; NRC, 2001). These goals typically focus on remediating a variety of skill deficits associated with ASD. However, treatments focused primarily on core symptomology have been shown to abate focal deficiencies, increase functional independence, improve overall quality of life, and assuage family stress factors (Myers & Johnson, 2007). Effective components and treatment goals have produced improvements in the areas of language, social functioning, cognitive abilities, adaptive behavior, play skills, academic skills, and maladaptive behaviors in children with ASD (Bristol et al., 1996, Harris & Handleman, 2000; Myers & Johnson, 2007; Rogers, 1996).

Non-Behavioral Approaches. Due to the complexity and multifaceted diagnosis of ASD, the NRC (2001) recommends a multidisciplinary approach to treatment (Diehl, 2003). Treatments such as medical management and educational interventions have been utilized to decrease maladaptive behaviors and to promote skill acquisition (Myers & Johnson, 2007). For example, pharmacotherapy has been shown to reduce problem behavior such as aggression, self-injury, and restrictive behaviors. Nevertheless, medical management alone is not sufficient to remediate the core symptoms of ASD and should not be used as the primary treatment (Bristol et al., 1996; Myers & Johnson, 2007).

Early intervention programs based on developmental theories typically include treatment approaches that are child-directed with a focus on relationship building (Corsello, 2005; Myers & Johnson, 2007). Communication and social reciprocity are facilitated by creating a therapeutic environment that promotes interactions between the child and the developmental therapist (Corsello, 2005). Therapy sessions are also designed to enhance generalized responding by implementing sessions within a naturalistic setting. Generally, developmental interventions often rely on independent child initiations in order to foster social communication; however, this may prove to be difficult when working with unresponsive children (Corsello, 2005; Landa, 2007).

In an effort to provide multidisciplinary treatment for ASD, many early educational programs include occupational therapy to promote self-care skills and speech and language therapy to increase language capabilities (Myers & Johnson, 2007). Given that language and communication impairments are one of the first identified symptoms in young children with ASD, speech and language therapy has played an important role in early identification of these children [American Speech-Language-Hearing Association (ASHA), 2005]. More specifically, speech-language pathologists (SLPs), knowledgeable in early language and communication development, are called upon to provide routine assessments and treatment for these impairments. Stone and Yoder (2001) showed that speech and language therapy may be beneficial for children diagnosed with ASD. In this study, additional hours of speech and language therapy for two-year-old children with ASD were predictive of better expressive language at age four. However, treatment components and number of hours responsible for the positive effects in language were not identified in this study.

Behavioral Approaches. Beginning in the 1960's, interventions centered on behavioral principles have been the most widely used and empirically supported treatments for individuals with ASD (Schreibman, 2000; Vismara & Rogers, 2010). Moreover, behavioral intervention research provided the first evidence that gains in language, social, and academic skills are possible for children with ASD (Schreibman, 2000). These interventions are based on ABA techniques, with a focus on functional assessment and manipulation of antecedents and consequences within the environment to change human behaviors (Landa, 2007; Schreibman, 2000). Early behavioral treatments are used to teach, increase, maintain, and generalize socially appropriate behaviors as well as decrease maladaptive behaviors (Landa, 2007; Myers & Johnson, 2007; Schreibman, 2000; Steege, Mace, Perry, & Longnecker, 2007). As with many interventions, children receiving intensive, early behavioral interventions have shown increases in cognitive abilities and adaptive behaviors (Harris & Handleman, 2000; Smith, 1999; Smith, 2008).

Early and intensive behavioral programs for ASD can be categorized under contemporary ABA interventions or more traditional approaches. Contemporary ABA interventions, also known as naturalistic behavioral interventions, incorporate developmental and pragmatic theories to facilitate skill acquisition in a more normalized manner (Landa, 2007; Vismara & Rogers, 2010). Incidental Teaching (Hart & Risley, 1975), Natural Language Paradigm (Koegel, O'Dell, & Koegel, 1987), and PRT (Koegel, Koegel, & Brookman, 2003) are examples of naturalistic treatments that were established to alleviate some of the shortfalls of traditional ABA interventions for children with ASD. These contemporary methods were designed to increase motivation and generalization to natural settings by incorporating a child's interests into teaching sessions (Koegel, Koegel, & McNerny, 2001; Landa, 2007; Myers & Johnson, 2007; Vismara &

Rogers, 2010). Other treatment elements include loosely structured therapy sessions, indirect instruction within natural settings (e.g., play time), child-directed sessions, functional reinforcers, and liberal shaping methods (Delprato, 2001). Such naturalistic interventions show gains in object imitation, joint attention, pretend play (Ingersoll & Schreibman, 2006), imitative speech, spontaneous speech (Hart & Risley, 1975; Koegel et al., 1987), and social initiations (Koegel, Koegel, Shoshan, & McNerney, 1999; Koegel et al., 2001). Although studies provide support for naturalistic treatments, some researchers still question whether treatment effectiveness is truly superior to more traditional ABA interventions, such as discrete trial instruction (Goldstein, 2002).

Discrete Trial Training

The most widely researched and practiced behavioral intervention for children with ASD is discrete trial training (DTT), also referred to as discrete trial teaching and discrete trial instruction (Ghezzi, 2007; Steege et al., 2007; Weiss & LaRue, 2008). DTT is an instructional method used for teaching foundational skills such as compliance, imitation, discrimination, academic readiness (Myers & Johnson, 2007), and language skills (Lovaas, 1987). This method divides complex skills into smaller units (i.e., subskills), which are taught in a highly structured, adult-led therapeutic environment. These subskills are presented over massed trials, utilizing antecedent-response-consequence chains, shaping procedures, and an inter-trial period to mark the end of each teaching unit (Ghezzi, 2007; Smith, 2001; Vismara & Rogers). To elucidate discrete trial teaching, Smith (2001) simplified each trial into five components.

Description of DTT

The first component of DTT is the presentation of a cue or antecedent stimulus at the beginning of each trial, indicating a response is required from the child. It is important to note that antecedent stimuli can be verbal or nonverbal. If verbal, the therapist must provide clear and concise instructions (Ghezzi, 2007). “Clap your hands” or “What is your name?” are examples of verbal antecedents provided to evoke a behavioral response. Once antecedent-behavior chains have been reinforced over time, the antecedent stimulus becomes the discriminative stimulus that signals the appropriate behavior will be followed by a reinforcer (Tarbox & Najdowski, 2008).

The second component of a discrete trial is prompting procedures, which are used to assist the child in providing the correct response. Prompts can also be verbal or nonverbal, such as vocal modeling or physical guidance, and must be faded so that responses are under the control of the appropriate discriminative stimulus (i.e., stimulus control; Tarbox & Najdowski, 2008). There are several procedures for response prompting (Wolery & Gast, 1984); however, the most commonly used systems incorporated within discrete trial teaching are most-to-least and least-to-most prompting (Ghezzi, 2007; Smith, 2001).

With most-to-least prompting, the therapist immediately begins at the most-intrusive prompt level, usually a full physical guidance or vocal model, to evoke the accurate response from the child (Wolery & Gast, 1984). Prompts are then faded to a least intrusive prompt until the discriminative stimulus independently produces the correct response. In least-to-most prompting, the therapist begins with the least invasive prompt and then moves toward more intrusive procedures. For example, if the original antecedent stimulus is a verbal directive, the least invasive prompt would be a verbal instruction that includes assistive information to foster the correct answer from the child. More intrusive prompts, such as gesturing, modeling, or physically guiding the appropriate behavior, are then sequentially introduced until the child generates the correct response (Ghezzi, 2007). This type of prompting system allows the therapist to evaluate the level of assistance needed for each skill. Moreover, the discriminative stimulus is presented at each prompt level and followed by a constant response interval (Ghezzi, 2007; Wolery & Gast, 1984).

The next component of discrete trial teaching is what naturally occurs after the antecedent is presented, the response. The child's response to the antecedent stimulus can be a correct response, an approximation to the correct response, an incorrect response, or no response at all (Tarbox & Najdowski, 2008). Approximated responses, incorrect responses, and no attempts may all be considered inaccurate; however, to evoke the correct response, different strategies may be used. For instance, behavioral approximations may be systematically changed by using shaping procedures to produce the necessary response, while more intrusive prompting methods may be necessary for incorrect behaviors or a lack of response (Wolery & Gast, 1984).

The fourth component of DTT completes the antecedent-behavior-consequence chain. The adult therapist provides the consequence dependent on the child's response. Target responses are reinforced by providing social praise, edibles, or tangibles, usually identified by indirect or direct reinforcer assessments (Ghezzi, 2007; Smith, 2001). To establish the temporal relationship between correct behaviors and reinforcement, reinforcers are delivered immediately after a correct response to eliminate inadvertent reinforcement of other behaviors. For incorrect responses, positive reinforcement is withheld or verbal feedback is provided to denote the answer was inaccurate (Ghezzi, 2007).

The final component of DTT is the inter-trial interval or the period of time before the next teaching trial. This period signals the end of each trial and allows the child to finish consuming a reinforcer, the therapist to record data, and permits the therapist to set up the next teaching trial (Tarbox & Najdowski, 2008). The duration between trials varies; however, shorter periods (e.g., between 1-5 s) often maintain the child's attention and may eliminate any escape-maintained behaviors that interfere with teaching trials (Ghezzi, 2007; Smith, 2001).

These five components make DTT a highly structured teaching paradigm, primarily therapist-directed, to systematically promote skill acquisition (Tarbox & Najdowski, 2008). Other defining characteristics are minimally distractive therapeutic environments, repeated and massed teaching trials, direct one-to-one instruction, fast-paced sessions, and adult-selected teaching goals (Ghezzi, 2007; Landa, 2007; Nelson & Huefner, 2003; Vismara & Rogers, 2010). Nevertheless, modifications to this teaching paradigm are possible by changing prompting methods, session duration, type or number of stimuli presented during trials, differential or intermittent reinforcement, and therapy locations (Steege et al., 2007).

Effectiveness of DTT for Children with ASD

DTT has been utilized as a teaching strategy for young children with ASD since Lovaas' early work in the 1970's, later published in 1987. This highly cited article was the first to provide breakthrough evidence that gains were possible in young children with ASD by using early behavioral and intensive treatment such as DTT (Lovaas, 1987; Vismara & Rogers, 2010). Three groups of children under the age of four, one experimental and two matched control groups participated in this influential study. The 19 children in the experimental group received rigorous one-to-one behavioral treatment for two or more years, averaging 40 hours per week, across several settings. The first control group received less than 10 hours of the same treatment; whereas, the second control group did not receive treatment within this program. Follow up measures yielded significant differences between the 19 children receiving DTT and the two control groups. Favorable gains for the experimental group showed an average IQ increase of 30 points. Additionally, 47% reached the average to above average intellectual range, completed first grade, and were placed in a general education classroom. The control groups did not fare as well in that initial measures remained stable with no significant differences between the two groups. Twenty-one children from the control groups were placed in severely impaired classrooms, while only two from the experimental group were placed in similar educational placements. The positive results seen in 17 of the 19 participants in the experimental group popularized DTT as the treatment of choice for early intervention programs for children with ASD. Several years later, McEachin, Smith, & Lovaas (1993) re-evaluated those children who participated in the 1987 investigation. Results from this study showed that the children in the experimental group were able to maintain their educational placements. Furthermore, those receiving DTT exhibited superior IQ scores and adaptive behaviors than those children in the control group that received less than 10 hours of treatment.

Criticisms of DTT research, particularly the Lovaas study, questioned the validity of the reported results based on methodology, such as outcome measures, selection biases, and control group characteristics (Gresham & MacMillan, 1997, 1998; Gresham, Beebe-Frankenberger, & MacMillan, 1999; Schopler, Short, & Mesibov, 1989). For instance, educational placement and assessment scores were challenged, arguing that child advocates may have pushed for higher school placements, promoted higher IQ scores by increasing compliance skills, and yielded unsound interpretations due to incorporating different post-treatment measures. Furthermore, several selection biases were outlined by these authors, including non-random selection, reconfigured mental age scores, and inclusion of children with higher functioning levels and language ability. These criticisms of selection bias claimed that lower-functioning children with ASD were excluded and the participant sample was unrepresentative of the average to below-average spectrum range. Finally, the Lovaas study was critiqued on unmatched control groups and skewed results due to statistical regression methods. Overall, implications of internal and external validity violations called into question the validity of the Lovaas study (Gresham et al., 1999). Nevertheless, DTT has been continuously utilized and proven as a beneficial and successful teaching tool for children with ASD.

Further analyses of the DTT methodology, as seen in the original Lovaas study (1987), have been replicated and re-analyzed over the years with children with ASD. Findings of these studies yielded gains in cognitive abilities, language skills, adaptive behavior, mental age scores, communication skills, less restrictive educational placements, social emotional functioning, nonverbal skills, learning rates, receptive and expressive language, visual-spatial skills, and academic achievement (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Bibby, Eikeseth, Martin, Mudford, & Reeves, 2002; Birnbrauer & Leach, 1993; Cohen, Amerine-Dickens, & Smith, 2006; Eikeseth, Smith, Jahr, & Eldevik, 2002; Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Luiselli, Cannon, Ellis, & Sisson, 2000; Sallows & Graupner, 2005; Sheinkopf & Siegel, 1998; Smith, Buch, & Gamby, 2000; Smith, Eikeseth, & Klevstrand, 1997; Smith, Groen, & Wynn, 2000). These improvements were seen in clinical-, school-, and home-based programs, professionally- and parent-led therapy sessions, and treatment programs of varying intensity. Furthermore, gains were observed in participants as early as 1.5 years of age, with positive results seen as early as one year post-treatment. Thus, establishing precursor foundational skills (e.g., academic readiness) through the use of DTT may produce broader advancements in intellectual, communication, social, and adaptive behavior (Lovaas, 1987; Myers & Johnson, 2007; Smith, 2001; Tarbox & Najdowski, 2008).

Advantages and Disadvantages. Numerous advantages led to the utilization of DTT as a teaching tool for children with ASD. Sundberg and Partington (1998) provided a concise list of benefits for using this instructional methodology. Discrete trial instruction: (a) allows for multiple presentations of the same trial which promotes skill acquisition and proficiency, (b) is easily implemented by staff and parents, (c) assists with the development of language, (d) can be applied in classrooms, (e) can be easily translated into a curriculum with instructional materials for staff, (f) has recognizable teaching objectives and target responses, (g) utilizes highly accessible reinforcers that can be delivered immediately, (h) has effortless data collection measures, (i) clearly outlines the progression of steps within the curriculum, (j) measures observable progress and regression, and (k) establishes stimulus control over learning readiness skills.

The primary disadvantage of DTT is its highly structured nature. For instance, stringent stimulus control over the child's behavioral responses may occur when the teaching environment is highly controlled, thereby limiting spontaneous skills and social initiations in the natural setting (Schreibman, 1997; Smith, 2001). Each teaching trial incorporates specific components with little room for variation and expansion of verbal interactions, leading to unnatural verbal communication between the therapist and child. Some argue that the emphasis on therapist-directed sessions and artificial reinforcers limit the use of motivating operations which may hinder mand instruction (i.e., teaching the child requests; Sundberg & Partington, 1998). Furthermore, the prompting procedures and repetitive trials can induce prompt dependency as well as rote responding in children with ASD (Smith, 2001; Sundberg & Partington, 1998). Due to the highly controlled teaching sessions, which can become aversive for children with ASD, escape or avoidance behaviors may also occur (Sundberg & Partington, 1998). These limitations highlight the principal concern of DTT—the lack of teaching opportunities within a natural context. In other words, the contrived nature of the teaching environment, as well as adult-led instruction, prompting, and reinforcement procedures, may prevent generalization of skill acquisition to the natural setting (Landa, 2007; Myers & Johnson, 2007; Schreibman, 1997; Sundberg & Partington, 1998; Tarbox & Najdowski, 2008).

The Importance of Generalization for Children with ASD

For most typically developing children, the process of generalization comes naturally; however, for children with ASD each learned skill may remain independent of others, restricting the process of generalization (Whalen, 2009). The difficulty with generalization for these children may be a function of the disorder, the treatment approach, or possibly both (Openden, Whalen, Cernich, & Vaupel, 2009). Without the ability to generalize learned behaviors, children with ASD may acquire a multitude of skills, but lack the knowledge to apply the skills in the real world (Whalen, 2009).

Defining Generalization

The term *generalization* or *generality of behavior*, within the realm of ABA, pertains to the transfer of skills over time, to untrained responses, and across different environments (Baer, Wolf, & Risley, 1968; Cooper, Heron, & Heward, 2007). Generality of behavior is an important area to the field, included as one of the seven dimensions that define ABA (Baer, Wolf, & Risley, 1968, 1987). According to Stokes and Baer (1977), generalization occurs when the target behavior is observed in non-trained environments with no training conditions in place. Any behavioral change as a result of treatment may become ineffective if generalized effects fail to occur across the three domains (Cooper et al., 2007; Stokes & Baer, 1977).

The first domain is temporal generalization, also known as response maintenance or simply maintenance, which is the persistence of behavior across time. The second domain, response generalization, refers to the strengthening of untrained responses. The reinforcement effects of the target response spread to other behaviors that are similar in form or function, establishing a response class (Cooper et al., 2007; Ghezzi & Bishop, 2008). The final domain, stimulus generalization (i.e., setting or situation generalization), differs from response generalization in that the same behavior is evoked, rather than different behaviors, but by untrained stimuli (Cooper et al., 2007). Furthermore, this type of generalized behavior change is likely to occur under stimulus conditions that are most similar to the discriminative stimulus (Ghezzi & Bishop, 2008).

As previously mentioned, maintenance occurs when the behavior endures after treatment is removed (Cooper et al., 2007; Ghezzi & Bishop, 2008). Maintenance must be assessed to differentiate between deficits across time and stimulus generalization. For example, an important finding regarding response maintenance and stimulus generalization was discovered when Koegel and Rincover (1977) evaluated responding in an extra-therapy setting with three boys with ASD. After the three boys were taught to imitate or identify body parts, generalization was assessed in an outside setting. Generalization of trained responses was detected in the second environment for two of the participants, but maintenance of the skills deteriorated shortly after. Had generalization been assessed following the regression of maintenance, behaviors would have appeared to lack stimulus generalization; however, this would have been a result of maintenance failure within the new environment. Therefore, it is important to evaluate generalization following treatment and establish a maintenance schedule within the new environment (Koegel & Rincover, 1977).

An example of response generalization is provided in a study of trained imitative response types (e.g., vocal, toy-play, and pantomime) in three young boys and one girl with ASD (Young, Krantz, McClannahan, & Poulson, 1994). Probes were conducted on new imitations within and across each response type to determine response generalization. Children correctly matched new imitations that were most similar to the trained imitative form, indicating generalization occurred within each response type. However, response generalization across response types did not occur for all the children. In other words, generalization of new responses may diminish as the stimuli become more and more dissimilar to the original discriminative stimulus.

Stimulus generalization of trained behavior can occur across verbal instructions, materials, settings, teacher/therapists, and other environmental stimuli (Ghezzi & Bishop, 2008; Haring, 1998). One study examined stimulus generalization of spontaneous responses to nonverbal stimuli in two young boys with ASD (Jones, Feeley, & Takacs, 2007). Verbal responses such as "bless you" or "coming" were taught when an adult provided a nonverbal stimulus of sneezing or using a "come here" gesture. Generalization of spontaneous responses emerged across different school settings (e.g., gym and hallway), across different activities (e.g., free play and transitions), and across teachers (e.g., another teacher assistant from another classroom) for both children.

Unfortunately, there are some complications that may arise when assessing for generalization in children with ASD. Many environmental stimuli exist within each training context; therefore, the target response may come under the control of very specific features or of many stimuli within the training setting. In one extreme, the target response is under stimulus control of an unrelated feature in the training situation due to previous reinforcement while the irrelevant stimulus was present (Ghezzi & Bishop, 2008). This is called over selectivity and may hinder stimulus generalization. For example, a child may learn to identify a picture of a black dog as "dog"; however, if the same dog is presented, but with a different color, then the child will fail to emit the same response. This occurs because the child has learned to respond "dog" to the color of the dog and not the dog itself. In the other extreme, children may overgeneralize, in that a response is evoked by an all-inclusive stimulus class. Thus, the trained behavior is induced by similar training conditions but under inaccurate circumstances (Cooper et al., 2007). For example, the label "dog" is trained for all types of dogs, yet the child begins to call every four-legged animal "dog."

Programming for Generalization

"Generalization is, perhaps, the most important phase of learning" (Haring, 1988, p. 5), specifically for children with developmental disabilities. Without generalization, the desired behavior would require instruction at different times of the day, in each setting, with each individual, and with several response options (Openden et al., 2009). The ability to generalize allows children with ASD to solve problems, develop their skills and interests, and adapt to new situations, people, and environments (Haring, 1988; Whalen, 2009). Therefore, generalization is essential for children with autism to succeed in naturalistic settings (Whalen, 2009). It should not, however, be presumed that a newly acquired behavior will automatically transfer across time, responses, or settings (Baer et al., 1968; Haring, 1988). Thus, programming generalization is a necessary component in any early treatment for children diagnosed with ASD (NRC, 2001).

The influential article by Stokes and Baer (1977) was the first to compile several programming techniques to promote generalization. This compilation included nine types of generalization procedures that have been commonly employed in research: (1) "train and hope,"

(2) sequential modification, (3) introduce to natural maintaining contingencies, (4) train sufficient exemplars, (5) train loosely, (6) use indiscriminable contingencies, (7) program common stimuli, (8) mediate generalization, and (9) train "to generalize" (Stokes & Baer, 1977, 46-47). These generalization training procedures, as well as other methods, can be categorized within the three domains of generalization: temporal generalization, response generalization, and stimulus generalization.

Before discussing generalization techniques, it must be taken into consideration that "train and hope" as well as sequential modification are not actual generalization programming techniques. Instead, "train and hope" research is just that, the expectation and hope that generalization will occur without the installation of any programmed techniques (Stokes & Baer, 1977; Stokes & Osnes, 1989, White et al., 1988). Sequential modification, on the other hand, is an experimental method that assesses for generalization, such as a multiple baseline design, rather than a technique for generalized behavior change (Stokes & Baer, 1977; Stokes & Osnes, 1989). A skill is trained, assessed, and if no generalized behavior change occurs, training commences for each condition until transfer of the target response is evoked (Stokes & Baer, 1977; White et al., 1988). For example, a mand training study for three preschool children with ASD describes both the "train and hope" and sequential modification approaches (Pellecchia & Hineline, 2007). Generalization of mands, or verbal requests, was assessed with parents (i.e., "train and hope") and proved to be successful for all three children. Transfer of mands was further evaluated with the participants' siblings and peers (i.e., "train and hope"). Mands did not generalize to their siblings or peers, thus mand training was successively introduced for both siblings and peers (i.e., sequential modification) until they met criteria.

Programming for Temporal Generalization. To promote temporal generalization, Ghezzi and Bishop (2008) recommended programming a schedule of intermittent reinforcement during training sessions. This is also referred to as using indiscriminable contingencies (Stokes & Baer, 1977). The individual is unable to discriminate response contingencies because intermittent schedules of reinforcement are variable in nature; therefore, responding occurs regardless of the reinforcement schedule promoting temporal generalization (Ghezzi & Bishop, 2008). Koegel and Rincover (1977) discovered this finding by examining different reinforcement schedules during training sessions of nine children with ASD, and then assessed for maintenance effects in the generalization setting. Those children receiving thinner schedules of reinforcement (e.g., Fixed Ratio-5) or noncontingent reinforcement, maintained their target responses for longer periods of time compared to those receiving continuous reinforcement.

Programming for Response Generalization. Stokes and Baer (1977) identified two programming techniques that promote response generalization: train to generalize and using sufficient exemplars. Train to generalize teaches the child to expand their behavioral repertoire by reinforcing new and appropriate, but functional responses (Cooper et al., 2007; Ghezzi & Bishop, 2008; White et al., 1988). This process can also be referred to as reinforcing response variability (Cooper et al., 2007). For example, Goetz and Baer (1973) increased the building of new block structures by reinforcing innovative creations in three preschool girls, thereby developing the diversity in their block building behavior.

Training sufficient response exemplars, or multiple exemplar training, reinforces a subset of appropriate responses when certain discriminative stimuli are presented (Cooper et al., 2007; Ghezzi & Bishop, 2008). Within this approach, training stimuli and responses are varied during sessions. The number of reinforced behaviors should be sufficient and representative of the response class in order to evoke generalization to other responses (Stokes & Osnes, 1989). One example of using sufficient response exemplars analyzed helping behavior in four young children with ASD (Reeve, Reeve, Townsend, & Poulson, 2007). Four categories of helping behavior (e.g., putting away items) were identified and several helping behavior exemplars (e.g., putting away books on shelf) within each category were specifically trained. Using sufficient response exemplars promoted response generalization of a new helping behavior within each category (e.g., putting away board games) and across untrained helping categories, such as cleaning behaviors (e.g., wiping tables).

Programming for Stimulus Generalization. Stimulus generalization has been facilitated using programming techniques such as mediating generalization, training loosely, introducing naturally maintaining contingencies, introducing common stimuli into the training environment, and training sufficient exemplars. Mediating generalization promotes transfer of skills utilizing a tangible item, an individual, or covert/overt verbal stimuli (e.g., self-instruction) to gain stimulus control over the target response in the generalization setting (Cooper et al., 2007; Stokes & Osnes, 1989). Ghezzi and Bishop (2008) defined this method as teaching rule-governed behavior. Mediating stimuli could be practical items that can be brought into the generalization setting or familiar stimuli that exists in natural conditions (Cooper et al., 2007; Ghezzi & Bishop, 2008; Stokes & Osnes, 1989). An example of this tactic is illustrated in a pictorial self-management study with three young boys with ASD (Pierce & Schreibman, 1994). Task completion of daily living skills (e.g., setting the table) was trained using picture schedules (i.e., mediating stimuli) to promote stimulus generalization across settings. In this study, the boys quickly acquired new daily living skills by being trained on one picture schedule task, indicating that this method may also promote response generalization.

Training loosely describes a generalization procedure that limits strict protocols, stimuli, or specific responses within an instructional program (Stokes & Baer, 1977). Varying the inclusion and exclusion of environmental stimuli decreases the possibility that any one feature will gain stimulus control over the behavior (Cooper et al., 2007). Stringent stimulus control is thereby reduced, promoting generalization by minimizing discrimination between training and natural conditions (Cooper et al., 2007). For example, loose training was used to promote language generalization with peers across school activities in two children with moderate language delays (Campbell & Stremel-Campbell, 1982). The correct verb usage of "is" and "are," for wh- questions, yes/no questions, and general statements were loosely trained, allowing for all types of questions and statements to be used as training trials (i.e., none were programmed). Participants learned to respond frequently (> 400 responses) to a variety of contextual stimuli, facilitating accurate verb usage to the generalization environment (i.e., free play with peers).

Incorporating natural maintaining contingencies within training sessions has proven to be an effective stimulus generalization procedure (Stokes & Baer, 1977). The following four strategies facilitate the use of this procedure: select functional skills that occur in the generalization environment, reinforce target behaviors with consequences from the natural environment, ensure proficiency or skill fluency, arrange for natural contingencies in the generalization environment, and teach the child to recruit reinforcement in the generalization environment (White et al., 1988). For example, Stokes, Fowler, and Baer (1978) first taught three preschool children to accurately complete an assignment and then recruit reinforcement using verbal cues, such as "Have I worked well?" Generalization results showed that the children were successful at recruiting praise statements from new teachers by using these verbal cues.

Introducing common and salient stimuli from the generalization setting into the training environment (or vice versa) is another strategy that evokes stimulus generalization (Stokes & Baer, 1977). This method may be beneficial if training in the generalization setting is costly, dangerous, or contains obstacles that could interfere with skill acquisition (Cooper et al., 2007). Speech loudness was targeted in a 15-year old girl by systematically reinforcing specific decibel levels of words read in the laboratory setting (Jackson & Wallace, 1974). Although she was successful at reading with the appropriate decibel level, generalization failed to occur in the classroom. Therefore, common stimuli, such as classmates, similar reading words, and partial view of her classroom, were programmed into the laboratory setting; thus promoting generalization of voice loudness into the classroom.

Training sufficient stimulus exemplars, instead of response exemplars, may also be employed to enhance stimulus generalization. Providing sufficient exemplars facilitates generalization of the target behavior to other stimuli within the stimulus class. For example, three children with ASD were taught to initiate play behavior and engage in cooperative play with three separate peer exemplars in a study by Belchic & Harris (1993). This study was successful at promoting generalization to new peers, siblings, and across settings (i.e., playground and home).

General case analysis is a variation of the training sufficient exemplars procedure, which incorporates a range of all possible stimulus and response exemplars. These exemplars are systematically identified and selected from a pre-defined instructional universe (i.e., a stimulus and response class) before training (Horner, Bellamy, & Colvin, 1984; Sprague & Horner, 1984).

For example, a list of common types of instructions delivered in a residential facility (e.g., "Go to…," "Look at…," "Put in/on…," etc.) were identified for three developmentally disabled women (Walters, Holborn, & Ediger, 2007). Multiple exemplars within each type of instruction were trained to successfully facilitate compliance in the generalization setting (i.e., day program events).

Training sufficient exemplars and multiple exemplar training are two interchangeable terms within the generalization literature (Hughes, Harmer, Killian, & Niarhos, 1995; Matson, Sevin, Box, Francis, & Sevin, 1993; Pierce & Schreibman; 1994; Reeve et al., 2004; Secan, Egel, & Tilley, 1989); however, some distinctions have been made and will be discussed (Cooper et al., 2007; Greer, Yaun, & Gautreaux, 2005; Marzullo-Kerth, Reeve, Reeve, & Townsend, 2011; White et al., 1988). In some cases, multiple exemplar training has been referred to as general case analysis, previously discussed as a variation of training sufficient exemplars (Greer et al., 2005; Marzullo-Kerth et al., 2011). These studies included several representative examples from environmental stimuli to promote response generalization of spelling and sharing behavior. On the other hand, Cooper et al. (2007) made a distinction between general case analysis and multiple exemplar training. Multiple exemplar training was defined as response generalization strategy that consists of varying multiple stimuli and response examples within training sessions. For example, multiple peer teachers, settings, locations within the settings (i.e., stimulus variations), and conversation starters (i.e., response variations) were included to facilitate conversational skills in four young women in special education (Hughes et al., 1995). White and colleagues (1988) made yet another differentiation between training sufficient exemplars and multiple exemplars. In their review, training sufficient exemplars was defined as sequentially instructing more and more exemplars until the target response transferred into the generalization setting; whereas multiple exemplar training is conducted by training several stimuli or responses simultaneously to promote generalization. The main commonality between the previous distinctions is that several characteristic exemplars of the discriminative stimuli or target response were included during instruction in order to evoke generalized responding. Therefore, for the sake of the current study, both sufficient exemplars and multiple exemplars will be used to denote the same generalization strategy that was first defined in the seminal article by Stokes and Baer (1977).

Programming Generalization in Early Behavioral Intervention

Generalized behavior is acknowledged as one of the most relevant educational goals for children with ASD (NRC, 2001). Thus, the greatest worth of any early intervention program is the ability to produce generalized outcomes, which must be directly programmed and measured (NRC, 2001). Some early intervention programs for children with ASD were designed to promote generalization of behavior; whereas other traditional treatments require generalization procedures to arrive at the same goal.

A naturalistic behavioral intervention, such as PRT, is one such early behavioral intervention developed to address generalization concerns of more traditional behavioral approaches (Schreibman, Stahmer, & Suhrheinrich, 2008). For example, PRT utilizes a child's interests to promote learning opportunities, includes reinforcers related to teaching objectives, and teaches responsiveness to multiple cues in the environment. PRT components increase child motivation and receptiveness to environmental stimuli, which foster generalized behavior change (Schreibman et al., 2008).

In contrast, traditional early interventions, such as DTT, depend upon additional programming to promote transfer of skills. DTT, as previously described, teaches skills in a tightly structured training environment with very specific protocols regarding delivery of instructions, prompts, and reinforcers. However, these specific methods may produce highly focused treatment outcomes, thereby hindering generalization (Stokes & Osnes, 1989). Since DTT has proven to be an effective early intervention for children with ASD, procedures to facilitate generalization for this method have been suggested.

Weiss and LaRue (2009) recommended several programmatic additions for DTT programs to develop generalized behavior change: teaching loosely, building fluency, programming common stimuli, and training sufficient exemplars. First, teaching loosely is by definition the exact opposite of the DTT instructional approach. This programming technique includes systematic, but unpredictable, variations of noncritical antecedent qualities. By making DTT more "loose", each session should change features such as tone of voice, seating or standing positions, material presentations, noise levels, and reinforcing various appropriate responses (Baer, 1999; Cooper et al., 2007, Weiss & LaRue, 2009). Second, skill fluency should be established in all DTT sessions prior to assessing for generalization (Weiss & LaRue, 2009). Skill fluency is defined as the combination of both speed and accuracy (Binder, 1996) and may promote both stimulus and response generalization (Ghezzi & Bishop, 2008; Johnson & Joe Layng, 1996; Weiss & LaRue, 2009). Behavior that is inconsistent, too brief, or has a long latency period is unlikely to contact reinforcement in the natural environment (Weiss & LaRue, 2009). Therefore, response fluency should be trained within DTT sessions by reinforcing consistent responses to discriminative stimuli, longer durations of the behavior (e.g., play behavior), and shorter latency periods. A third way to enhance generalized behavior change is programming common stimuli from the generalization setting into DTT sessions (Weiss & LaRue, 2009). For example, if the child is learning an academic skill, DTT sessions should include common and salient stimuli from a classroom setting, such as a blackboard, a desk, and colorful posters.

Training Sufficient Stimulus Exemplars in DTT. The last recommended generalization strategy for DTT is training sufficient exemplars (Weiss & LaRue, 2009). This generalization technique was deemed "one of the most valuable areas of programming" (Stokes & Baer, 1977, p. 51). The key word "sufficient" was selected to represent the appropriate number of exemplars to train in order to induce generalization; whereas, "exemplars" refers to various stimulus conditions (e.g., settings, experimenters, instructions, materials) in which the discriminative stimulus should evoke the appropriate response (Stokes & Baer, 1977; Weiss & LaRue, 2009). The purpose behind this methodology is that by training the desired response while using sufficient, but not all, exemplars may facilitate the transfer of the correct response to new stimulus conditions that contain similar exemplar properties (Stokes & Osnes, 1989). For example, in teaching the greeting response "Hi," several stimulus exemplars would be trained within DTT sessions, such as "Hi," "Hey," and "Hello," to represent several greetings the child may encounter in the natural setting.

No systematic evaluation determining the standard amount of training exemplars has been conducted to date; however, some generalization studies have required as few as two exemplars to promote generalized behavior change (Cooper et al., 2007; Stokes & Baer, 1977; Stokes & Osnes, 1989). Nevertheless, incorporating a variety of training exemplars during instruction may increase the likelihood that generalization will occur to other untrained stimuli. Several considerations should be taken when selecting the appropriate amount of exemplars: difficulty of target response, instructional approach, response opportunities within each training condition, the availability of natural reinforcement contingencies, and previous experience with reinforced generalized responding (Cooper et al., 2007; Stokes & Baer, 1977).

Another procedural consideration is the presentation of training exemplars within DTT sessions. In the exemplar literature, multiple exemplars are either sequentially presented so that each prototype is mastered prior to moving on to the next, or all selected exemplars are concurrently presented from the outset and trained to mastery (Lowther & Martin, 1980; Schroeder, Schuster, & Hemmeter, 1998). For example, a multiple exemplar study using an instructional method similar to DTT evaluated expressive labeling of object classes with sequential and concurrent picture presentations (Schroeder et al., 1998). Results from this study showed that three out of the four preschool-aged boys with developmental disabilities acquired expressive labels in fewer trials and generalized to new objects faster when multiple pictures were concurrently trained. These results indicate that training all exemplars during each teaching session may efficiently promote generalization.

Training Sufficient Trainer Exemplars. Several generalization studies examining sufficient stimulus exemplars were conducted prior to Stokes & Baer's (1977) fundamental exposition, and even more studies emerged after the authors' publication (Boyle & Lutzker, 2005; Garcia, 1974; Griffiths & Craighead, 1972; Handleman, 1979). One of the earliest studies in this area programmed multiple therapeutic agents to induce generalization across individuals. For example, multiple adult trainers taught four pre-teens with intellectual disabilities a greeting response by using shaping and differential reinforcement procedures (Stokes, Baer, & Jackson, 1974). Three participants were able to generalize a hand wave to multiple persons after two trainers, while the fourth teen needed only one trainer to achieve the same results. By the end of the study, the participants greeted approximately 15 different people during generalization probes. Another early study by Garcia (1974) utilized one therapist to train verbal sequences with a set of pictures to two teens with intellectual disabilities. Probes were conducted to assess generalization across trainers with new pictures. Results showed that generalization only occurred once new pictures were intermixed with mastered pictures and only after the inclusion of two trainers during training sessions.

A later study evaluated multiple therapists using a behavior momentum approach on nonresponsive children diagnosed with developmental disabilities and behavior disorders (Davis, Brady, Williams, & Hamilton, 1992). Effects of high probability request sequences on responsiveness to low probability requests were analyzed by programming trainers sequentially in a multiple baseline design. Compliance across new trainers was assessed by using a concurrent baseline. Treatment gains of low probability requests across new trainers were achieved for both participants. Furthermore, only three trainer exemplars were utilized for one participant and two trainers for the second participant to produce generalized effects.

Multiple peers as therapeutic agents, instead of adult therapists, have been integrated to promote generalization of social interactions across settings and peers (Hughes, Harmer, Killian, & Niarhos, 1995; McEvoy et al., 1988; Stewart, Van Houten, & Van Houten, 1992). In a 1993 study, initiating play behavior was trained in three children with ASD by sequentially programming three peer exemplars into training sessions (Belchic & Harris, 1993). Peer exemplar training was successful at promoting generalization of play behavior across siblings for all participants; furthermore, generalization across settings (e.g., playground and home) was also observed.

Training Sufficient Setting Exemplars. Programming multiple training settings as stimulus exemplars may also generate transfer of skills across environments. Several early studies examined the effects of setting generalization of verbal responses when trained in single or multiple exemplar settings (Griffiths & Craighead, 1972; Handleman, 1979; Handleman & Harris, 1980; Handleman, 1981; Handleman & Harris, 1983). An early account of this approach found that multiple stimulus techniques failed to evoke generalization of the /l/ phoneme across settings (i.e., clinic to residence) in a woman with intellectual disabilities (Griffiths & Craighead, 1972). However, training in a second setting with a second experimenter produced generalized results of the /l/ sound in the generalization setting.

Handleman (1979) initiated a series of generalization studies comparing the effects of single versus multiple setting exemplars. In the first study, four young participants with ASD were divided into two groups and were trained on six sets of questions. Three sets were trained in the restricted setting (i.e., single training room) and the remainder of the questions were taught in multiple areas around the specialized school. Training conditions were counterbalanced within a multiple baseline design across question sets. Generalization probes were then conducted at home in either a restricted setting (e.g., kitchen) or in multiple settings. Three of the children were successful at generalizing correct responses to the home setting after being trained in multiple areas around the school setting. A follow-up study by Handleman and Harris (1980) controlled for the amount of participating trainers within the school and generalization locations at home. Three young boys with ASD also generalized responses after training in multiple settings.

The previous studies were extended to assess generalization across instructional settings, rather than home settings, by using the same procedures (Handleman, 1981; Handleman & Harris, 1983). After training in either single or multiple setting exemplars, generalization was assessed by a teacher in a nearby preschool within a classroom setting (Handleman, 1981). Only two of six participants generalized into the preschool setting and no differential effects were observed between the two training conditions (i.e., restricted versus multiple settings). Generalization across instructional settings was re-evaluated in a second study with five boys with ASD (Handleman & Harris, 1983). As before, one classroom within the specialized school was used for the single setting exemplar condition; whereas, two classrooms with similar furniture were utilized in the multiple setting exemplar condition. Furthermore, classmates receiving individual instruction were included in all training conditions. Results showed that three boys generalized to the second instructional setting after the multiple setting condition, while the other two boys were more successful with one setting exemplar.

Finally, Lowther and Martin (1980) evaluated the effects of both multiple trainers and multiple settings in two separate experiments. Three adults with intellectual disabilities were taught the verbal greeting, “Hi,” and generalization was assessed across multiple staff members and settings within their residence. Training occurred in one setting with one trainer until mastery criterion was met before sequentially training another exemplar (either trainer or setting). In Experiment 1 (i.e., multiple trainer exemplars), generalization of the verbal greeting was evaluated by probing across multiple staff members in one location; whereas in Experiment 2 (i.e., multiple setting exemplars), probes were conducted to assess transfer of skill across four locations with one staff member. Overall, generalization across trainers in Experiment 1 was successful for all of the participants with the number of trainer exemplars ranging from two to five; furthermore, the greeting “Hi” transferred across various settings. In Experiment 2, the greeting “Hi” generalized across settings with the number of setting exemplars ranging from one and four locations; additionally, the greeting generalized across new staff members. This study provided evidence that either multiple trainers or multiple settings may foster stimulus generalization; therefore, selection of exemplar type should be based on school or clinic resources.

Purpose and Rationale for the Current Experiments

Early intervention is essential for successful outcomes in children with ASD (Dawson et al., 2000; Guralnick, 1998; NIHCD, 2005); specifically, evidence-based interventions, such as DTT, that have been shown to produce positive gains in overall functioning (Simpson, 2005). Although DTT is one of the most effective skill acquisition paradigms for children with ASD, one disadvantage is the method's highly structured nature which can hinder stimulus generalization (Sundberg & Partington, 1998). The ability to generalize acquired skills with new individuals, settings, and tasks promotes independence within naturalistic settings, making stimulus generalization an important learning process for children with ASD (Haring, 1988; Whalen, 2009). Thus, the first objective in Experiment 1 was to determine whether skills acquired through standard DTT, one therapist in one therapy setting, generalized when the discriminative stimulus was provided by another therapeutic agent in a new setting.

Early work from Rincover and Koegel (1977) discovered that one-to-one therapeutic settings may occasion over selectivity in children with ASD, leading to generalization deficits of trained responses across therapists or settings. These authors suggested that training skills in multiple settings and with multiple therapists may minimize responding to erroneous stimuli in the environment, thereby promoting stimulus generalization more successfully. Within the same year, Stokes and Baer (1977) emphasized the importance of programming for generalization in behavioral treatments and provided a compendium of effective strategies, one strategy being training sufficient exemplars. The main purpose of Experiment 1 was to expand the literature on generalization programming for children diagnosed with ASD. More specifically, sufficient exemplar training was evaluated using therapists and settings in an early intervention DTT program.

Within the generalization literature, programming multiple therapist exemplars during treatment has shown to engender generalized results across adults and peers (Belchic & Harris, 1993; Davis et al., 1992; Garcia, 1974; Stokes et al., 1974). While multiple therapeutic agents have been examined within several skill acquisition paradigms (Belchic & Harris, 1993; Davis et al., 1992; Garcia, 1974; Stokes et al., 1974), DTT was not the intervention of choice for any of these experiments. Furthermore, the studies focusing on the transfer of skills across adult therapists have only included intellectuall+y disabled participants (except for one participant with autistic features; Davis et al., 1992; Garcia, 1974; Lowther & Martin, 1980; Stokes et al., 1974); whereas most of the peer exemplar research has been comprised of participants with ASD (Belchic & Harris, 1994; Hughes et al., 1995; McEvoy et al., 1988). Since programming for generalization, specifically across individuals, is a key component for any effective therapeutic program for children with ASD (NRC, 2001), it seems that programming multiple therapists within treatment sessions should be an essential element for an early intervention DTT program. Therefore, the second objective of Experiment 1 was to systematically program multiple therapist exemplars within DTT sessions to promote generalized results in a multidisciplinary early intervention clinic. In previous studies, programming multiple therapists within treatment sessions evoked transfer across individuals as well as settings (Belchic & Harris, 1994; Garcia, 1974; Stokes et al., 1974); thus, transfer of treatment gains were evaluated across therapeutic agents and therapy settings.

The exemplar literature also includes studies incorporating multiple treatment settings and evaluating generalization across environments. This area of research has shown generalized outcomes across sites within clinics or institutions (Griffiths & Craighead, 1972; Lowther & Martin, 1980; Stokes et al., 1974), from clinic to home setting (Handleman, 1979; Handleman & Harris, 1980), and across instructional settings (Handleman & Harris, 1983); however, no studies have focused on generalization across multidisciplinary therapeutic settings. A multidisciplinary early intervention clinic that conjoins different treatment approaches for children with ASD would be a worthy avenue to investigate the effects of sufficient exemplars on stimulus generalization across therapeutic settings. Therefore, the third objective of Experiment 1 was to facilitate generalization across therapists and settings in a multidisciplinary early intervention program by training children with ASD in multiple settings (i.e., therapy rooms) using discrete trial instruction.

The discrete trial method is a common skill acquisition technique for children with ASD (Steege et al., 2007; Smith, T. 2001), therefore, studies investigating generalization strategies using this teaching paradigm are important. Current studies emphasizing both DTT and training sufficient exemplars have included multiple stimulus exemplars (i.e., instructional materials) within discrete trial sessions (Boyle & Lutzker; Schroeder et al., 1998) or have trained parents on DTT while using multiple skill exemplars (Crockett, Fleming, Doepke, & Stevens, 2005). However, programming multiple therapists or setting exemplars has not been systematically evaluated while using the DTT method. Although previous studies examining multiple therapists and settings have included components of discrete trials within their training sessions (Belchic & Harris, 1994; Garcia, 1974; Handleman, 1979; Handleman, 1981; Handleman & Harris, 1980; Handleman & Harris, 1983; Stokes et al., 1974), no studies to date have labeled or highlighted the procedural training sessions as such. Hence, the purpose of the foregoing objectives of Experiment 1 was to evaluate generalization across therapeutic agents and settings in an early intervention clinic for young children with ASD by using multiple exemplar training within a DTT instructional format.

Notably, most of the studies examining multiple therapists have trained exemplars sequentially until mastery was achieved for each one (Belchic & Harris, 1993; Davis et al., 1992; Garcia, 1974; Lowther & Martin, 1980). Conversely, most of the literature on setting exemplars trained participants in all settings concurrently during treatment sessions (Handleman, 1979; Handleman & Harris, 1980, Handleman, 1981; Handleman & Harris, 1983). Experiment 1 incorporated concurrent exemplar training, rather than sequential training, so that DTT instruction occurred with all therapists or in all settings during training sessions.

In a previously discussed study by Schroeder et al. (1998), the authors evaluated two methods, sequential and concurrent presentations of multiple exemplars during treatment sessions with young children with developmental disabilities. Most of the participants in this study were able to generalize target skills more efficiently when exemplars were trained concurrently rather than one at a time; moreover, the number of trials to acquisition also proceeded more quickly for exemplars trained in a concurrent fashion. Experiment 2 was conducted to further evaluate multiple exemplar training strategy by comparing both presentation methods on acquisition and generalization efficiency. More specifically, differential effects of sequential and concurrent multiple exemplars during tact training were investigated in Experiment 2 similarly to the Schroeder et al. (1998) study; however, the present study incorporated the two methods within a DTT instructional format with young children with ASD.

CHAPTER II:
GENERAL METHOD

Participants

Participants were recruited from a local multidisciplinary clinic that provided early intervention for children diagnosed with ASD. Invitations to participate in the current studies were sent to all parents of children meeting inclusion criteria. General inclusion criteria for both experiments were child participants with a professional diagnosis of ASD. Child participants were female or male between the ages of 3 years, 1 month and 6 years, 2 months.

Further inclusion criteria for Experiment 1 were three children exhibiting generalization deficits across therapists and settings who were identified by the clinic's licensed school psychologist and SLPs. Exclusion criteria for Experiment 1 were children diagnosed with a comorbid medical condition impacting gross-motor coordination or movement. Three participants, Rickon, Bran, and Jon, met the above criteria and were selected for this study. The first participant was a 3-year, 7-month-old boy named Rickon who was diagnosed with ASD. Rickon had several skills including gross-motor imitation, receptive identification of several body parts, and a variety of one-step instructions, including actions such as "stand up" and "sit down." Bran was a boy of four years and six months of age with a diagnosis of ASD. Bran had more expressive skills in his repertoire than receptive skills and responded better with teaching stimuli than without during therapy. Jon, the final participant in Experiment 1, was a 3-year, 1-month-old boy diagnosed with ASD. Jon had a few skills within his repertoire including sitting in his chair, providing eye contact, and simple imitation actions.

Inclusion criteria for Experiment 2 consisted of at least three children with mastery level tacting (i.e., expressive labeling) in at least three categories of common objects or entities. For example, a child tacting a variety of common animals, colors, and transportation vehicles was considered a potential candidate for participation. A total of four participants were selected for Experiment 2: Kelly, Zack, Lisa, and Samuel. Kelly was six years and two months of age and was diagnosed with ASD and Developmental Apraxia of Speech. She had receptive and expressive language delays with limited verbal output and vocal imitation. She primarily communicated by gestures and was an early American Sign Language (ASL) learner. At the time of the study she had approximately 90 signs, including a variety of mands and tacts (i.e., labels). Kelly had learned several ASL tacts in five categories, including food, drinks, colors, animals, and clothing during her time at the clinic. Zack was a 5-year, 10-month-old boy diagnosed with ASD. He was enrolled in a local kindergarten class and was able to verbally communicate in full sentences. However, Zack exhibited delayed echolalia which occasionally impeded his verbal language and communication with others. Zack had an existing tacting repertoire of over 10 common categories prior to beginning treatment at the clinic. The third participant was Lisa, a 5-year, 2-month-old girl with a diagnosis of ASD. Lisa communicated using 3-5 word phrases and had several mands and tacts in her verbal repertoire. Lisa engaged in frequent vocal stereotypy which sometimes hindered her expressive language. She had mastered a variety of common tact categories at the clinic, including colors, shapes, body parts, food, animals, vehicles, clothing, and household items. A 5-year, 10-month-old boy named Samuel was the last participant in Experiment 2. Samuel was diagnosed with ASD and had receptive and expressive language delays. Samuel's speech was limited to 3-5 word phrases. He struggled with pronunciation of words containing multiple syllables and consonant blends. He was able to tact common items in several categories including animals, colors, shapes, food, drinks, toys, plants, clothing, vehicles, and community helpers.

Therapeutic Agents and Training

ABA therapists from the ASD program were recruited to participate in both studies. All ABA therapists were required to have at least a high school diploma and complete the program's training package. ABA therapists first received a training manual that was reviewed by the supervisor which included the following information about the program: ASD characteristics (APA, 2013), ABA principles (Baer et al., 1967, 1987), DTT description (Smith, 2001) and examples, procedural steps for discrete trials and data collection, daily schedules, behavioral problems, and outdoor protocols. The therapist then viewed a 20-minute video created by doctoral students at Louisiana State University's school psychology program which reviewed training manual information and examples of discrete trial sessions. After reviewing the manual and video, therapists observed and practiced collecting data with several experienced ABA therapists and their respective child. Finally, new therapists conducted several independent sessions using the five components of the DTT procedure outlined by Smith (2001). Upon training completion, supervising staff approved competence prior to therapist independently working with children.

Participating ABA therapists were trained on the current research protocols assigned to each participant. They were responsible for implementing all DTT sessions for both experiments and generalization probes in Experiment 2. All ABA therapists were specifically trained on the following procedures: gaining the child's attention prior to providing the discriminative stimulus, providing the target instruction clearly, waiting 5 s for a response, initiating the correct prompting procedure for each child if needed, providing social reinforcement for all correct responses, and delivering an edible or tangible reinforcer after two correct responses [Fixed Ratio-2 (FR-2)] during all treatment sessions. ABA therapists in Experiment 1 were trained on a three-step, least-to-most prompting method (Wolery & Gast, 1984) when participants provided no response to discriminative stimuli. Incorrect or approximated responses within the 5 s response time were followed by a physical prompt (i.e., hand-over-hand prompt) to guide the appropriate response. In Experiment 2, incorrect responses, approximations, and no responses were followed by a verbal prompt after a constant time-delay of 5 s for Zack, Lisa, and Samuel. For Kelly, the three-step, least-to-most prompting method was used to promote an accurate ASL sign of the target tact. Supervision and performance feedback was provided during DTT sessions until ABA therapists were implementing all procedures with 100% integrity. Further training occurred for baseline and generalization sessions consisting of skill presentations without the use of prompting techniques or reinforcement schedules.

SLPs were recruited for Experiment 1 to conduct generalization probes for child participants enrolled in their speech/language groups. SLPs were certified in their field and had a graduate degree in the area of communication disorders. The primary experimenter trained the SLPs in their classroom and discussed the purpose and expectations of the study. The importance of precise skill presentation and scoring procedures for each participant was explained. The experimenter also role-played skill presentation, different participant response types (e.g., approximations or delayed responses), and data collection procedures. The SLPs were considered trained once two consecutive generalization probes were presented and scored with 100% integrity in the generalization setting.

Setting and Materials

The following experiments took place at a local multidisciplinary early intervention clinic that provided speech/language therapy, audiology, occupational therapy, and early behavioral intervention services to the Baton Rouge community. Within the clinic, the early intervention program for children with ASD was designed to combine two types of services: DTT and speech/language group therapy. Some clients received additional individual speech therapy and/or occupational therapy. In general, two hours of DTT and two hours of speech/language group therapy were provided each therapy day. Structured indoor play, outdoor play, a lunch break, and a resting period (i.e., nap-time) were also included on therapy days. A licensed school psychologist with a board certification in behavior analysis oversaw DTT sessions, ABA therapist training, and behavioral interventions for enrolled children with ASD. Speech/language groups were supervised by SLPs who primarily led all group therapy sessions within various contexts (e.g., circle-time, snack-time, interactive play-time). The overall treatment goals for the ASD program were to promote adaptive, academic, language, and/or social skills for all clients.

There were two general therapeutic settings for both experiments: individual therapy rooms and SLP classrooms. All DTT sessions and generalization probes for Experiment 2 occurred in individual therapy rooms. Therapy rooms with limited distractions were selected for each participant and included a child-size table and chair. A folder was assigned to each child that contained training stimuli, preference assessment results, research protocols, and data collection forms for DTT and probe sessions. Data collection forms listed target skills, appropriate verbal discriminative stimuli, and a location to collect and aggregate data. Generalization probes for Experiment 1 were conducted in SLP classrooms. Classroom composition resembled a traditional Pre-Kindergarten classroom to facilitate group therapy. Classrooms included a work station with a table and chairs, as well as a carpeted area for interactive play and instruction. Research protocols and data collections forms for generalization probes were provided to all participating SLPs.

Reinforcer and Preference Assessments

Reinforcer and preference assessments were administered prior to commencing treatment phases in Experiment 1 and 2. Parents of the participants received the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD), which is a structured parent interview identifying potentially reinforcing items for children with special needs (Fisher, Piazza, Bowman, & Amari, 1996). Questions on the RAISD are categorized to identify items that provide reinforcing feedback to the child's senses (e.g., visual, auditory, tactile). Paired-stimulus preference assessments (Fisher et al., 1992) were also conducted to identify edible and tangible items for each participant. Eight items were selected for each child and included items that were reported on the RAISD. The experimenter randomized the paired presentations of the stimuli during each preference assessment. Each item was presented once with every other item in the assessment and all child selections were recorded. The child was given 5 s to select an item and 15 s to consume the edible or interact with the tangible before the next pair of items were presented. A hierarchy of preferred items was established by dividing the number of item selections by the number of item presentations and multiplying by 100 to determine a percentage score. The top two preferred items in the edible and tangible assessments were used during DTT sessions. The following preferred items were selected as reinforcers for Experiment 1 participants: Bubbles and a musical piano for Rickon; soda crackers and a musical toy for Bran; Doritos and an "ABC spin" toy for Jon. Highly preferred items for participants in Experiment 2 were Smarties candy and a mirror for Kelly, jelly beans and a trampoline for Zack, Oreo cookies and bubbles for Lisa, and Play-Doh and train tracks for Samuel.

Data Collection

Responses provided by child participants during baseline, treatment, and generalization sessions were recorded for both experiments. A correct response was scored as *1*; whereas, a *0* was scored for an incorrect response, an approximation of the response, a response provided after a model or physical prompt, or no response during the pre-specified time. Baseline and treatment sessions for both experiments, as well as generalization probes for Experiment 2, consisted of 10 trials; therefore, one session was the aggregate of 10 responses. SLPs in Experiment 1 conducted four probes, instead of 10 trials, during a generalization session for practical purposes. The total score for each session was then converted into a percentage to measure the proportion of trials with correct responses.

Inter-Observer Agreement and Treatment Integrity

Inter-observer agreement (IOA) and treatment integrity (TI) were collected by the primary experimenter and research assistants for at least 30% of all baseline, treatment, and generalization sessions for both studies. The primary researcher trained research assistants to collect IOA and TI until at least 90% agreement was obtained for three consecutive sessions. IOA was calculated by adding all agreements, dividing it by the total number of agreements and disagreements for each session, and then multiplying the number by 100 to convert into a percentage. During TI sessions, the primary researcher and research assistants evaluated the accuracy of baseline, treatment, and generalization sessions. Several treatment components were observed, such as gaining the child's attention before the discriminative stimulus was presented, skill presentation, the five DTT components, prompting systems, reinforcement schedules, and data collection methods. ABA therapists and SLPs were re-trained if treatment integrity decreased below 90% during any session. Performance feedback, modeling of appropriate procedures, and observation of an in-vivo DTT or probe session was conducted to re-establish treatment integrity.

For Experiment 1, researchers collected IOA and TI for three participants across all sessions and conditions. Rickon's IOA was collected for 41% of total sessions and an average agreement of 99.8% was found. Rickon's ABA therapist had 98.3% TI for 39% of total sessions. For 39% of Bran's sessions IOA was collected showing 99.8% agreement across sessions. TI was collected for 44% of Bran's sessions and had 97.1% integrity. Researchers collected IOA for 49% and TI for 41% of Jon's total sessions. Average scores for his IOA and TI were 99.6% and 99.3%, respectively.

For Experiment 2, researchers collected IOA and TI for four participants across both conditions and generalization sessions. Kelly's ABA therapist had 100% IOA on 34% of her sessions and 99.8% TI on 33% of her sessions. IOA was collected for 46% of Zack's sessions and had 100% agreement. Zack's ABA therapist also had 100% TI for 45% of sessions. IOA was collected for Lisa for 50% of her sessions and had 99.8% agreement. Her therapist's treatment integrity average score was 99.7% for 42% of sessions. Samuel's IOA was 100% for 32% of sessions and 98.9% integrity for 33% of total sessions.

Experiment 1

Experiment 1 evaluated the effectiveness of utilizing multiple exemplars within DTT sessions to promote stimulus generalization in children with ASD. Generalization effects were evaluated across therapists (i.e., ABA therapist to SLP) and environmental settings (i.e., individual therapy rooms to SLP classroom) in a multidisciplinary clinic. The following research questions for Experiment 1 were considered for participants with generalization deficits: (1) will the target skill transfer across different therapists and settings without programming for generalization, (2) if generalized results are not observed, will training across multiple therapist exemplars be an effective method to facilitate stimulus generalization, or (3) will multiple setting exemplars foster generalization more successfully?

Method

Target Skill Selection, Training Stimuli, and Dependent Measures. Body part identification (BPI) and following verbal instructions are common skills evaluated to assess deficits in fundamental skill areas such as language and adaptive functioning in young children with ASD (Partington, 2006). Therefore, a target skill in one of these previously described skill sets was selected for each participant based on its current therapeutic and educational relevance as the dependent measures of the current study. Furthermore, new target skills were selected that had little to no history of exposure in the generalization setting in order to reduce threats to internal validity. For instance, touching *head* was frequently taught during speech/language groups in the classroom; therefore, commonly programmed body parts, such as head, were not targeted as a new BPI skill. The two-step instruction selected for Rickon was *shake head and arms up*. A correct response for the two-step instruction required Rickon to initiate the first step within 5 s of the initial demand and complete both parts consecutively. Bran was unable to identify any body part; *touch mouth* was selected for his target goal. Since Bran performed better with visual stimuli during instructional sessions, an 8” x 10” laminated black and white drawing of a male’s face containing all facial features was used to teach *touch mouth*. The dependent measure was scored as correct if Bran pointed to the mouth depicted on the visual stimulus within 5 s of the verbal instruction. Jon was also unable to identify any body part at the time of the study; *touch arm* was selected for his target goal. A correct response for Jon’s BPI skill was touching his arm with his hand within 5 s of the initial verbal discriminative stimulus.

Experimental Design. A multiple baseline and probe design across participants was employed for this study. The multiple probe design was combined with a traditional multiple baseline in order to minimize extinction effects that may occur during prolonged baselines (Horner & Baer, 1978). It was also hypothesized that without direct training (i.e., baseline phase) correct responses would remain at a low and stable level, thereby eliminating the need to collect continuous baseline data. A multiple probe design proved to be efficient within the clinic setting, allowing for SLPs to conduct probes expeditiously during group therapy.

Within this design, a baseline phase was followed by treatment phases for each participant. Baseline probes were conducted prior to commencing the first treatment phase and continued until response level and trend were stable across participants. Treatment conditions were then sequentially introduced within this design to promote skill generalization across therapists and settings. The first treatment phase was introduced to one participant, while the second and third participants remained in baseline. A stable baseline was re-established for the second and third participant before treatment began for the next participant, and so forth. Experimental control was achieved when the percentage of correct responding reached mastery level after a particular treatment condition was introduced across participants.

Generalization data were also displayed within this design to assess transfer across therapists and settings. After a treatment condition was mastered, generalization data determined whether the next treatment phase was presented or discontinued. Thus, generalization probes served two purposes: evaluation of stimulus generalization and baseline data for the next treatment phase.

Baseline Probes. Baseline probes were conducted by the ABA therapist in individual therapy rooms to determine if the target skill existed in the participants' repertoire. The ABA therapist began each probe by saying the child's name to gain his or her attention. Once the child was attending, the ABA therapist provided the specific verbal discriminative stimulus for the target skill. The child was given 5 s to respond. Responses were scored and no prompting or reinforcement was provided. Each baseline session was a percentage of correct responses out of 10 trials. The first treatment phase began when baseline remained stable across three days for all participants.

Standard-DTT. In the first treatment phase, each child was assigned to one ABA therapist and one individual therapy room. The target skill was taught using the DTT method described earlier, including the least-to-most prompting procedure, continuous social reinforcement, and a FR-2 edible/tangible schedule for correct responses. With these procedures, responding was not observed for Rickon across 40 sessions, minimal responding (below 10%) was observed for Bran across 32 sessions, and no responding occurred for Jon across eight consecutive sessions. Thus, a FR-1 schedule of edibles/tangibles and social reinforcement was initiated for all participants. Alternate prompting methods were also used including: most-to-least prompting, stimulus prompting, prompt fading, and response blocking.

Rickon required most-to-least prompting, prompt fading procedures, response blocking, and behavior chaining. His ABA therapist provided model prompts initially and faded assistance (e.g., a full model prompt to minimal movements) as he became more independent. She also reinforced prompted responses first until he independently completed both steps consecutively. In later sessions, response blocking, along with most-to-least prompting, was implemented to minimize incorrect responses. Model prompts were faded to verbal prompts by re-stating the instruction or verbally emphasizing the first instruction. Finally, the ABA therapist attempted to chain both target steps together by teaching *shake head* first, and then reinforcing the consecutive completion of both steps (*shake head and arms up*).

For Bran, most-to-least and prompt fading procedures were used first. Physical guidance to *touch mouth* was gradually faded to minimal prompts and all attempts were reinforced. However, due to minimal responding, a stimulus prompt (i.e., sticker) was introduced to promote response accuracy. A bright colored sticker was placed directly on the mouth of the training stimulus. The size of the stimulus prompt was systematically faded within 20 sessions as Bran accurately pointed to the sticker. An FR-1 schedule of reinforcement was used for all prompted responses until he was able to touch mouth correctly without the sticker.

The same most-to-least prompting procedure described for Bran was used for Jon's BPI skill. Prompts were faded from full physical guidance to light touches to his arm until he was able to independently respond. Reinforcement was also faded from prompted responses to independent *touch arm* responses.

Independent responses during S-DTT sessions were recorded as the dependent measure for the current study. At minimum, two S-DTT sessions were completed each day of therapy; however, the maximum number completed per day was five sessions. Each session consisted of 10 trials; therefore, the number of scored responses per therapy day varied between 20 and 50 trials. Natural and scheduled breaks were included in all S-DTT sessions. Sessions were not conducted on days that the participant was absent due to sickness. For instance, Jon became ill and missed one week of therapy and S-DTT sessions. Sessions were then resumed after the participant returned to the clinic. Target skill mastery criteria were two sessions of correct responding at 90% or greater across two consecutive therapy days. The ABA therapist discontinued sessions when the child met mastery criteria.

Multiple Therapist-DTT. Participants entered into the Multiple Therapist-DTT (MT-DTT) phase when generalization probes continued to display a performance deficit (i.e., below 100% across two consecutive days). The MT-DTT procedures included the five components of discrete trial instruction; however, instead of one ABA therapist, each child was assigned three therapists. The FR-1 edible/tangible and social reinforcement schedule was continued for correct responses; however, a full physical prompt was used for incorrect responses (as opposed to the previous methods described above). All other therapeutic elements, including the target skill, therapy room, treatment procedure, therapy time, and session breaks, remained stable. A minimum of three sessions (one for each ABA therapist) and a maximum of six MT-DTT sessions were completed each therapy day. The order of ABA therapists were randomized and counterbalanced across MT-DTT sessions. Data collection and mastery criteria for the MT-DTT phase were comparable to the S-DTT phase, with the exception of mastery level required for all ABA therapists. In other words, two complete therapist rotations, with responding at or above 90% across two days, are required to meet mastery criteria of this phase.

Multiple Room-DTT. The Multiple Room-DTT (MR-DTT) was the third treatment phase for participants with continuing generalization deficits upon the completion of the MT-DTT phase. The MR-DTT treatment phase planned to program one ABA therapist and three individual therapy rooms for each participant. All therapy rooms consisted of chairs and a work table, but differed slightly in room characteristics such as size, inclusion of windows, and other furniture (e.g., desks, computer, and shelves). Counterbalancing procedures and mastery criteria were analogous to the MT-DTT phase, with the exception that participants required mastery levels across all therapy rooms for two full rotations.

Generalization Probes. Generalization probes were commenced by the SLP during group therapy in the classroom across baseline and treatment phases. Probes were administered using similar presentation procedures as baseline probes, presented and scored by the SLPs instead of the ABA therapists. Generalization probes for Rickon and Jon occurred later in the day after DTT sessions were conducted in the morning. Bran's DTT sessions occurred every afternoon; therefore, generalization probes were conducted the next morning. Generalization sessions consisted of four probes, instead of 10, and were scored as a percentage of total opportunities. Initially, probes occurred after two baseline or treatment sessions; however, the demands of multiple children in group therapy only allowed SLPs to probe participants after the completion of four treatment sessions. The SLP conducted probes for 22% of Rickon's total sessions, 24% of Bran's sessions, and 32% of Jon's sessions. Mastery criteria was 100% correct responding for two consecutive sessions in the generalization setting, across two therapy days. If generalized results remained below 100% with the SLP in the classroom, the participants were introduced into the next programmed treatment phase. Treatment conditions were discontinued when participants reached generalization mastery.

Experiment 2

Experiment 2 evaluated the differential effects of teaching multiple stimulus exemplars concurrently and sequentially during DTT sessions to efficiently promote stimulus generalization in children with ASD. Multiple pictorial exemplars were utilized during tact training to evaluate generalization effects of expressive labeling across new pictorial stimuli. Research questions for Experiment 2 analyzed acquisition and generalization efficiency by comparing the following components across treatment conditions: (1) the number of acquisition sessions to meet mastery criteria, (2) the number of probe sessions required for generalization criteria, and (3) the percentage of incorrect trials during treatment and generalization sessions.

Method

Stimuli. Training stimuli consisted of 4” x 6” color representations of common items printed on white paper and laminated with clear laminating sheets. Five different representations (i.e., exemplars) for each pictorial item (e.g., pot) were utilized during treatment sessions. The five pictorial exemplars varied in characteristics, such as color, size within the picture, details, and position. Two new pictures of the same training item were used to evaluate generalization. Generalization pictures were laminated and had the same dimensions as the training pictures, but differed in color contrast (i.e., black and white photo) and background details (e.g., a pot on a kitchen stove).

Target Skill Selection and Dependent Measures. The dependent measure of the current experiment were correct tact responses to pictorial stimuli presented during baseline, treatment, and generalization sessions. Two untrained tact categories were selected for each participant, which was determined by reviewing each child’s mastered tact list. For example, if a child mastered a variety of items within the categories of animals, shapes, and colors, then two new categories such as household and classroom items were selected for the participant. The two categories for Kelly were community helpers and household items. For Zack, classroom and household items were selected for the study. Items within the classroom and playground environment were chosen for Lisa. Finally, Samuel was designated items within the school and household categories.

Two items within each new category (i.e., a total of four items) were selected for tact training. Several strategies were conducted to ensure tact responses were matched on difficulty level (Gast & Ledford, 2010). First, target tacts were matched on number of syllables, phonetic structure (i.e., consonant blends) or motor complexity for Kelly, and picture characteristics. Second, the program's licensed psychologist, SLP, and occupational therapist (for Kelly) was consulted for a second opinion on difficulty level across tact responses. Third, a brief receptive identification assessment was completed for all participants to determine whether some objects were more difficult to identify than others. Finally, ABA therapists conducted probe sessions to determine whether participants were able to provide an echoic/physical imitation response of the target tacts. Kelly's target tacts were *Police* and *Doctor* for community helpers and *Window* and *Soap* for household items. Zack's target tacts were *Bulletin Board* and *Calculator* for the classroom category and *Chandelier* and *Shower Curtain* for the household category. *Desk* and *Paint* were selected for Lisa's classroom category and *Fence* and *Bench* for the playground category. Samuel's tacts were *Bell* and *Map* for the school category and *Pot* and *Mop* for the household category.

The four target tacts for each participant were divided in two, so that each treatment condition, sequential and concurrent, trained two target items representing both categories. For Kelly, *Police* and *Window* were randomly assigned to the sequential condition and *Doctor* and *Soap* were assigned to the concurrent condition. Therefore, responding was evaluated across sequential *Police* and concurrent *Doctor* for the community helper category, while sequential *Window* and concurrent *Soap* were compared for the household category. The sequential condition for Zack consisted of *Bulletin Board* and *Chandelier*, while his concurrent condition was assigned *Calculator* and *Shower Curtain* tact responses. Lisa's sequential tacts were *Desk* and *Fence* and her concurrent tacts were *Paint* and *Bench*. Target tacts *Bell* and *Pot* were randomly assigned to Samuel's sequential condition and *Map* and *Mop* were taught concurrently.

Tact responses, number of acquisition sessions, number of generalization sessions, and percentage of incorrect trials were collected by the ABA therapists for all phases of the current study. A correct tact response was scored if the child expressively labeled or signed the item within 5 s of the verbal discriminative stimulus, “what is it?” and picture presentation. Each session consisted of 10 trials and a percentage of correct and incorrect trials was calculated for all baseline, treatment, and generalization sessions.

Experimental Design. An adapted alternating treatments design (Wolery, Gast & Hammond, 2010; Schroeder et al., 1998; Sindelar, Rosenberg, & Wilson, 1985) was used in this study to compare two instructional strategies within DTT sessions on matched tact responses. An initial baseline of responses for both treatment conditions was conducted to ensure that these tacts did not exist in the participants’ repertoire. Treatment conditions commenced after baseline remained at or below chance level across three days. Two treatment conditions followed baseline and were randomly alternated each therapy session. Probes were conducted for generalization pictures across baseline and treatment phases. Treatment and generalization sessions were continued until mastery criteria was met for each target tact within both conditions and generalization was achieved. Experimental control was established once differential mastery levels and/or trend were exhibited between the two treatment conditions (Cooper et al., 2007).

Baseline Probes. An initial baseline phase was conducted prior to the alternating treatments phase for three days. Baseline sessions were conducted on all target tact responses in both conditions and each session consisted of 10 probes. More specifically, four baseline sessions occurred each day, one for each target tact item and included the presentation of all five exemplars. Order of stimulus presentation and conditions were randomized and each exemplar was presented twice for each session.

ABA therapists conducted all baseline sessions and data collection. Each trial started with the ABA therapist gaining the child's attention by saying his or her name and waiting for eye contact. The ABA therapist then provided the verbal discriminative stimulus, "what is it?", and simultaneously presented the pictorial stimulus at eye level. No social, tangible, or edible reinforcement was provided for correct responses. All correct and incorrect responses were scored.

Treatment. Two treatment sessions, one for each condition, occurred each therapy day. Order of treatment conditions and pictorial items were randomly alternated across therapy days. ABA therapists conducted DTT sessions in a similar fashion to baseline probes; however, a FR-1 social reinforcement schedule, a FR-2 edible/tangible schedule, and prompting procedures were incorporated. Prompting methods for Zack, Lisa, and Samuel was a constant time-delay of 5 s, while Kelly required the three-step, least-to-most prompting method described earlier in order to facilitate accurate ASL tact signs. Kelly also needed an additional stimulus prompt to promote correct responses after several acquisition sessions of low level responding was observed for sequential *Police* and concurrent *Doctor*. The stimulus prompt was a colored sticker that was placed on Kelly to prompt the correct placement of her fingers or hand. The ASL sign for *Police* was a right-hand formation of the letter *C* placed on the left side of her chest. Kelly consistently used her left-hand instead of her right-hand and placed the *C* on the incorrect side. Therefore, the stimulus prompt was placed on the left side of her chest while the therapist modeled the correct response. The ASL sign for *Doctor* was tapping two fingers on the inside of her wrist, however Kelly was incorrectly tapping the palm of her hand. The stimulus prompt was then placed on the accurate location of her wrist and the model prompt was provided to increase accurate responding. Mastery criteria for both conditions were two days of correct responding at or above 90%.

Sequential Multiple Exemplars. The first treatment condition trained five pictorial exemplars in a sequential fashion for both target tacts. The five pictorial exemplars for each tact were taught in a serial manner so that each exemplar had to meet mastery criteria before the next exemplar was trained. For example, the first exemplar of *Map*, a multi-colored picture of the continents, countries, and oceans of the world, was taught to Samuel until he achieved mastery criteria. Once he reached mastery level he was trained on the second *Map* exemplar, and so forth. The training order of exemplars was randomized for all participants.

Concurrent Multiple Exemplars. The second treatment condition trained five pictorial exemplars concurrently for both target tacts. The five pictorial exemplars for each tact were randomly presented within each training session, so that each participant learned all prototypes simultaneously. Each exemplar was reordered and presented twice during each session for a total of 10 trials.

Generalization Probes. Generalization probes were conducted during baseline and alternating treatments phase. A generalization session was administered after the target tact had been trained twice. The same procedure described above in baseline sessions was implemented for probes; however, two generalization pictures, instead of five pictures, were evaluated for each target tact. No error correction, prompting method, or reinforcement schedules were implemented during generalization probes, except for Lisa in later sessions. After Lisa mastered all target tacts during acquisition sessions, a FR-1 social reinforcement schedule (i.e., praise) was introduced to increase generalized responding and reduce extinction side effects of escape motivated behaviors (e.g., crying and swiping generalization pictures). For all participants the two generalization pictures were presented in random order for a session of 10 trials and scored as either correct or incorrect. Generalization mastery criteria was similar to acquisition mastery in that two sessions at or above 90% indicated stimulus generalization had occurred. Additional generalization probes using objects rather than pictures were conducted after generalization mastery criteria was attained for Kelly and Zack. The same presentation and scoring procedures were used; however, instead of using pictorial stimuli the therapist used physical examples (e.g., different bulletin boards in the clinic).

CHAPTER III:
RESULTS

The following studies were exploratory in nature; therefore, no hypotheses were established prior to implementing treatment conditions. Single-subject methodology was employed in both experiments. Participants' data were displayed within graphical representations and visual analysis was utilized to determine treatment effectiveness in the following research projects.

Experiment 1

Figure 1 contains three, single-subject line graphs within a multiple baseline design. Multiple probes were integrated into the multiple baseline design to efficiently assess baseline and generalized responding. Target skill performance for three participants was evaluated using visual analysis during treatment conditions and generalization sessions. Graphs for Experiment 1 depict the number of sessions on the x-axis and percentage of correct responses on the y-axis. The dashed horizontal line, demarcating 90% on the y-axis, indicates mastery level for all treatment conditions in each graph. Black arrows highlight specific sessions containing changes to prompting methods or reinforcement procedures. Target responses for each participant are represented by a solid black data stream with closed circle markers. Generalization data is illustrated in each graph by a dashed data stream with open circles. Mastery criteria for generalization were two consecutive days of 100% responding with the SLP. Level, trend, and variability were also analyzed within each panel to identify response patterns.

Rickon

Rickon's results for *shake head and arms up* are presented in the first panel of Figure 1. Rickon began participating in the study in October 2013, completing a total of 147 sessions by

March 2014 of the following year. The first phase consisted of eight baseline sessions in an individual therapy room (with one ABA therapist) and two generalization probes. Zero level responding occurred during his baseline and generalization sessions.

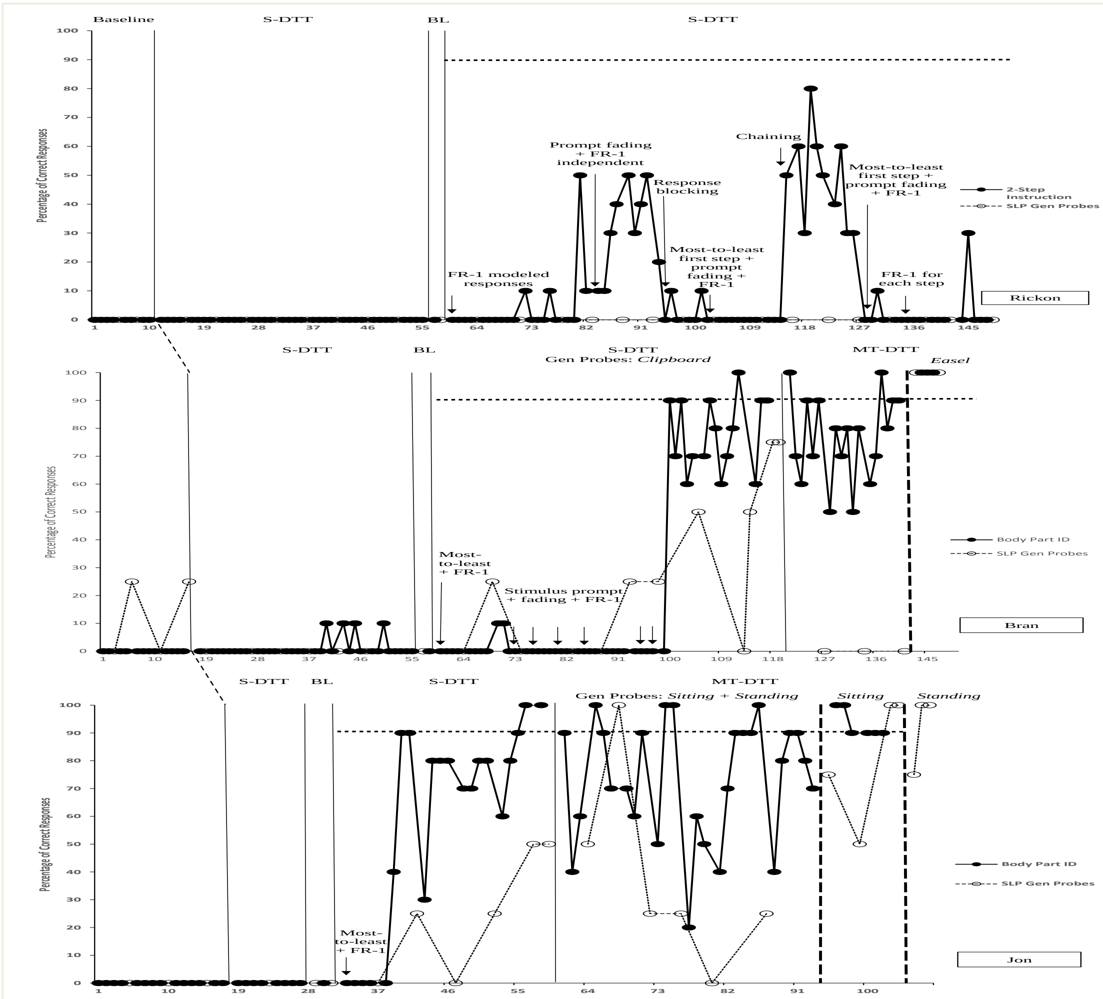


Figure 1. Percentage of correct responses in a multiple baseline design across three participants.

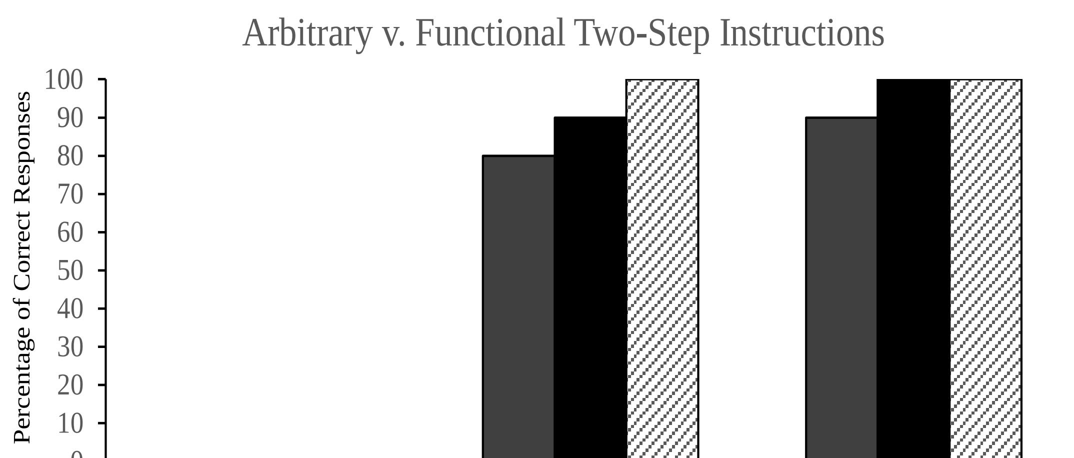
Low and stable baseline levels were also observed for Bran and Jon; therefore, Rickon entered into the first treatment phase, S-DTT. The ABA therapist began training the two-step instruction using the DTT method, with least-to-most prompting procedures, continuous social reinforcement for correct responses, and a FR-2 edible/tangible schedule of reinforcement. A total of 36 S-DTT sessions were conducted, with eight generalization sessions completed before the Christmas break began. Although Rickon began responding to the therapist's model prompt during S-DTT sessions, no independent or generalized responses were observed in either the individual therapy room or the SLP's classroom.

After the winter holiday break, a new ABA therapist was assigned to Rickon due to the resignation of his previous therapist. Rickon's new therapist was trained on research protocols until TI and IOA criteria was reached. One baseline and generalization session were completed by his new therapist and SLP to ensure the target skill had not been acquired over the break. Rickon did not respond during these sessions, thus S-DTT sessions were reconvened.

After four sessions of no responding and 36 previous S-DTT sessions with zero level responding, the first procedural changes were made to include a FR-1 edible/tangible reinforcement schedule for independent and modeled responses. Rickon began responding independently at a low level with two sessions at 10% followed by one session at 50%. Sessions decreased back to 10% for three consecutive sessions. Observations showed Rickon consistently responded to the ABA therapist's model prompt and initiated the *shake head* response independently. Therefore, the model prompt was faded to a verbal prompt and only independent responses of the two-step instruction were reinforced. After these changes a higher level of responding occurred, yet sessions remained below 50% accuracy. Rickon began responding only to the second step of the instruction (*arms up*) and a decreasing trend to zero level was observed. A response blocking procedure was utilized to prevent him from raising his arms first and *shake head* was then taught in isolation. The *shake head* response was taught using a most-to-least prompting procedure, starting with the model prompt and a FR-1 schedule of reinforcement for modeled and independent responses. Model prompts were then faded to verbal prompts, and reinforcement was delivered for independent responses only. Once Rickon consistently responded to the first instruction, *shake head*, a behavior chaining procedure was introduced in Session 115. The *shake head and arms up* response were chained by reinforcing the independent and consecutive completion of both steps. Based on visual analysis of the first panel in Figure 1, an increasing trend was observed with the highest level of overall responding detected since the initiation of the S-DTT phase. Session 119 was Rickon's highest score with 80% correct responding for *shake head and arms up*. A decreasing trend to zero level re-occurred after he ceased responding to *shake head* and completed only the second step. Most-to-least prompting procedures were recommenced for *shake head* and were gradually faded from a full model prompt to minimal head movements. During these sessions minimal model prompts were still required to evoke a response from Rickon; therefore, a FR-1 schedule of reinforcement was implemented for each component of the two-step instruction. Model prompts of *shake head* were faded to verbal prompts after Rickon imitated the ABA therapist's head movement consistently. Lastly, verbal prompts were removed in Session 145. Rickon independently responded for 30% of trials, but decreased back to zero level for three consecutive sessions.

During these procedural changes, Rickon did not exhibit any generalized responding of the target skill *shake head and arms up* in the classroom. Based on observations of the final generalization sessions, Rickon emitted either a *shake head* or *arms up* response for some probes, but did not complete the two steps consecutively. Previously mastered one-step skills were then probed using a two-step instruction format in the individual therapy room and found that Rickon was unable to complete both skills consecutively. Therefore, the target skill *shake head and arms* was discontinued and additional data was collected to determine Rickon's competency with novel two-step instructions.

The following two-step instructions were targeted during Rickon's last sessions: (1) *Pick up the block and put it in your backpack*, and (2) *get the bowl and put it on the table*. Two sessions were conducted for each novel two-step instruction and compared to Rickon's last two sessions of *shake head and arms up*. The S-DTT method with least-to-most prompting and a FR-1 schedule of reinforcement was used to teach all two-step instructions. All other treatment and generalization procedures remained the same. Figure 2 presents two-step instructions on the x-axis and percentage of correct responding within each session on the y-axis. The gray bars represent results for S-DTT Session 1 and the black bars depict Session 2. The final patterned bar represents generalized responding during a four-probe session with the SLP in the classroom.



	Shake Head and Arms Up	Pick up the block and Put in your backpack	Get the bowl and Put it on the table
S-DTT Session 1	0	80	90
S-DTT Session 2	0	90	100
Generalization	0	100	100

Figure 2. A comparison of arbitrary and functional two-step instructions for Rickon. Percentage of correct responses for two S-DTT sessions and one generalization session across Rickon's target skill and functional two-step instructions.

As previously seen in Figure 1, zero responding for *shake head and arms up* occurred during Rickon's last two S-DTT and generalization sessions. Rickon responded to 80% of trials for the first novel two-step instruction, *pick up the block and put it in your back pack*¸ and 90% on the following therapy day. A generalization session was conducted on the second therapy day and Rickon generalized during all SLP probes. The second instruction, *get the bowl and put it on the table*, was completed for 90% of opportunities during Session 1 and 100% for Session 2. Rickon also generalized during all probes in the classroom.

Bran

The second panel of Figure 1 graphs Bran's target skill performance and generalization results of *touch mouth* across 142 sessions. The first phase consisted of 12 baseline sessions with zero level responding with one ABA therapist. During the baseline phase, four generalization sessions, or a total of 16 probes (four per session), were conducted. Bran independently responded to two of the 16 generalization probes during these sessions. Baseline remained at a low and stable level across participants; therefore, the S-DTT phase was initiated with least-to-most prompting procedures, social praise of independent responses, and FR-2 edible/tangible reinforcement schedule. The ABA therapist used these procedures for 32 S-DTT sessions and only four independent responses were exhibited by Bran. Bran also did not generalize with the SLP during group therapy.

Changes in therapists' availability was a fairly common occurrence at the clinic after the winter holiday break. Most ABA therapists were enrolled in the local university and school schedules affected their work schedules. Therefore, to accommodate schedules and other clients, changes to therapist and room assignments were made after the holidays. Bran's new ABA therapist re-assessed baseline in a new therapy room and a generalization session was conducted with his SLP. The S-DTT was then recommenced with new prompting and reinforcement procedures. Most-to-least prompting, fading procedures, and a FR-1 edible/tangible reinforcement schedule of assisted and independent responses were utilized in the second S-DTT phase. Bran generalized once at 25% and scored 10% for two consecutive S-DTT sessions. Based on session observations, Bran was having difficulties with accurately pointing to mouth, instead he would touch the area surrounding the mouth by placing his finger on the chin or cheek. After the stimulus prompt (colored sticker) was placed on the training stimulus, and faded in size, Bran accurately responded. As the sticker became smaller in size, Bran accurately responded twice within the generalization context during two consecutive sessions. Once the stimulus prompt was completely removed from the training stimulus, Bran immediately responded to his ABA therapist with 90% accuracy. Although a higher level of overall responding was observed, responding consistently varied from 60-100%. Variability was also exhibited during generalization sessions with probes ranging from 0-75%. After 16 S-DTT sessions with no stimulus prompts, Bran mastered *touch mouth* with his ABA therapist and responded at 75% for two consecutive generalization sessions.

The MT-DTT phase was implemented after Bran did not meet generalization criteria during the S-DTT phase. The first MT-DTT session was randomly assigned to his S-DTT therapist and Bran responded with 100% accuracy, but decreased in responding with the other two ABA therapists. Variable response patterns were observed across therapists with overall responding ranging between 50-100%. An increase in response level was observed in Session 137 and maintained across all therapists. Contrastingly, his generalized responding remained at zero level. A phase change was then implemented (highlighted by a dashed phase line) to include the instructional easel from MT-DTT sessions into the classroom. Bran's generalized responding immediately increased to 100%. The next therapy day, Bran reached mastery level with all therapists for one rotation during MT-DTT sessions. Finally, Bran responded at 100% for a second consecutive generalization session in the classroom.

Jon

Results for Jon's BPI skill *touch arm* are shown in the third panel of Figure 1 across 102 sessions. Jon's initial phase consisted of 14 baseline sessions with the ABA therapist and three generalization sessions. Jon exhibited zero level responding during the initial baseline phase and was then introduced to the S-DTT phase. Before the winter holiday, Jon completed eight S-DTT sessions and one generalization session. These S-DTT sessions included the least-to-most prompting procedure, social praise for correct responses, and FR-2 edible/tangible schedule of reinforcement. Jon did not exhibit any responding before the holiday break.

A new ABA therapist was assigned to Jon after the winter break. The new therapist was trained on the research protocols and baseline was re-assessed. Generalized responding was also re-evaluated for two sessions. Similar zero level responding was found during baseline and generalization sessions, thus the S-DTT phase was re-introduced. New procedures were implemented at the initiation of the second S-DTT phase, including the most-to-least prompting method, fading techniques, and a FR-1 schedule of reinforcement. Physical prompts were faded over five sessions until responding occurred at 40% in Session 39. An increase to 90% correct responding occurred in the following two consecutive sessions. Subsequently, Jon responded for the first time with his SLP with 25% generalized responding. Due to a holiday clinic closure and Jon becoming ill, data was not collected for one week. Upon Jon's return, his responding initially decreased to 30% for one session, but increased to 80% for three consecutive S-DTT sessions. After 21 S-DTT sessions using the most-to-least prompting technique and FR-1 schedule, Jon mastered *touch arm* with his ABA therapist in the individual therapy room with two consecutive sessions at 90%, across two therapy days. Generalization responding during the last two S-DTT sessions increased from 25% to 50% for two sessions, across two days.

When generalization criteria was not achieved during the S-DTT phase, Jon entered into the next treatment phase—MT-DTT. Jon was able to maintain mastery level during the first session with his original ABA therapist. His first generalization session also maintained at 50% from the S-DTT phase. Similar to Bran's results, responding decreased when new therapists conducted their sessions. Response variability also increased with scores ranging from 20-100%. Notably, Jon remained at mastery level with his original therapist for all but two sessions. After the second therapist rotation was completed, a generalization session was conducted where he responded at 100%. Thereafter, a decreasing trend of generalized responding occurred for three consecutive sessions. Contrastingly, the *touch arm* response was improving within MT-DTT sessions. In Sessions 84-86, Jon exhibited mastery level responding across therapist exemplars in one rotation. Observations during generalization sessions found that Jon was responding more successfully when he was sitting in a chair instead of standing. Therefore, a protocol change was made within the generalization setting to ensure consistency of probe presentations. First, generalization was assessed while he was sitting in a chair, resulting in 75% responding to probes during group therapy. An increase to mastery level responding was also observed during MT-DTT sessions with all ABA therapists. These results were followed by two consecutive generalization sessions at 100% across two therapy days. A final phase change was implemented to determine whether sitting in a chair or standing up in the classroom affected generalized responding of *touch arm*. Probes were presented during occasions when Jon was standing instead of sitting, which resulted in 75% responding for the first session, followed by 100% for the final two consecutive therapy days.

Experiment 2

Two single-subject line graphs were created for each participant in Experiment 2 to graph acquisition and generalization data of target tacts. An alternating treatments design with an initial baseline phase was utilized for each participant to demonstrate differential effects between treatment conditions. For line graphs in Experiment 2, the x-axis represents the number of sessions and the y-axis delineates the percentage of correct responding within each session. The dashed horizontal line highlighting 90% on the y-axis signifies mastery responding for both treatment conditions and generalization sessions. The sequential tacts are represented by dashed data streams and the concurrent tacts are solid black lines. Visual analysis was utilized to determine differences in overall response patterns (level, trend, variability) and to identify the condition exhibiting fewer number of acquisition and generalization sessions required for mastery level. A condition with fewer number of sessions to mastery level was illustrated by shorter data streams on the graphs. Two bar graphs were also generated for each participant to compare the number of sessions and the percentage of incorrect trials for each condition. More specifically, the first bar graph compiled the number of acquisition and generalization sessions needed to achieve mastery in the sequential and concurrent conditions. The second bar graph represented the percentage of error trials, or incorrect responses, during acquisition and generalization sessions for both conditions. Both bar graphs display acquisition sessions and generalization sessions on the x-axis with the dark gray bars representing sequential tacts and the light gray bars depicted concurrent tacts. The y-axis delineates the number of sessions in the first bar graph and percentage of trials in the second graph.

Kelly

Figure 3 presents Kelly's acquisition results for the target tacts *Police*, *Window*, *Doctor*, and *Soap*. During baseline sessions, Kelly did not respond to any of the target tacts for either condition. The sequential and concurrent conditions were then randomly implemented in an alternating fashion. Sequential *Police*, represented by the closed diamond markers, was compared to concurrent *Doctor* indicated by the closed triangle markers; whereas, sequential *Window* was matched with concurrent *Soap*. The first tact to reach mastery criteria was concurrent *Soap*, illustrated by the closed circle markers, which was achieved in four acquisition sessions. The first exemplar of sequential *Window* (closed square markers) was mastered two sessions after the mastery of concurrent *Soap*.

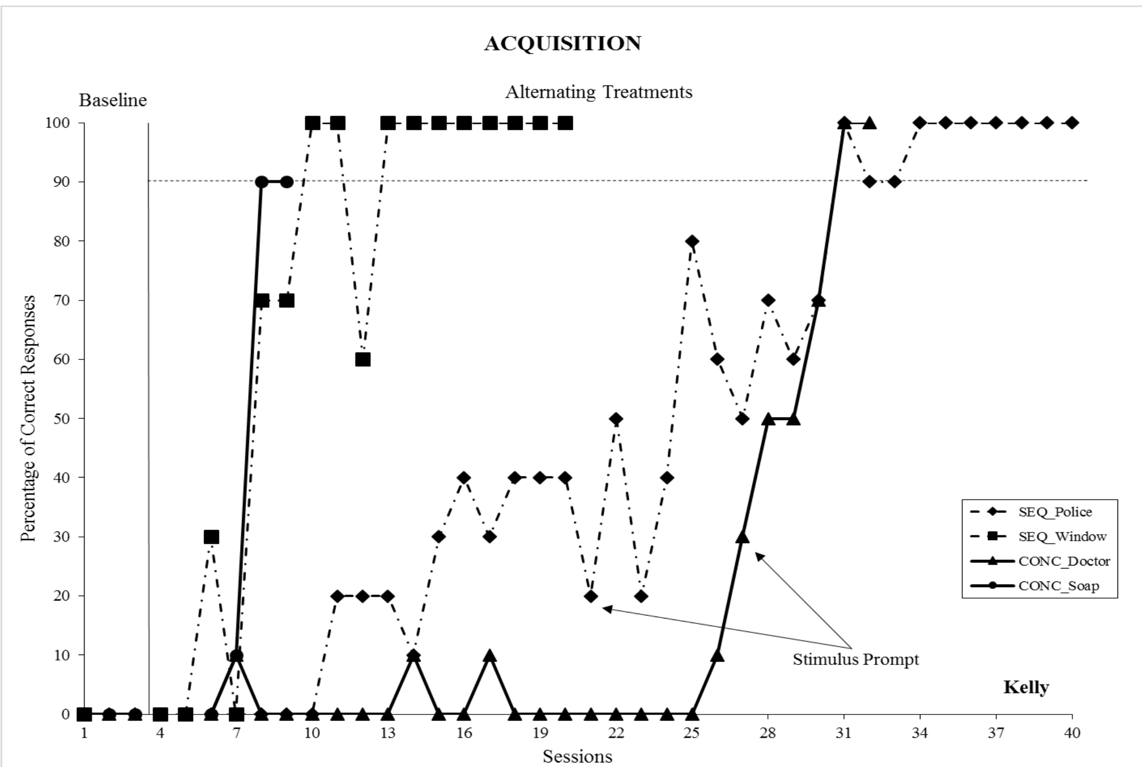


Figure 3. Percentage of correct responding across sequential (SEQ) and concurrent (CONC) tacts during baseline and alternating treatments phase for Kelly. The commencement of stimulus prompts within sessions are denoted by the arrows.

Once the first exemplar of sequential *Window* was mastered, all except one session remained at 100% across exemplars. Both sequential *Police* and concurrent *Doctor* required more acquisition sessions. After the stimulus prompt was implemented, Kelly began responding with greater accuracy as observed by an increasing trend for both target tacts. Concurrent *Doctor* and the first exemplar of sequential *Police* reached mastery level simultaneously. Acquisition sessions for the remainder of the sequential *Police* exemplars continued and remained at or above mastery level. Initially, Kelly exhibited a higher level of responding to the first sequential *Police* exemplar in comparison to concurrent *Doctor*; however, a faster ascending trend was observed for both concurrent tacts. Sequential tacts tended to have more variable response patterns, while concurrent tacts were fairly stable.

Figure 4 depicts Kelly's generalization probes of *Police*, *Window*, *Doctor*, and *Soap* within the alternating treatments design. The markers in Figure 3 represent the same generalization tacts in Figure 4. During the baseline phase, Kelly did not respond to any of the generalization pictures. Once the alternating treatments phase commenced, sequential *Window* and concurrent *Doctor* reached mastery criteria first with a difference of only one session. Similar to the acquisition graph, more generalization sessions were needed for sequential *Police* and concurrent *Doctor*; however, once Kelly began responding to generalization pictures both tacts reached mastery level with a difference of one session. The two additional markers, the open square and open circle, represent the generalization probes using items rather than picture examples for sequential *Window* and concurrent *Soap*. Kelly was successful at generalizing with 100% correct responding for sequential *Window* and concurrent *Soap* exemplars for probes using physical examples. Overall level, trend, and variability for matched tacts across conditions were similar. For example, sequential *Police* and concurrent *Doctor* displayed the same low level of responding at first with some variability, and then quickly ascended to generalization mastery level. For sequential *Window* and concurrent *Soap*, the same level and rapidly ascending trend occurred with no variability in responses.

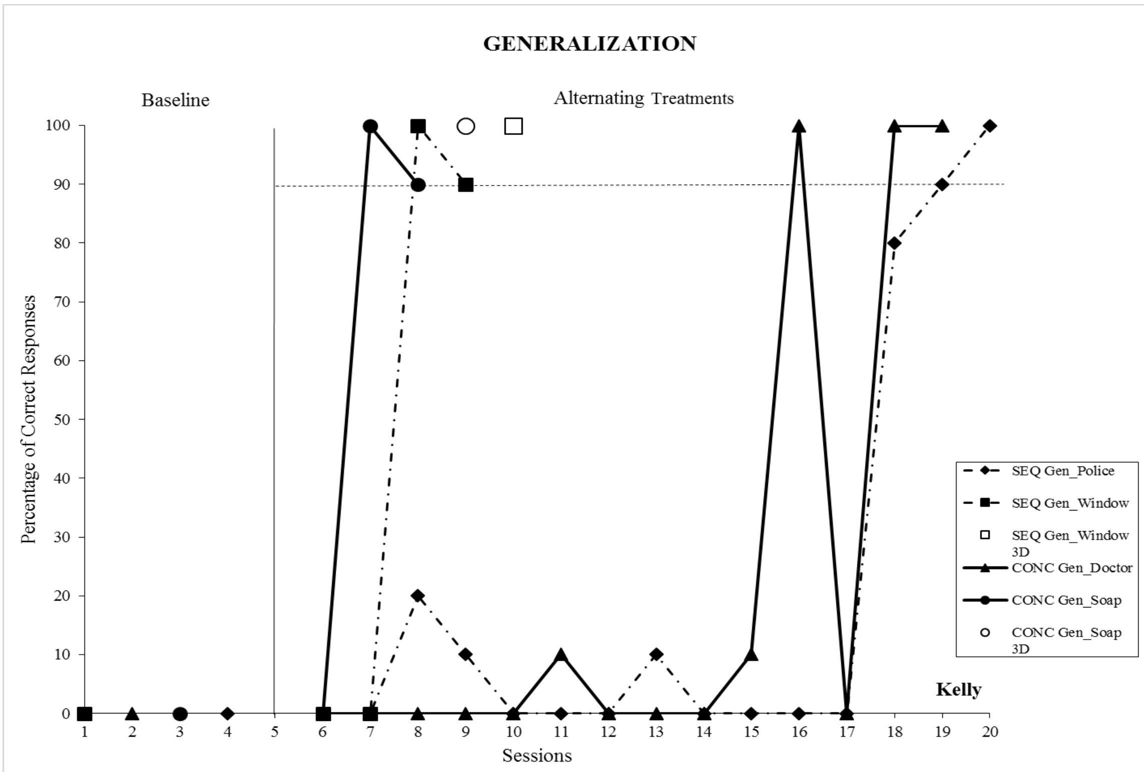


Figure 4. Percentage of correct responding across sequential (SEQ) and concurrent (CONC) tacts during baseline and alternating treatments phase for Kelly.

Figures 5 and 6 illustrate Kelly's number of sessions and error trial percentages, respectively. Figure 5 reveals that a higher number of acquisition sessions were needed for Kelly's sequential tacts in comparison to her concurrent tacts. When comparing the matched tacts, sequential *Police* was acquired in 35 sessions and concurrent *Doctor* in 27 sessions; moreover, Kelly learned all exemplars of sequential *Window* in 17 sessions and only four sessions were needed for concurrent *Soap*. Figure 5 also demonstrates that both concurrent generalization tacts were mastered in one less session than the sequential tacts (i.e., 15 sessions for *Doctor* and 14 for *Police*; four sessions for *Window* and three for *Soap*). Figure 6 highlights percentage differences for incorrect responses during acquisition and generalization sessions. During acquisition sessions, there was very little difference in percentages between sequential *Window* and concurrent *Soap*; however, sequential *Police* had fewer percentage of errors, 44% of total trials, in comparison to 87% of concurrent *Doctor* trials. The right side of the bar graph represents incorrect trials during generalization sessions. There was a 2% difference in incorrect percentages between sequential *Police* and concurrent *Doctor* during generalization sessions. However, for sequential *Window* (52%) and concurrent *Soap* (37%) there was a 15% difference of incorrect trials per session.

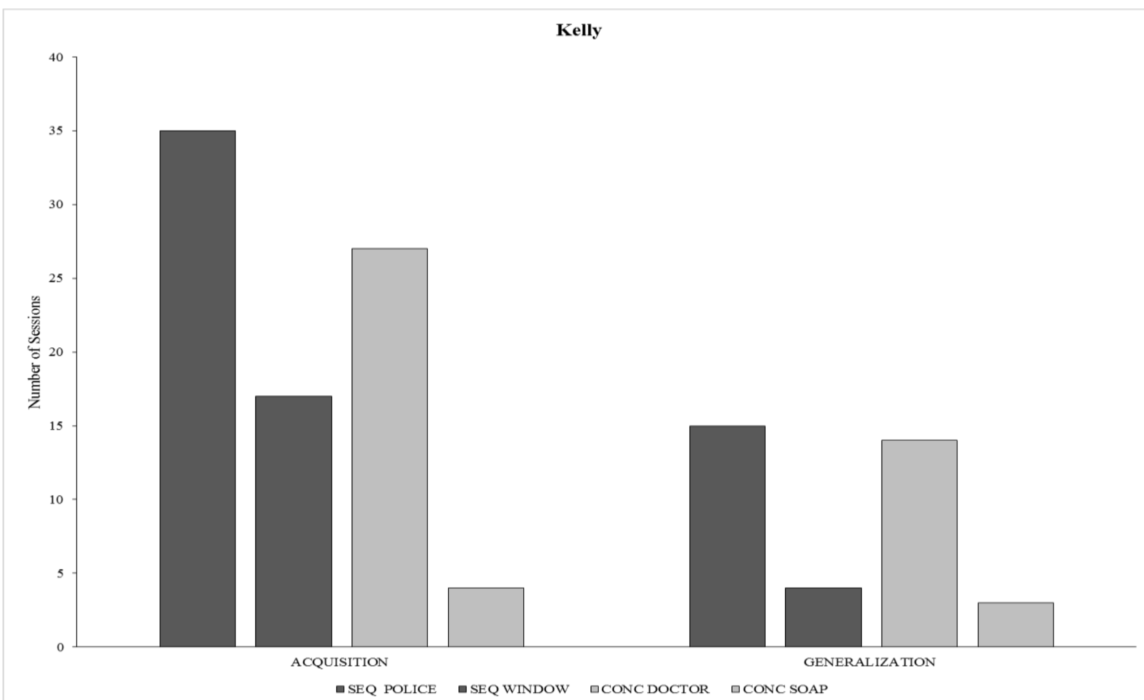


Figure 5. Number of acquisition and generalization sessions to reach mastery criteria across sequential (SEQ) and concurrent (CONC) tacts for Kelly.

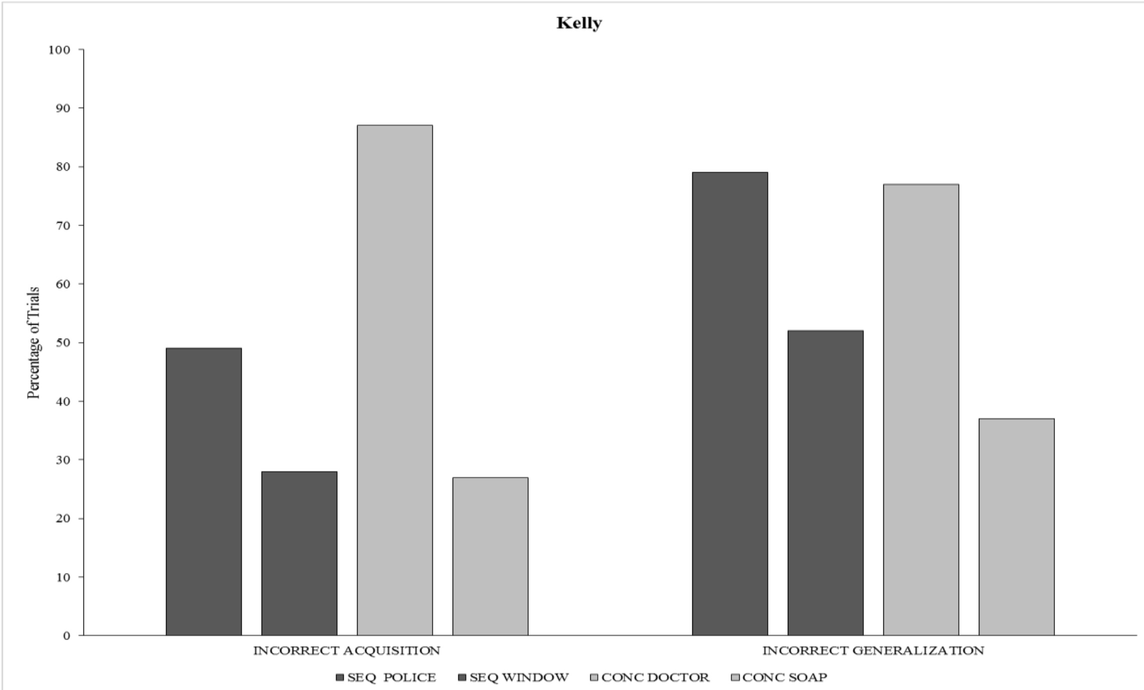


Figure 6. Percentage of incorrect responding during acquisition and generalization sessions across sequential (SEQ) and concurrent (CONC) tacts for Kelly.

Zack

Zack's acquisition data for target tacts *Bulletin Board*, *Chandelier*, *Calculator,* and *Shower Curtain* are graphed in Figure 7. Baseline responding remained at zero level for all tacts across three sessions. Two treatment conditions were then alternated until mastery criteria was achieved for all tacts. Sequential *Bulletin Board* and concurrent *Calculator,* indicated by the closed circle and closed square markers, were compared across sessions. Concurrent *Calculator* was mastered by Zack prior to completing the first *Bulletin Board* exemplar during sequential training. However, once Zack mastered the first sequential exemplar he remained above 90% accuracy across exemplars. For the household categories, more training sessions were required for sequential *Chandelier* compared to concurrent *Shower Curtain* as displayed by the closed diamond and closed triangle markers. When concurrent *Shower Curtain* was mastered, only two exemplars of sequential *Chandelier* had been trained to mastery. After three *Chandelier* exemplars were sequentially trained, Zack remained at 100% responding for the last two pictorial prototypes. Zack's acquisition graph depicts concurrent tacts reaching mastery level with fewer sessions than sequential tacts. There was minimal differentiation in response level between conditions, with sequential tacts demonstrating a slightly higher level than concurrent tacts. While highly variable response patterns were observed in both conditions, sequential tacts demonstrated a lower degree of variability.

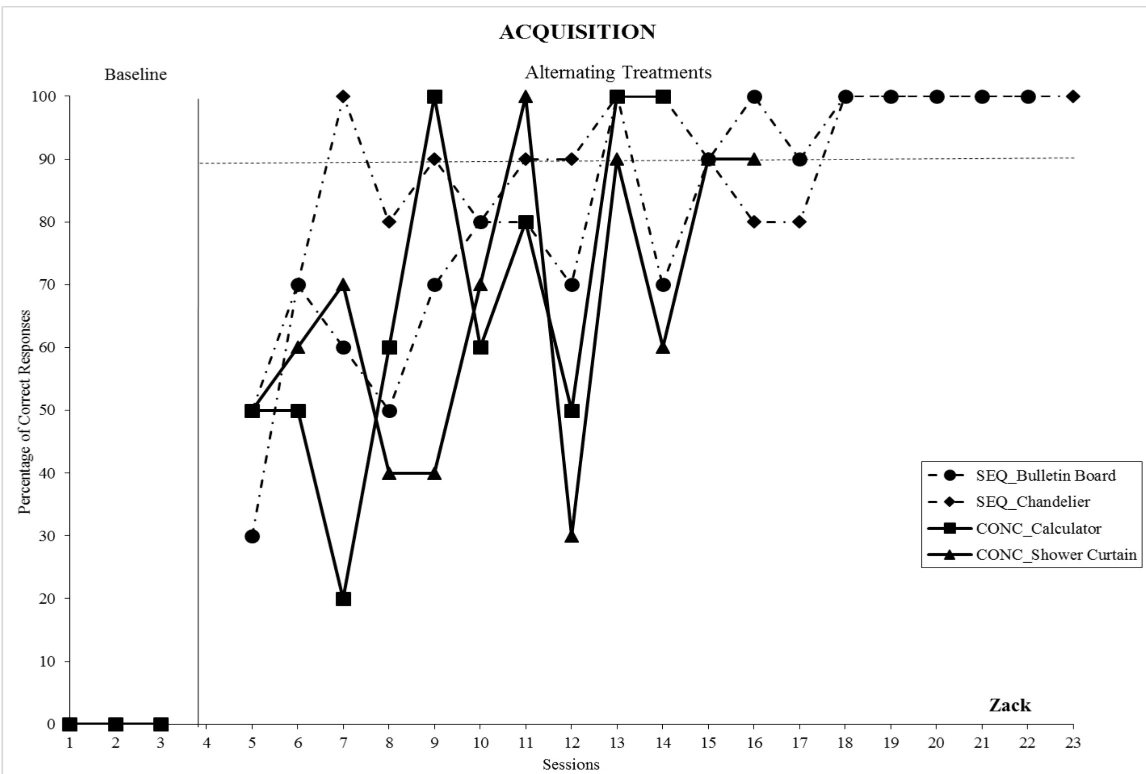


Figure 7. Percentage of correct responding across sequential (SEQ) and concurrent (CONC) tacts during baseline and alternating treatments phase for Zack.

Zack's generalization data for both conditions are presented in Figure 8. Generalization pictures evoked no responses from Zack during the baseline phase. Once treatment sessions began Zack immediately responded to both sequential tacts. Nevertheless, Zack mastered concurrent generalization pictures for both tacts first by only a few sessions. For instance, only one generalization session differentiated sequential *Bulletin Board* from concurrent *Calculator*. Zack also generalized to physical examples of *Bulletin Board* and *Calculator*, as shown by the open circle and open square, with 100% accuracy. Differences in level were not observed for either condition, although a rapid ascending trend was observed in both concurrent generalization tacts. All tacts exhibited variability in responding, except for sequential *Bulletin Board*.

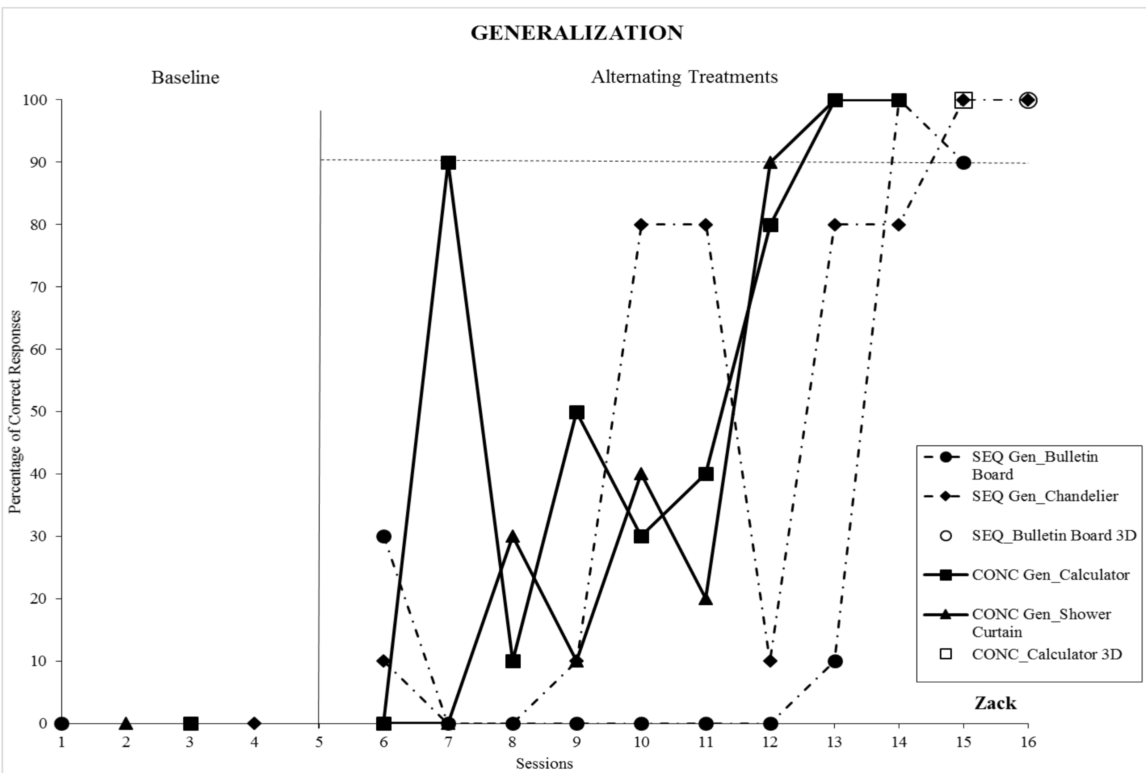


Figure 8. Percentage of correct responding across sequential (SEQ) and concurrent (CONC) tacts during baseline and alternating treatments phase for Zack.

Number of sessions and percentage of incorrect trials for Zack are presented in Figures 9 and 10. On the left side of Figure 9, sequential tacts surpassed concurrent tacts in number of acquisition sessions to mastery. More specifically, sequential *Bulletin Board* was trained to mastery in 27 sessions, while concurrent *Calculator* was achieved in 10 sessions. Zack needed 19 sessions for sequential *Chandelier* and 12 sessions to master concurrent *Shower Curtain*. On the right side of Figure 9, the number of sessions to reach generalization criteria was not clearly differentiated. One session separated sequential *Bulletin Board* and concurrent *Calculator*. Only three sessions differentiated sequential *Chandelier* and concurrent *Shower Curtain*.

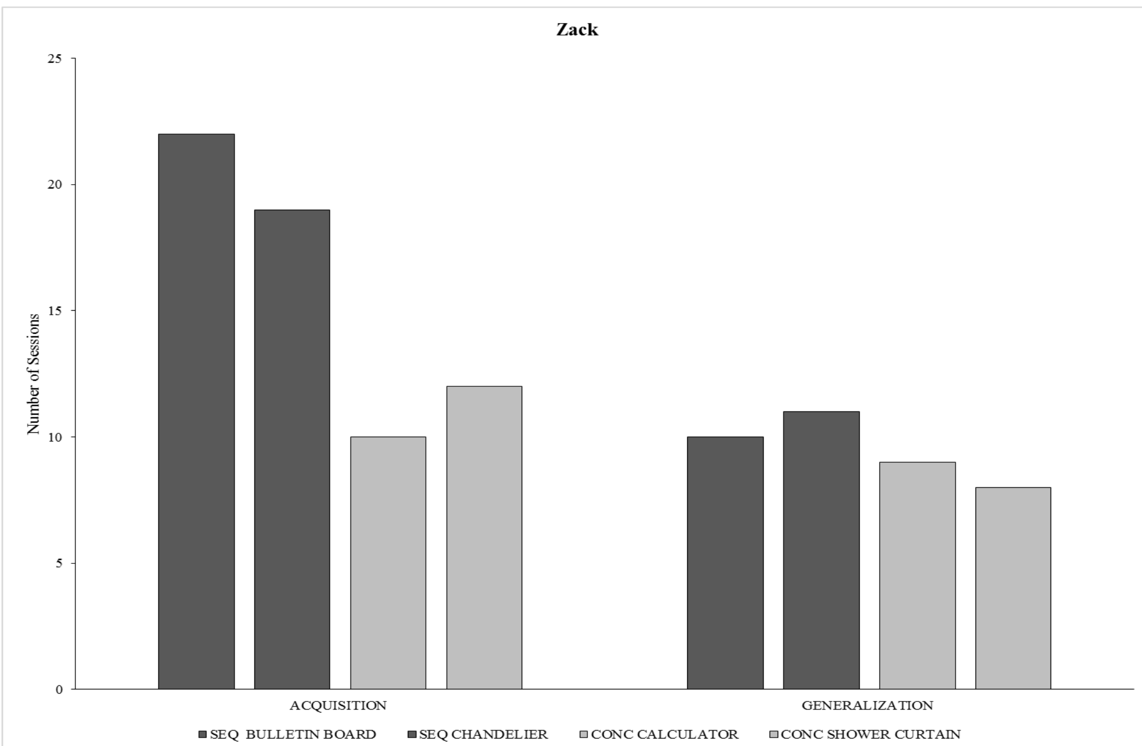


Figure 9. Number of acquisition and generalization sessions to reach mastery criteria across sequential (SEQ) and concurrent (CONC) tacts for Zack.

In Figure 10, Zack emitted a higher percentage of incorrect responding during concurrent acquisition sessions compared to sequential sessions. Of total trials, 33% and 34% were inaccurate for *Calculator* and *Shower Curtain*; whereas, 19% and 10% of trials were incorrect for *Bulletin Board* and *Chandelier*. There was no clear discrimination across conditions for error percentages during generalization sessions. Zack responded incorrectly for 77% of sequential *Bulletin Board* generalization trials and for 44% of concurrent *Calculator* trials. For sequential *Chandelier* and concurrent *Shower Curtain* the opposite occurred, in that less errors were made for *Chandelier* with 50% error trials and 65% for *Shower Curtain*.

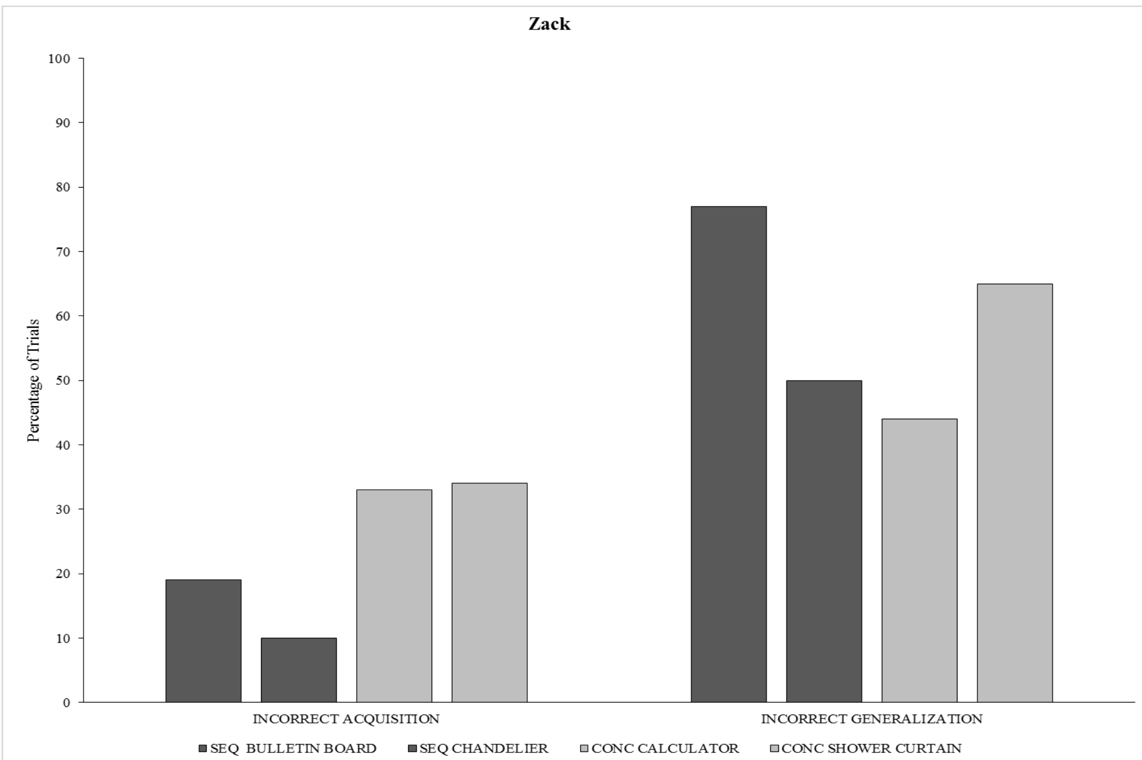


Figure 10. Percentage of incorrect responding during acquisition and generalization sessions across sequential (SEQ) and concurrent (CONC) tacts for Zack.

Lisa

Lisa's acquisition data for *Desk*, *Fence*, *Paint*, and *Bench* are recorded in Figure 11. All target tacts remained at zero level throughout the initial baseline phase. Lisa began responding immediately to all tacts once the alternating treatment phase was initiated. Both concurrent tacts, *Paint* and *Bench*, reached mastery criteria prior to the sequential tacts. The first exemplar of sequential *Desk*, designated by the circle markers, was completed one session after concurrent *Paint* was mastered, which is represented by the triangle markers. Sequential training continued for the rest of the *Desk* exemplars with all but three sessions remaining above 90% correct responding. The diamond markers symbolize correct responding for sequential *Fence*.

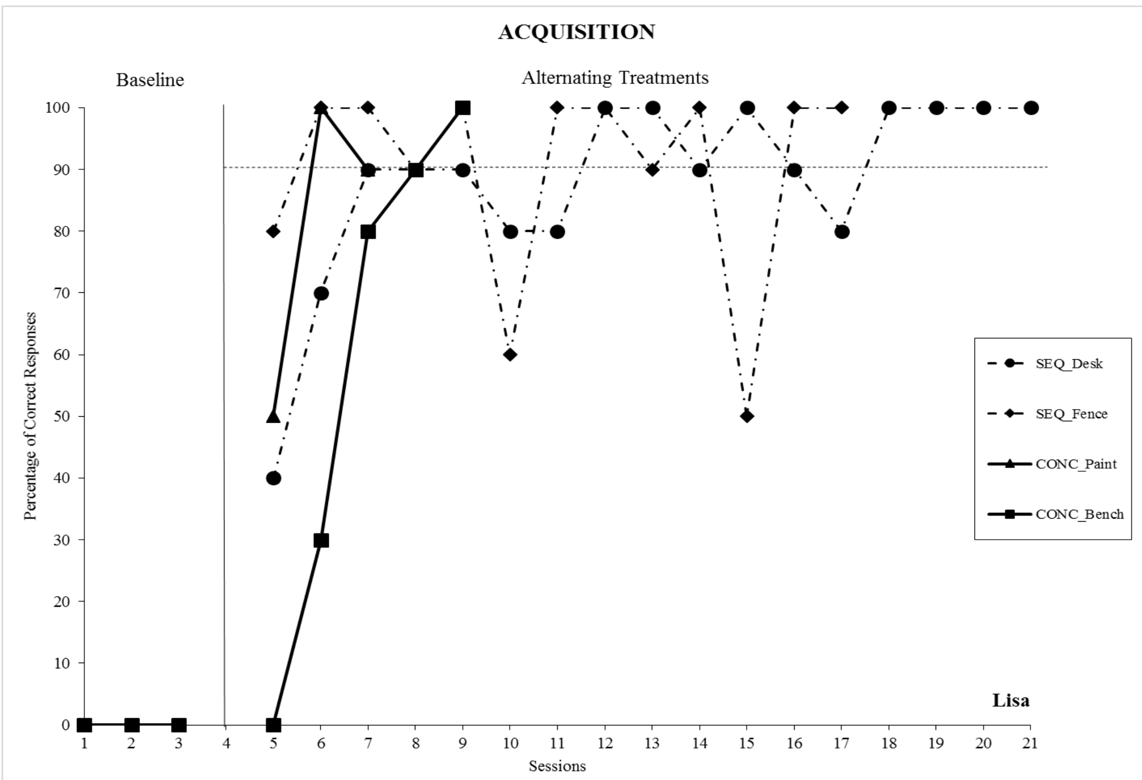


Figure 11. Percentage of correct responding across sequential (SEQ) and concurrent (CONC) tacts during baseline and alternating treatments phase for Lisa.

Lisa tacted *Fence* with 80% accuracy for the first session and proceeded to master the first *Fence* exemplar prior to completing concurrent *Bench* exemplars. Nevertheless, concurrent *Bench* met target criteria for mastery in fewer sessions than sequential *Fence* as illustrated by the square markers. Lisa also maintained above mastery criteria for sequential *Fence* sessions except for two acquisition sessions. There was no clear distinction in overall level of responding or trend for either condition. Based on visual analysis, Lisa's response patterns were more variable during sequential training than concurrent training.

Figure 12 contains Lisa's generalization data depicted by the aforementioned target tact markers. Baseline responding was at zero level for *Desk*, *Fence*, *Paint*, and *Bench*; therefore both treatment conditions were initiated. During the first three generalization sessions, Lisa responded below 20% accuracy for all tacts. Concurrent tacts displayed a slightly higher level of responding than the sequential generalization sessions.

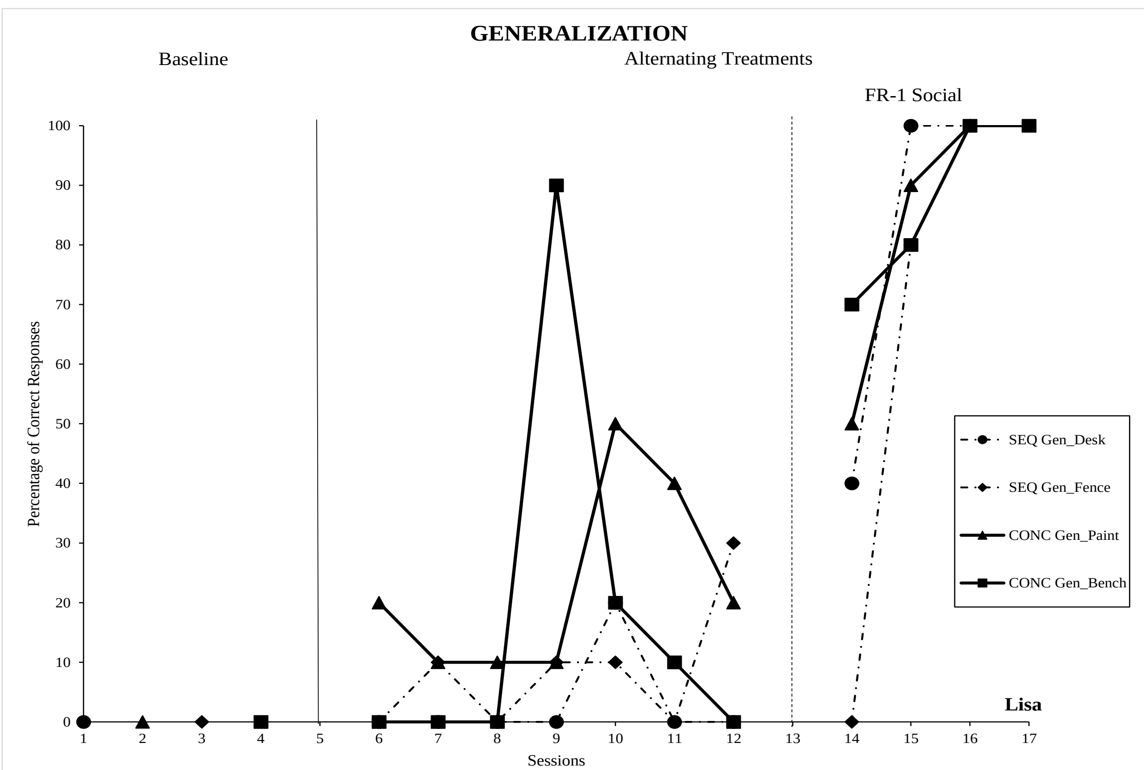


Figure 12. Percentage of correct responding across sequential (SEQ) and concurrent (CONC) tacts during baseline and alternating treatments phase for Lisa. A third phase included a FR-1 social reinforcement schedule during generalization sessions.

Sessions 4 and 5 illustrate a noticeable increase in responding for concurrent tacts with 90% correct responding for *Bench* and 50% for *Paint*; however, both concurrent tacts soon decreased below chance level for several sessions. Lisa's responding to generalization sequential tacts, *Desk* and *Fence*, was more stable yet persisted at low levels. After the FR-1 social reinforcement was introduced into her sessions, Lisa began tacting at higher percentages for all matched tacts. Moreover, Lisa exhibited generalized responding to sequential *Desk* and concurrent *Paint* in the same number of sessions, which was also observed for the playground tacts sequential *Fence* and concurrent *Bench*. Differences in variability were not detected across treatment conditions.

Figures 13 and 14 were created to present differences in Lisa's number of sessions and overall percentage of errors across conditions.

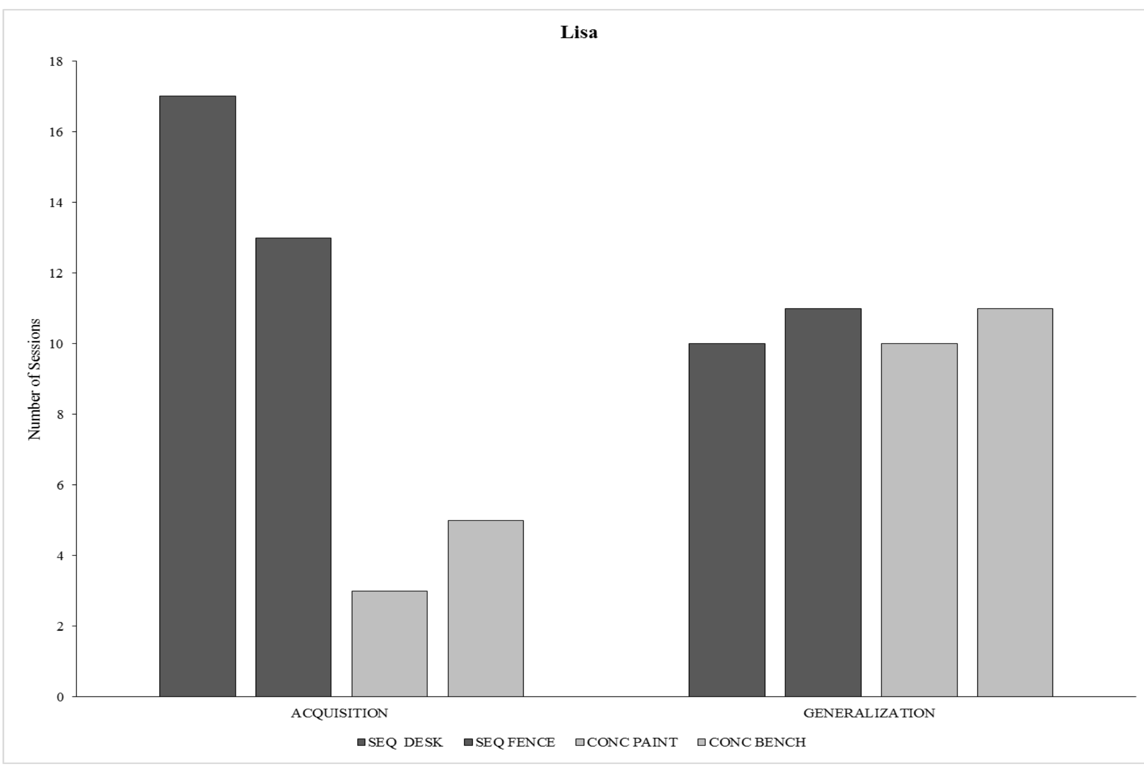


Figure 13. Number of acquisition and generalization sessions to reach mastery criteria across sequential (SEQ) and concurrent (CONC) tacts for Lisa.

The number of acquisition sessions for sequential tacts, *Desk* and *Fence*, were notably higher with 17 and 13 sessions, respectively, compared to three and five sessions for concurrent *Paint* and *Bench* tacts. The number of generalization sessions were equivalent for the comparison tacts sequential *Desk* and concurrent *Paint* with a total of 10 sessions. Sequential *Fence* and concurrent *Bench* were generalized after 11 sessions each. The percentage of incorrect responding in Figure 14 demonstrates unclear differentiation between sequential and concurrent sessions. Overall, sequential tacts had lower error percentages compared to concurrent acquisition sessions; whereas, a higher percentage was observed for sequential generalization sessions.

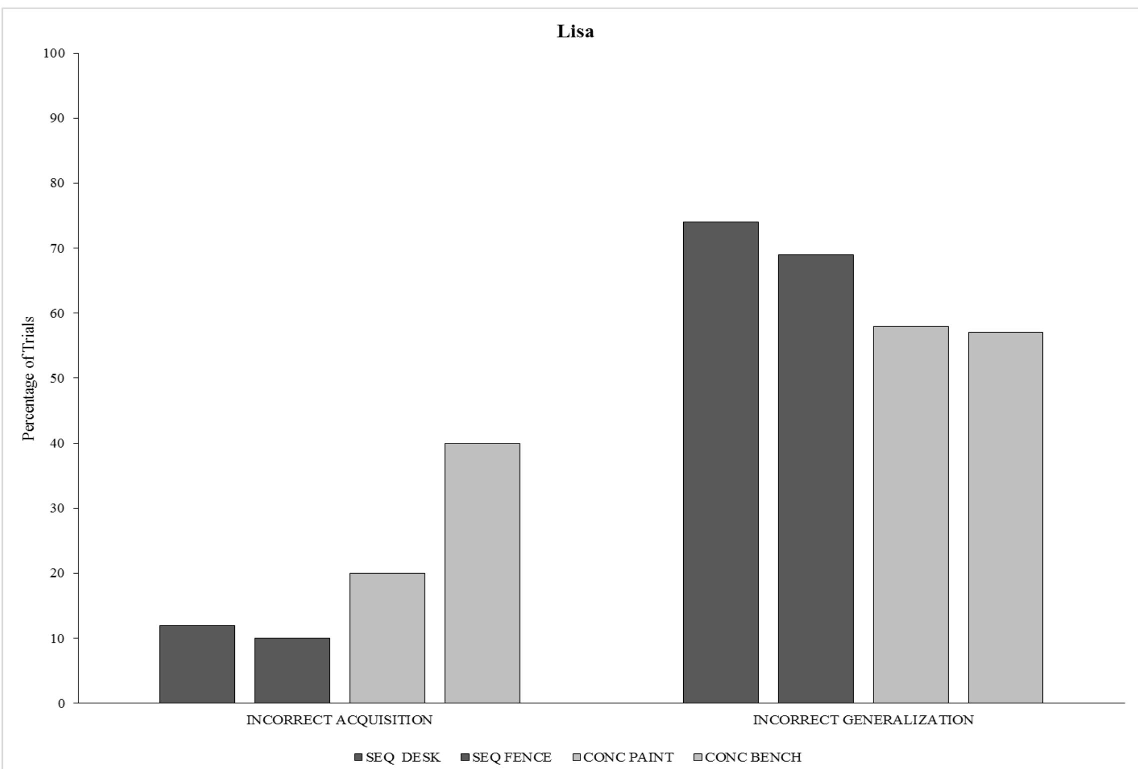


Figure 14. Percentage of incorrect responding during acquisition and generalization.

Samuel

Acquisition data for Samuel is presented in Figure 15 for sequential *Pot* and *Bell* along with concurrent *Mop* and *Map*. Zero level responding was observed for all target tacts during the initial baseline. Samuel produced correct responses for all tacts in both conditions once the alternating phase commenced. When comparing sequential *Pot* and concurrent *Mop* (circle and triangle markers), concurrent training for Samuel promoted acquisition mastery in fewer sessions. Concurrent *Mop* was mastered in five sessions; whereas, the first out of five *Pot* exemplars reached mastery criteria in eight sessions. Sequential *Bell* and concurrent *Map*, illustrated by diamond and square markers, required more sessions to reach mastery, yet Samuel achieved the *Map* tact in less sessions than *Bell*.

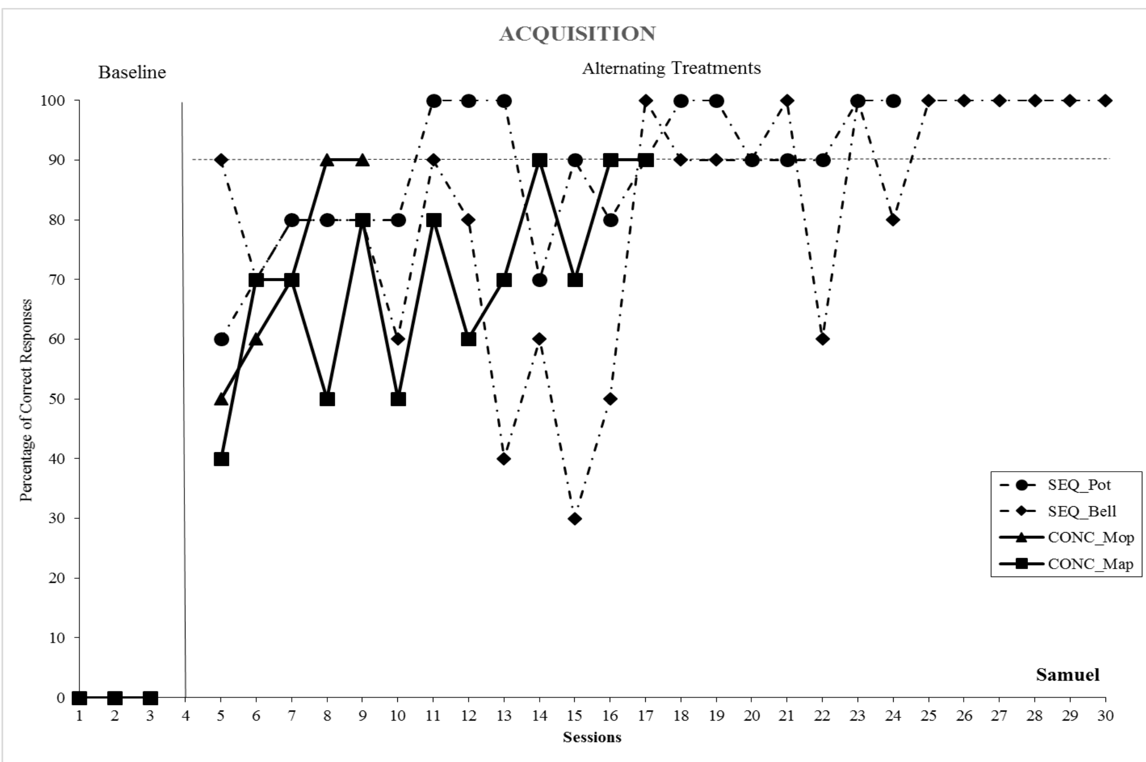


Figure 15. Percentage of correct responding across sequential (SEQ) and concurrent (CONC) tacts during baseline and alternating treatments phase for Samuel.

Similar to previous responding, the first sequential *Bell* exemplar was mastered jointly with concurrent *Map*. Patterns of responding demonstrated no distinction in overall level, but concurrent tacts displayed a quicker ascending trend. Variability was observed in all tacts, except for concurrent *Mop*; however, the inconsistent responding was detected for sequential *Bell*.

Generalization data was collected for Samuel and is presented on Figure 16. All generalization tacts were mastered in less than five sessions. The first generalized target was concurrent *Mop* with only three sessions, followed by sequential *Bell* with four sessions. Sequential *Pot* and concurrent *Map* were mastered in the same number of sessions.

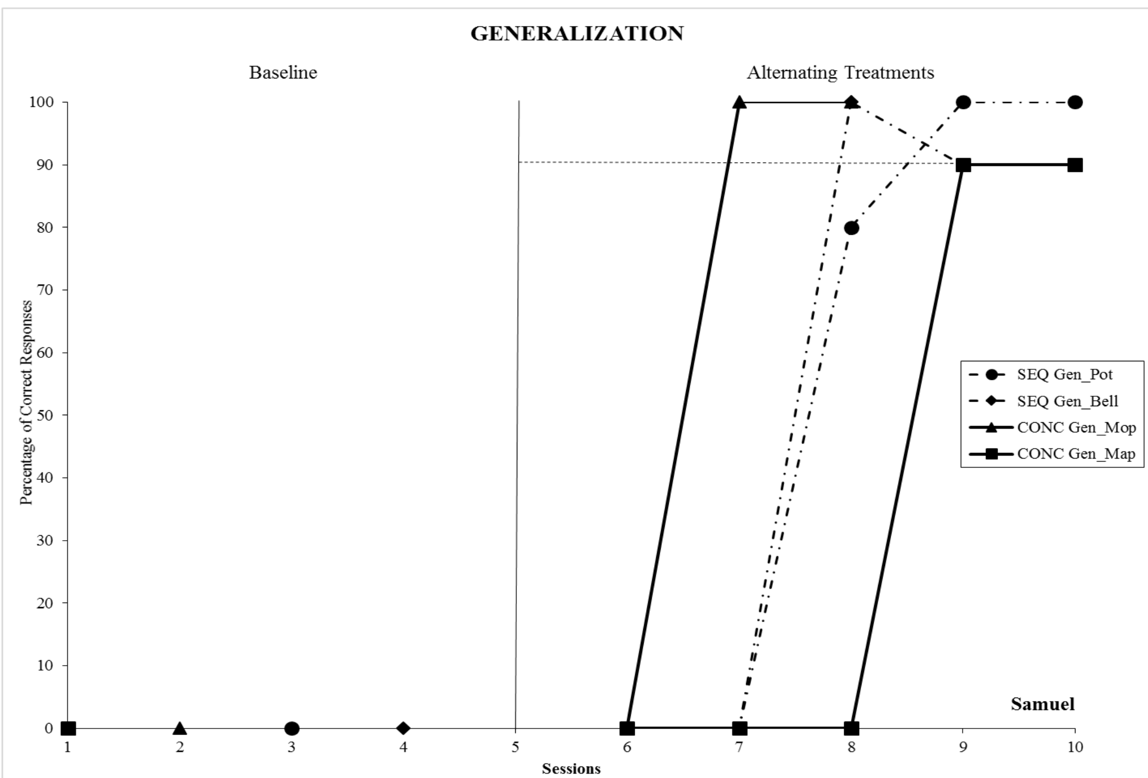


Figure 16. Percentage of correct responding across sequential (SEQ) and concurrent (CONC) tacts during baseline and alternating treatments phase for Samuel.

The same overall pattern of generalized responding was observed for Samuel in that all target tacts had the same level and rapidly ascending trend to mastery with no variability in responses.

Further information regarding Samuel's number of sessions and error percentages are graphed in Figures 17 and 18. In Figure 17, both sequential tacts depicted a higher number of acquisition sessions than concurrent tacts. For instance, sequential *Pot* was acquired in 20 sessions, while only five sessions were needed for concurrent *Mop*. Twenty-six acquisition sessions were required for sequential *Bell* and only half the number of sessions were needed for concurrent *Map*. On the right side of Figure 17, generalization data on number of sessions were compiled and revealed very little difference across treatment conditions.

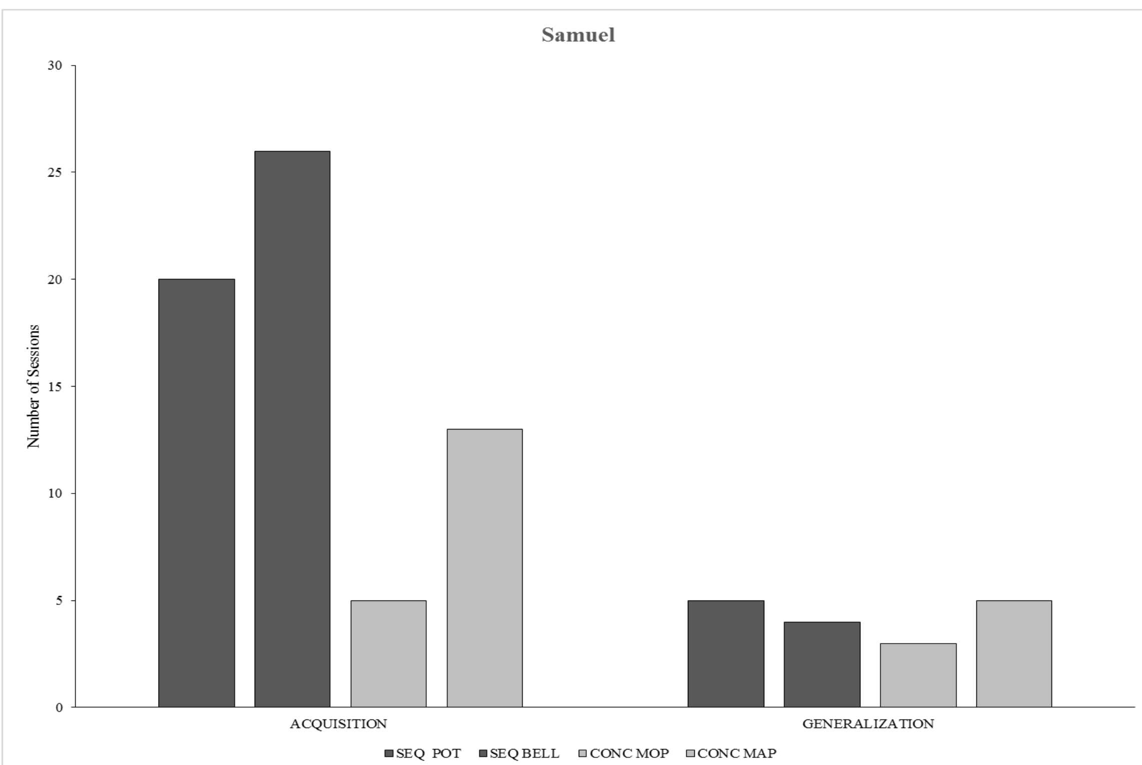


Figure 17. Number of acquisition and generalization sessions to reach mastery criteria across sequential (SEQ) and concurrent (CONC) tacts for Samuel.

Percentages of incorrect responding varied across conditions in Figure 18. Sequential tacts had less error percentages during sessions, with 12% and 18% for *Pot* and *Bell*, compared to 28% and 30% for concurrent *Mop* and *Map*. During generalization sessions, sequential *Pot* had 10% more incorrect responding than concurrent *Mop*, while sequential *Bell* had 12% less errors in overall sessions than concurrent *Map*.

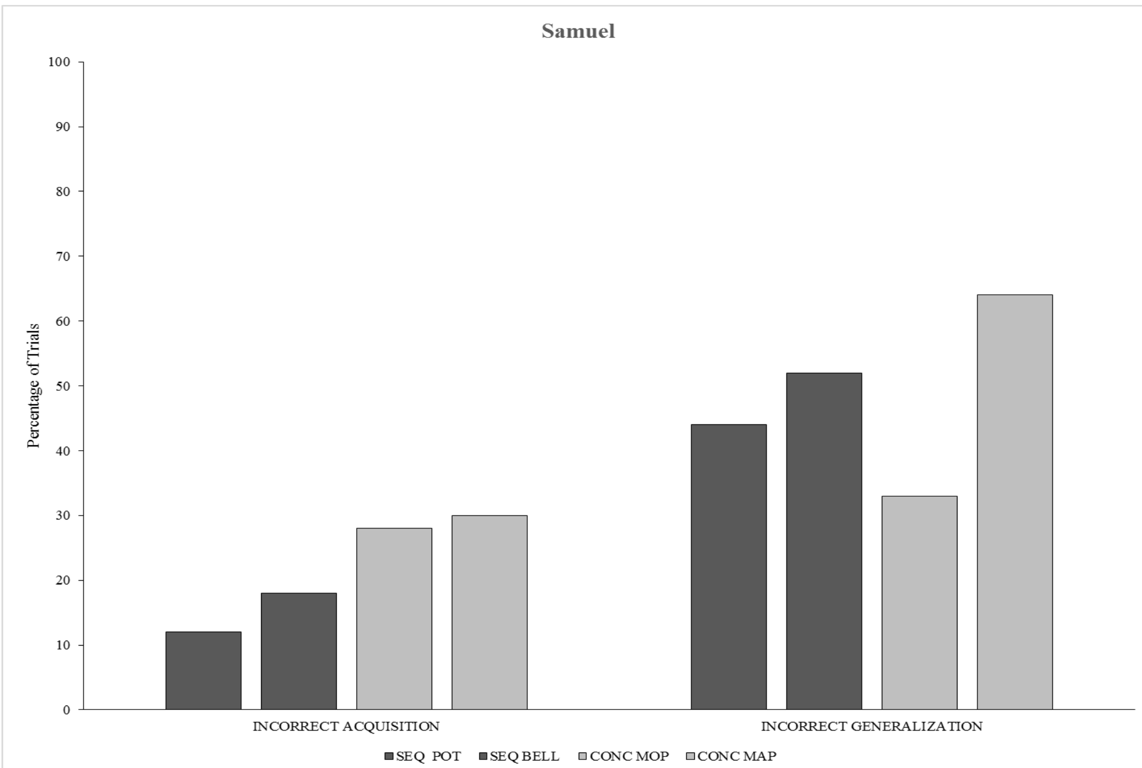


Figure 18. Percentage of incorrect responding during acquisition and generalization sessions across sequential (SEQ) and concurrent (CONC) tacts for Samuel.

CHAPTER IV: DISCUSSION

Generalization is an essential treatment outcome, if not the most important (Haring, 1988), for all early intervention services targeting behavior change (Baer et al., 1968; Cooper et al., 2007; Stokes & Baer, 1977, Whalen, 2009). Without generalization, children with ASD would learn to respond to restricted contexts, and utilization of new skills would be prevented in the natural environment (Whalen, 2009). Therefore, programming generalization strategies within the established DTT method should be required to promote responding in children with generalization deficits (NRC, 2001; Stokes & Baer, 1977; Weiss & LaRue, 2009). A variety of programming techniques that potentially promote generalized behavior change have been identified by Stokes and Baer (1977), including strategies that facilitate stimulus generalization. Stimulus generalization is important in children with ASD. It allows children to transfer learned skills across various environmental contexts, such as individuals, settings, and teaching stimuli (Ghezzi & Bishop, 2008; Haring, 1998), thereby decreasing over selectivity. Training sufficient exemplars is one such strategy that has improved stimulus generalization by incorporating multiple stimulus exemplars while teaching new skills (Boyle & Lutzker, 2005; Garcia, 1974; Griffiths & Craighead, 1972; Handleman, 1979 Griffiths & Craighead, 1972; Handleman, 1979; Handleman & Harris, 1980; Handleman & Harris, 1983). While many studies have examined stimulus generalization using multiple exemplar training, research using this strategy has not been evaluated within a DTT paradigm.

Experiment 1

Previous literature on programming sufficient therapist and setting exemplars has shown generalized results for adults, teenagers, and children with disabilities (Boyle & Lutzker, 2005;

Davis et al., 1992; Garcia, 1974; Griffiths & Craighead, 1972; Handleman, 1979; Stokes et al., 1974). For children with ASD, the training of multiple peer exemplars has increased social interactions with other children; moreover, training in multiple settings has induced stimulus generalization across instructional environments (Belchic & Harris, 1993; Handleman, 1979; Handleman & Harris, 1980; Handleman & Harris, 1983; McEvoy et al., 1988; Stewart et al., 1992). However, studies investigating therapist and setting exemplars have not evaluated this strategy using the DTT method. Experiment 1 attempted to expand the exemplar literature using DTT for young children with ASD who were experiencing generalization deficits in an early intervention, multidisciplinary clinic.

Discrete trial instruction is a commonly used skill acquisition method for children with ASD (Steege et al., 2007; Smith, T. 2001); however, for some children, DTT inhibits generalized behavior change (Landa, 2007; Myers & Johnson, 2007; Schreibman, 1997; Sundberg & Partington, 1998; Tarbox & Najdowski, 2008). The first question in Experiment 1 evaluated whether S-DTT, with one ABA therapist in an individual therapy room (arguably the most common S-DTT format), produced generalized results across therapeutic agents and settings. For Bran and Jon, generalized responding was observed intermittently, while remaining below mastery criteria, during the S-DTT phase after prompting procedures were changed to meet their needs. Once acquisition mastery was achieved for the S-DTT phase, generalized responding increased from previous generalizations sessions and remained stable for both participants. For example, Bran responded at 75% for two generalization sessions across two days after he mastered *touch mouth* with his ABA therapist. An early study evaluating multiple trainer exemplars found that some participants required only one trainer to produce generalized results across trainers and settings (Stokes et al., 1974). Research evaluating setting exemplars discovered that young children with ASD showed skill transfer after instruction in one therapy setting (i.e., one therapist/one therapy room). However, higher levels of stimulus generalization occurred when training was programmed in multiple therapeutic settings (Handleman, 1979; Handleman & Harris, 1980; Handleman & Harris, 1983). Similar to earlier investigations, the current results showed some generalized responding by utilizing one therapist and one setting exemplar in two young children with ASD. Although Bran and Jon did not meet generalization criteria during S-DTT, stimulus generalization was periodically engendered, suggesting that some generalized behavior change can be facilitated for some clients using the DTT method.

Unfortunately, one participant in the study did not acquire the target skill during the S-DTT phase. Several possible explanations can be postulated for Rickon's results. First, Rickon required multiple modifications of prompting procedures and reinforcement schedules, prolonging the acquisition of his target skill. The least-to-most prompting method, utilized during the first S-DTT phase, yielded zero results for his target skill. The most-to-least prompting method was effective at producing some independent responding, however Rickon became prompt dependent and required very slow fading procedures. The chaining procedure produced the highest degree of responding for the two-step instruction; nonetheless, a decreasing trend soon followed after Rickon began emitting only the second response (*arms up*). Session observations found that the *shake head* response was extinguished due to the chaining procedure. After reinforcement was ceased for the completion of one step and delivered after the completion of both steps, Rickon discontinued responding to the first instruction, *shake head*, and exclusively responded to the instruction preceding reinforcement—*arms up*. After 146 S-DTT sessions, prompting procedures and a FR-1 schedule of reinforcement were still required to promote correct responses during Rickon's final sessions.

Given these extensive assistive methods, a second explanation could be that Rickon's functioning level was more impaired compared to the other participants in Experiment 1. Upon reviewing the number of sessions and protocol changes during the second S-DTT phase, Bran acquired his target skill, *touch mouth*, in 48 sessions with four protocol changes; Jon mastered *touch arm* in 21 sessions with two protocol changes; and, Rickon participated in 71 sessions for *shake head and arms up* with 12 protocol modifications. This noticeable acquisition discrepancy between Rickon and the other participants suggests that Rickon's lack of generalized responding during the participant selection process may have been an acquisition deficit instead. At the commencement of the study, the participants' mastered skill lists were reviewed to determine target skills for instruction. At the time, Rickon had approximately six one-step instructions and identified over five body parts independently. Bran had approximately five one-step instructions, but no BPI skills. Jon did not have any of these skill sets in his repertoire. When comparing BPI and instruction-following skill sets, Rickon had more mastered skills compared to Bran and Jon. Furthermore, Rickon continuously mastered new skills during regular therapy sessions throughout Experiment 1, implying that his functioning level did not affect his ability to acquire new skills.

A third explanation could be the difficulty level of Rickon's target two-step instruction. Bran and Jon's target BPI skills required only one action, while Rickon's skill consisted of two consecutive actions. The researcher then probed two previously mastered one-step instructions consecutively and Rickon was still unable to complete both steps. To determine whether Rickon could independently follow two-step instructions, novel instructions were evaluated during his final S-DTT and generalization sessions. The novel two-step instructions, *pick up the block and put it in your backpack*, and *get the bowl and put it on the table*, were targeted with least-to-most prompting and a FR-1 schedule of reinforcement. Rickon responded at high levels, with 80% and 90% correct responding for *pick up the block and put it in your backpack* and 90% and 100% for *get the bowl and put it on the table,* across two days. It is important to note that Rickon missed the first trials for each of the latter two-step instructions, but, once prompted with least-to-most methods, he maintained the skill independently throughout the session. Furthermore, generalized responding with his SLP was observed in his classroom. These supplementary findings suggest that Rickon was quite capable of following two-step instructions. The fundamental difference between Rickon's initial target skill and the novel two-step instructions was the functionality of the goal. For instance, *shake head and arms up* were two arbitrary actions conjoined together with no functional purpose; whereas, two-step instructions such as *get the bowl and put it on the table* are two environmentally related actions. Rickon's ability to acquire and generalize functional instructions suggests that the target two-step instruction may have been too difficult to acquire due to the contrived nature of the *shake head and arms up* response. Additionally, Rickon may have had some prior environmental exposure to the functional two-step chains examined that facilitated learning.

The second research question of Experiment 1 examined multiple therapist exemplar training within DTT on generalized behavior change in children with ASD. Bran and Jon did not meet the established generalization criteria for the S-DTT phase; therefore, multiple ABA therapists were programmed across sessions. For Bran, variable responding was observed during MT-DTT sessions, while his generalized results decreased to zero level for three sessions. Moreover, stimulus generalization was not observed, even after mastery level responding occurred with all ABA therapists. Based on anecdotal observations, the SLP would present the visual stimulus on a clipboard; whereas, the ABA therapists placed the stimulus on an instructional easel. A procedural change was then implemented to include the instructional easel during probe presentations in the classroom. After this procedural change, generalized responding was observed at mastery level. These results differ from Bran's generalized responding during the S-DTT phase, where he generalized without the instructional easel for 75% of opportunities across two consecutive sessions. The MT-DTT generalization results suggest that the implementation of multiple therapist exemplars led to over selective responses in the generalization setting, thereby requiring additional supports to transfer the *touch mouth* response. The easel was initially implemented during S-DTT sessions to present the training stimulus efficiently. By placing the training stimulus on the easel, the depiction of facial features were presented within Bran's visual field, which allowed therapists to ensure that he was attending. It seems that after multiple therapists were programmed within DTT sessions, Bran identified one common feature across ABA therapists and reinforcement delivery, which was the presentation of the instructional easel and training stimulus.

Previous research comparing single exemplar to multiple exemplar training found that two out of five participants generalized more effectively when taught in one instructional environment rather than multiple environments (Handleman & Harris, 1983). These earlier findings were similar to Bran's generalized responding during S-DTT and MT-DTT phases, implying that programming multiple exemplars may actually hinder generalized results in some children with ASD when another dimension of the training context can acquire stimulus over selectivity. Furthermore, research evaluating transfer of skills across instructional environments found differential results in children with ASD (Handleman, 1981; Handleman & Harris, 1983), suggesting that transitioning from one-to-one teaching environments to classroom settings may impact generalization results as well. Particularly for Bran, probes were conducted during group therapy across various activities with five other children in the room. Distractions during group therapy may have affected results, which may explain why the instructional easel facilitated responding in the classroom. The presentation of the easel may have assisted with gaining his attention within a busy a classroom, thereby producing the target response.

For Jon, highly variable responding was also observed as new ABA therapists conducted DTT sessions. Jon's generalized responding also decreased to a lower level. Once a higher level of responding occurred with all ABA therapists, generalization increased to mastery level in the classroom. Over selectivity was also assessed in the generalization setting with Jon by probing responses while sitting down versus standing up. Jon generalized for both contexts, achieving mastery criteria for both MT-DTT and generalization sessions. Thus, for one child with ASD, learning a skill with multiple therapists produced the transfer of the target skill across therapeutic agents and settings. Similar to previous findings (Handleman, 1979; Handleman & Harris, 1980; Handleman & Harris, 1983), Jon showed some generalization (50%) after learning *touch arm* with one therapeutic agent within one setting; however, generalized responding was stronger (100%) when multiple exemplars were included within instructional sessions.

A series of studies investigating setting exemplars revealed that teaching young children with ASD within multiple settings promoted generalized results (Handleman, 1979; Handleman, 1979; Handleman & Harris, 1980; Handleman & Harris, 1983). The final research question for Experiment 1 proposed to evaluate multiple setting exemplars on stimulus generalization by utilizing DTT with young children with ASD. The multiple setting exemplars strategy was not initiated because the trigger conditions were not met for any participant. Rickon did not meet mastery criteria for the S-DTT phase; consequently, generalization of his target skill could not be evaluated. Jon was able to effectively generalize with the MT-DTT technique and did not necessitate other generalization programming strategies. Bran displayed over selective responses and required additional supports (i.e., instructional easel) during the MT-DTT phase, however programming multiple therapeutic settings instead of therapists may have proven to be a more effective generalization technique. Future research should compare MT-DTT and MR-DTT on generalized results in children exhibiting over selective responding.

Experiment 2

Programming multiple exemplars during instruction has shown successful stimulus generalization outcomes across various contexts (Boyle & Lutzker, 2005; Garcia, 1974; Griffiths & Craighead, 1972; Handleman, 1979 Griffiths & Craighead, 1972; Handleman, 1979; Handleman & Harris, 1980; Handleman & Harris, 1983); however, there is limited research examining procedural application of exemplar training using DTT. Generally, exemplars have been presented in either a sequential or concurrent manner using several types of instruction. One study has evaluated these procedural differences in children with developmental disabilities by manipulating training stimuli presentations and assessing acquisition and generalization efficiency using teaching procedures similar to DTT (Schroeder et al., 1998). Experiment 2 attempted to further elucidate differential effects of procedural manipulations of multiple stimulus exemplars using DTT to teach expressive tacts to children with ASD.

The first research question in Experiment 2 analyzed acquisition efficiency by evaluating number of instructional sessions across sequential and concurrent conditions. For all participants concurrent exemplar presentations required fewer sessions to reach mastery level for tact responses during DTT sessions compared to sequential exemplar training. For example, Lisa acquired the *Paint* tact response to five exemplars in only three concurrent sessions, while 17 sequential sessions were necessary for her to learn five exemplars of the corresponding tact

Desk. These results map on to the findings from Schroeder et al. (1998) demonstrating that concurrent exemplar training was more efficient than teaching exemplars one at a time for pre-school aged children with developmental disabilities. In the current study, multiple stimulus exemplars taught in a concurrent fashion during DTT promoted faster acquisition of tact responses in young children with ASD. This may suggest that presenting a variety of exemplars during concurrent sessions teaches stimulus concepts faster by interconnecting a reinforced tact response to multiple stimulus items in fewer sessions. Sequential training, on the other hand, promotes overlearning which requires more acquisition sessions to reach mastery level (Schroeder et al., 1998). Once one tact item is trained, the child then has to re-learn the same tact response to a new pictorial representation until all five stimulus items are acquired. However, it is important to note that after one exemplar was acquired during sequential training, the remainder of exemplars required fewer sessions to meet mastery level. For example, once Kelly mastered the first sequential *Window* exemplar, she responded at 100% for the subsequent four exemplars. Similar results were found for her second sequential target tact *Police*.

Error percentages within DTT sessions were also collected to determine acquisition efficiency for both treatment conditions. For all participants, teaching multiple exemplars concurrently evoked more incorrect responding during acquisition sessions. The most notable difference was for Kelly with 87% errors during concurrent *Doctor* trials in comparison to 44% incorrect responses for sequential *Police*. Eventually, these two target tacts required additional stimulus prompts to evoke accurate responding. With the exception of Kelly, the error percentage difference between conditions was below 30%. Schroeder et al. (1998) also found that more incorrect responses were produced when all exemplars were presented within each session. These authors argued that their teaching procedures may have promoted more errors. In the present study, all participants, except for Kelly's two target tacts, responded almost immediately to training procedures (i.e., constant time delay, continuous social reinforcement, FR-2 edible/tangible reinforcement schedule) during both conditions suggesting that errors cannot be explained by teaching methods alone. Another probable explanation could simply be that while all concurrent exemplars represent the same item, each pictorial representation contains slightly different stimulus features, thereby evoking more incorrect responding during initial sessions. Conversely, sequential training decreases the likelihood of incorrect responding by presenting the same pictorial stimulus across trials and promoting more accurate responding.

The second research question in Experiment 2 evaluated generalization efficiency between sequential and concurrent exemplar presentations by assessing tact responses to untrained stimuli after DTT sessions were conducted. Surprisingly, there was no substantial difference between number of generalization sessions for sequential and concurrent exemplar training. These findings contrast with Schroeder et al. (1998) reporting faster generalization results during concurrent exemplar training. The only slight distinction in the current study was that Kelly and Zack generalized concurrent tacts a few sessions faster (less than a three session difference) than their sequential tacts. Kelly and Zack also went on to successfully generalize to physical examples for one sequential and one concurrent target tact. For example, Kelly was able to produce the ASL sign for *Window* and *Soap* using physical items around the clinic setting. These results imply that young children with ASD can attain stimulus generalization efficiently by programming multiple exemplars using either presentation method.

Upon closer inspection, Kelly and Samuel's data illuminated similar generalized response patterns, which could explain the lack of differential effects between treatment conditions. The acquisition of their concurrent target tacts (five exemplars per target tact) was immediately followed by the mastery of generalization pictures (two generalization exemplars per tact) for that treatment condition. Whereas, the acquisition of only one or two sequential exemplars promoted generalized responding to the two generalization exemplars. Since the sequential condition required only one or two exemplars to achieve stimulus generalization, no differential results were observed in number of sessions across conditions. However, it must be noted that at the time of generalization, a total of seven exemplars had been acquired (five trained exemplars and two generalization exemplars) during concurrent training. On the other hand, only three to four exemplars (trained and generalization exemplars) had been acquired during sequential training. Given these findings, acquisition results must be taken into consideration to highlight overall efficiency of a particular procedural application during exemplar training. In this case, Kelly and Samuel tacted more concurrent exemplars (five training exemplars and two generalization pictures) than sequential exemplars after generalization was simultaneously achieved for both conditions.

Zack and Lisa's results suggest nearly all exemplars for each target tact were acquired before generalization occurred, resulting in no distinction between treatment conditions. Yet there were other factors, such as extinction effects, that may have impeded the efficiency of generalized responding for these two participants. Notably, Zack and Lisa displayed an extinction burst (i.e., an initial increase in responding; Cooper et al., 2007) for one of their concurrent tacts and showed more variability in their generalized responding overall than the other participants (see Figures 8 and 12, respectively). Similar to Schroeder et al. (1998) participants, Zack and Lisa responded correctly during some trials and expectantly look for therapist feedback. While correct responses to generalization pictures were observed, Zack began emitting incorrect tact responses that had been previously reinforced; whereas, Lisa started engaging in escape behaviors instead of responding to stimuli. For instance, Lisa became agitated when generalization pictures were presented and would swipe them away, turn away from the stimuli, begin whining and/or crying. During later sessions, Lisa stopped responding and would engage in vocal stereotypy. When Lisa acquired all tact exemplars in both treatment conditions, a FR-1 social reinforcement schedule was introduced into generalization sessions for both sequential and concurrent tacts, producing immediate generalized responding in both conditions. Zack did not require social reinforcement during generalization sessions, but additional acquisition sessions of previously mastered concurrent tacts were implemented in order to promote stimulus generalization across untrained pictorial stimuli. All of these factors provided evidence that Zack and Lisa's generalized responding was particularly affected by the removal of reinforcement (i.e., extinction; Lerman & Iwata, 1996) previously received for correct tact responses during DTT instruction.

Percentage of incorrect trials during generalization sessions was also evaluated to determine efficiency of generalized responding across conditions. Mixed results were found for Zack and Samuel in that sequential generalization sessions resulted in higher percentages of incorrect responding in one set of compared tacts, and lower percentage of errors in the other set of tacts. For Kelly and Lisa, higher percentages of incorrect responding (12-16% difference) occurred during sequential generalization probe sessions; however, this only affected one target tact set for Kelly (sequential *Window*/concurrent *Soap*). A closer look at Kelly's data revealed that concurrent *Soap* was generalized in fewer sessions than sequential *Window* explaining the lower percentage of errors during concurrent generalization probes. Although Lisa displayed no differentiation in number of generalization sessions to mastery, a higher level of accurate generalized responding for concurrent *Paint* and *Bench* was observed in Figure 12 signifying lower error percentages.

Limitations and Future Research

Experiment 1

Overall, mixed results were found across participants in Experiment 1. Discrete trial sessions were implemented, with one therapist per setting, as a control phase to evaluate effectiveness of this instructional approach on generalization. Notably, Rickon did not acquire his target skill during S-DTT sessions. It seems that the target skill selected for Rickon was more complex than the other participants' target skills, thereby making it more difficult to acquire without prompts. The prompting systems and repetitive trials within the DTT paradigm may have evoked prompt dependency in Rickon (Smith, 2001; Sundberg & Partington, 1998). Furthermore, Rickon's inability to acquire his target skill prevented evaluation of generalized behavior change within the S-DTT phase. Thus, a limitation of the current study is that difficulty level of target skills was not controlled across participants within the design. Future research should continue evaluation of exemplar training using the DTT paradigm in order to determine whether standard methods (one therapist/one setting) can produce generalized responding more effectively than multiple exemplar training (therapists or settings) in children with ASD.

Stokes and Baer (1977) defined generalization "as the occurrence of relevant behavior under different non-training conditions (i.e., across subjects, settings, people, behaviors, and/or time) without the scheduling of the same events in those conditions as had been scheduled in the training conditions" (p. 350). Experiment 1 sought to evaluate stimulus generalization across four probes, rather than one probe, during a two-hour group therapy session to avoid false positive results. Additionally, generalization probes were administered with no prompting methods or reinforcement schedules as the generalization definition suggests. Bran and Jon did not reach generalization mastery during the S-DTT phase. However, based on the Stokes and Baer's (1977) definition, both participants exhibited some generalized responding across settings, people, and time, yet inconsistent responding occurred across four probes. Rincover and Koegel (1977) found that inadequate skill transfer to the generalization setting can sometimes be a maintenance issue rather than a generalization deficit. Thus, a possible limitation of Experiment 1 could be that Bran and Jon's generalization sessions actually assessed response maintenance rather than stimulus generalization. Future research should investigate how to exclusively assess for stimulus generalization by utilizing efficient probing procedures while simultaneously eliminating false positive results. For example, Lowther and Martin's (1980) generalization sessions included multiple probes of different trainers within one setting. A possible solution for the current study would be to have four therapeutic agents (e.g., SLP, paraprofessional, occupational therapist, behavior therapist) administer probes within the classroom setting.

Another limitation of the current study was Bran's over selective responding during generalization sessions within the MT-DTT phase. The highly controlled environment during DTT sessions can result in stringent stimulus control over the child's behavioral responses (Schreibman, 1997; Smith, 2001). However, Bran responded during the S-DTT phase (two sessions at 75%) without the use of the instructional easel, suggesting that over selectivity of his generalized responses occurred once multiple therapists were incorporated into his instructional sessions. It is possible that the incorporation of multiple therapist exemplars hindered stimulus generalization, especially after responding decreased across ABA therapists. By programming multiple therapist exemplars Bran's responding came under the stimulus control of an extraneous feature (easel) within his instructional environment. Anecdotally, when the instructional easel was first introduced within the generalization setting, Bran was standing at the door waiting to go outside and play (a preferred activity). Once the instructional easel was placed on the table along with the training stimulus, Bran maintained eye contact with the stimulus and walked across the room, sat down at the table, and accurately responded to each generalization probe. Future research should evaluate the drawbacks of programming multiple exemplars on generalized responding, specifically over selectivity. Another explanation could simply be that by programming a common stimulus (another generalization technique) from his instructional environment into the generalization context, transferred the target skill more efficiently. Handleman and Harris (1983) programmed common stimuli (e.g., furniture and classmates) within multiple setting exemplars and found generalized results in two boys with ASD. Future research should investigate other effective generalization strategies within the DTT paradigm to promote skill transfer across therapeutic settings.

Previous exemplar research demonstrated stimulus generalization results within a multiple baseline across skill sets, therapists, and/or settings (Handleman, 1979; Handleman & Harris, 1980; Handleman, 1981; Handleman & Harris, 1983; Lowther & Martin, 1980; Stokes et al., 1974). The current study differed by using a multiple baseline across participants by analyzing generalization within each condition. This design proved to be difficult to maintain within the clinic setting due to uncontrollable factors, such as changes to therapist, rooms, and, ultimately, facility. Furthermore, the number of sessions and prompting strategies required for acquisition exceeded what had been commonly observed working with children with similar needs in the past. For example, Rickon and Bran required more sessions and prompting supports to acquire the target skill; whereas, Jon learned the skill in fewer sessions and started the MT-

DTT phase earlier than the previous two participants. Sequence effects may have also played a role in facilitating generalized results in the second treatment condition, MT-DTT, due to the sequential introduction of the treatment conditions. Future research should compare treatment conditions on generalized results in children with ASD by using a more efficient design, such as an alternating treatments design.

Experiment 2

Overall outcomes for participants demonstrate similar acquisition efficiency results to previous research evaluating pre-school aged children with developmental disabilities (Schroeder et al., 1998). Concurrent exemplar presentations required less sessions to reach mastery level during DTT sessions and incurred higher percentages of incorrect responding when compared to sequential exemplar training. One possible limitation is that although procedures were implemented to ensure tact responses were matched on difficulty level, the same did not occur for the selection of pictorial exemplars used for each participant. Perhaps some pictorial representations were more dissimilar in stimulus characteristics than others, possibly affecting outcome measures for acquisition, error percentages, and even generalization. Future research evaluating differences in stimulus features during exemplar training may demonstrate whether acquisition efficiency is affected by a higher degree of characteristic variations between pictures. For example, when searching for pictorial representations for target tacts, more diverse examples were found for *Bell* than for *Map*. Another important finding was observed during sequential training. For all participants, once one exemplar was trained to mastery, a higher level of responding was observed for the remainder of target exemplars during instruction. This may suggest that learning one exemplar promotes faster acquisition of untrained exemplars. Future research should evaluate whether sequential training inherently promotes generalization effects by facilitating immediate transfer of tact responses as new exemplars are introduced.

In Experiment 2, generalization efficiency outcomes for young children with ASD receiving DTT diverged from previous research (Schroeder et al., 1998) in that no differential outcome measures were identified across treatment conditions. Generalization to untrained stimuli occurred using both presentation methods and unclear results for error percentages were found. Although both presentation methods were effective at facilitating stimulus generalization in the same number of sessions, Kelly and Samuel learned more exemplars with concurrent training than sequential training. For example at the time of generalization, Kelly and Samuel could accurately tact seven exemplars (five training and two generalization pictures) in the concurrent condition and less than four exemplars in the sequential condition (one to two training and two generalization pictures). Thus, it could be argued that concurrent training had a higher degree of overall efficiency. However, since the current study did not evaluate stimulus generalization past two untrained pictorial representations it cannot be determined whether Kelly and Samuel would have tacted seven exemplars for the sequential condition once generalization occurred. Future research should evaluate the inclusion of additional untrained exemplars once generalization is reached to evaluate the extent of generalized tact responding in both conditions. Another limitation of this study was that further procedural methods were required for Zack and Lisa due to extinction effects. Future research should include a reinforcement schedule during generalization trials especially if exemplar training includes a dense schedule of reinforcement similar to discrete trial instruction.

Summary and Conclusion

The current experiments were conducted to broaden the generalization literature by including young children with ASD receiving DTT within an early intervention, multidisciplinary clinic. Programming generalization within a DTT framework may be achieved by training sufficient exemplars (Weiss & LaRue, 2009). Therefore, multiple therapist exemplars were programmed in Experiment 1 to promote stimulus generalization across therapeutic agents and settings within a multidisciplinary clinic. Experiment 1 results found that the S-DTT method was ineffective at promoting skill acquisition in the first participant but yielded moderate generalized results in two participants. Programming multiple therapist exemplars was correlated with stimulus over selectivity in the second participant and established clear stimulus generalization in the third participant. Experiment 2 extended previous research by examining the procedural application of multiple exemplars within instructional sessions (Schroeder et al., 1988). More specifically, concurrent and sequential presentations of the training stimuli were compared within a DTT paradigm. Four young participants with ASD acquired target responses faster with concurrent stimulus presentations than with sequential training, despite more errors being produced with the former presentation method. Generalized results were demonstrated for both concurrent and sequential exemplar training with no differential effects. However, two participants exhibited escape-maintained behaviors during generalization sessions.

Implications of these results convey that sufficient exemplar training within a DTT framework can produce acquisition and generalized results in children with ASD. Both experiments utilized concurrent training of exemplars and proved to be an efficient method for acquisition in Experiment 2, producing generalized results for all participants. Procedural application of exemplars was not examined in Experiment 1; nevertheless, once therapists were concurrently teaching the target skill, response levels decreased initially, but acquisition was eventually reached. However, generalized responding was only seen in one participant with this method. More work is needed to better understand the differential effects of exemplar presentations on acquisition and generalized results.

Certain collateral behaviors were observed in both experiments that are worth mentioning. For instance, prompt dependency was seen in one participant throughout DTT sessions, which impeded his ability to acquire the skill. A second participant became over selective in his generalized responding after multiple therapists were programmed within DTT sessions. Furthermore in Experiment 2, two participants exhibited escape-maintained behaviors during generalization sessions for both DTT conditions. Prompt dependency, over selectivity, and escape-motivated behaviors are three potential disadvantages of the DTT method (Schreibman, 1997; Smith, 2001; Sundberg & Partington, 1998) that can hinder generalized responding in some individuals. While generalization occurred for most of these participants, future research should investigate which programming technique is most effective at producing generalization, as well as reducing discrepant behaviors, within a DTT framework.

Significant positive outcomes have been reported across various outcome measures, ages, and environmental contexts for children with ASD receiving DTT (Lovaas, 1987; Myers & Johnson, 2007; Simpson, 2005; Smith, 2001; Tarbox & Najdowski, 2008). However, with all the advantages that DTT has to offer as an early intervention treatment, shortcomings in the area of generalized responding limit the maximum potential of treatment effectiveness (Landa, 2007; Myers & Johnson, 2007; Schreibman, 1997; Sundberg & Partington, 1998; Tarbox & Najdowski, 2008). The current investigation found that stimulus generalization was promoted for most participants receiving DTT. In Experiment 1, participants exhibited some generalized responding with the standard DTT method. Stronger generalized results were seen in one participant after multiple therapist exemplars were programmed with DTT sessions. Experiment 2 found similar generalized results for all participants by using sufficient stimulus exemplars during DTT sessions. The present experiments attempted to add to the generalization literature by including young children with ASD, as very limited studies have evaluated multiple exemplars in children with ASD. Future studies should continue researching exemplar training with multiple therapists within the ASD population. Overall, these results suggest that the DTT method can produce generalized results in some children with ASD, but it proves to be most effective when generalization strategies, such as training sufficient exemplars, are programmed. Additionally, idiosyncratic responding to unique features of the training environment remains an enduring concern in the treatment of children with ASD.

REFERENCES

American Academy of Pediatrics, Committee of Children with Disabilities. (2001). The pediatrician's role in the diagnosis and management of autistic spectrum disorder in children. *Pediatrics, 107,* 1221-1226. doi: 10.1542/peds.107.5.1221

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

American Speech-Language-Hearing Association. (2006). *Principles for speech-language pathologists in* diagnosis, *assessment, and treatment of autism spectrum disorders across the life span* [Technical Report: EB37-2005]. Available from www.asha.org/policy.

Anderson, S. R., Avery, D. L., DiPietro, E. K., Edwards, G. L., & Christian, W. P. (1987). Intensive home-based intervention with autistic children. *Education and Treatment of Children, 10,* 352–366.

Baer, D. M. (1999). *How to plan for generalization* (2nd ed.). Austin, TX: Pro-Ed.

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, *1*, 91-97.

Baer, D. M., Wolf, M. M., & Risley, T. R. (1987). Some still-current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, *20*, 313-327.

Belchic, J. K., & Harris, S. L. (1994). The use of multiple peer exemplars to enhance the generalization of play skills to the siblings of children with autism. *Child & Family Therapy*, *16*, 2-25.

Binder, C. (1996). Behavioral fluency: The evolution of a new paradigm. *The Behavior Analyst*, *19*, 163-197.

Birnbrauer, J.S., & Leach, D.J. (1993). The Murdoch Early Intervention Program after 2 years. *Behavior Change*, *10*, 63-74.

Boyle, C. A., Boulet, S., Schieve, L. A., Cohen, R. A., Blumberg, S. J., Yeargin-Allsopp, M., Visser, S., & Kogan, M. D. (2011). Trends in the prevalence of developmental disabilities in US children, 1997-2008. *Pediatrics*. Advance online publication. doi: 10.1542/peds.2010-2989.

Boyle, C. L., & Lutzker, J. R. (2005). Teaching young children to discriminate abusive from nonabusive situations using multiple exemplars in a modified discrete trial format. *Journal of Family Violence*, *20*, 55-67.

Bristol, M. M., Cohen, D. J., Costello, E. J., Denckla, M., Eckberg, T. J., Kallen, R., … Spence, M. A. (1996). State of the science in autism: Report to the National Institutes of Health. *Journal of Autism and Developmental Disorders*, *26*, 121-154.

Bristol, M. M., McIlvane, W. J., & Alexander, D. (1998). Autism research: Current context and future direction. *Mental Retardation and Developmental Disabilities*, *4*, 61-64.

Campbell, C. R., & Stremel-Campbell, K. (1982). Programming “loose training” as a strategy to facilitate language generalization. *Journal of Applied Behavior Analysis*, *15*, 295-301.

Centers for Disease Control and Prevention. (2014). Prevalence of autism spectrum disorder among children aged 8 years – Autism and developmental disabilities monitoring network, 11 sites, United States, 2010. *MMWR Surveillance Summaries, 63*, 1-21. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6302a1.htm?s_cid=ss6302a1_w

Cohen, H., Amerine-Dickens, M., & Smith, T. (2006). Early intensive behavioral treatment: Replication of the UCLA model in a community setting. *Journal of Developmental and Behavioral Pediatrics*, 27, 145-155.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Applied behavior analysis (Second ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Corsello, C. M. (2005). Early intervention in autism. *Infants & Young Children*, *18*, 74-85.

Craighead, W. E., O’Leary, K. D., & Allen, J. S. (1973). Teaching and generalization of instruction-following in an “autistic” child. *Journal of Behavior Therapy and Experimental Psychiatry*, *4*, 171-176.

Crockett, J. L., Fleming, R. K., Doepke, K. J. & Stevens, J. S. (2007). Parent training: Acquisition and generalization of discrete trials teaching skills with parents of children with autism. *Research in Developmental Disabilities*, *28*, 23-26.

Davis, C., Brady, M. P., Williams, R. E., & Hamilton, R. (1992). Effects of high-probability requests on the acquisition and generalization of responses to requests in young children with behavior disorders.

Dawson, G., Ashman, S. B., & Carver, L. J. (2000). The role of early experience in shaping behavioral and brain development and its implications for social policy. *Development and Psychopathology*, *12*, 695-712.

Delprato, D. J. (2001). Comparisons on discrete-trial and normalized behavioral language intervention for young children with autism. *Journal of Autism and Developmental Disabilities*, *31*, 315-325.

Diehl, S. F. (2003). Autism spectrum disorder: The context of speech-language pathologist intervention. *Language, Speech, and Hearing Services in School*, *34*, 177-179.

Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2002). Intensive behavioral treatment at school for 4- to 7-year-old children with autism. *Behavior Modification*, *26*, 49-68.

Fenske, E. C., Zalenski, S., Krantz, P. J., & McClannahan, L. E. (1985). Age at intervention and treatment outcome for autistic children in a comprehensive intervention program. *Analysis and Intervention in Developmental Disabilities*, *5*, 49-58.

Fisher, W. W., Piazza, C. C., Bowman, L. G., & Amari, A. (1996). Integrating caregiver report with systematic choice assessment to enhance reinforcer identification. *American Journal of Mental Retardation*, *101*, 15-25.

Fisher, W. W., Piazza, C. C., Bowman, L. G., Hagiopian, L. G., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis*, *25*, 491-498.

Garcia, E. (1974). The training and generalization of a conversational speech form in nonverbal retardates. *Journal of Applied Behavior Analysis*, *7*, 137-149.

Gardener, H., Spiegelman, D., & Buka, S. (2011). Perinatal and neonatal risk factors for autism: A comprehensive meta-analysis. *Pediatrics*, *128*, 344-355. doi: 10.1542/peds.2010-1036

Ghezzi, P. M. (2007). Discrete trials teaching. *Psychology in the Schools*, *44*, 667-677.

Ghezzi, P. M., & Bishop, M. R. (2008). Generalized behavior change in young children with autism. In J. K. Luiselli, D. C. Russo, W. P. Christian, & S. M. Wilczynski (Eds.), *Effective practices for children with autism* (pp. 137-158). Oxford, NY: Oxford University Press.

Goetz, E. M., & Baer, D. M. (1973). Social control of form diversity and the emergence of new forms in children's block building. *Journal of Applied Behavior Analysis*, *6*, 209-217.

Goldstein, H. (2002). Communication intervention for children with autism: A review of treatment efficacy. *Journal of Autism and Developmental Disabilities*, *32*, 373-396.

Gresham, F. M., & MacMillan, D. L. (1997). Autistic recovery?: An analysis and critique of the empirical evidence on the Early Intervention Project. *Behavioral Disorders*, *22*, 185-201.

Gresham, F. M., & MacMillan, D. L. (1998). Early intervention project: Can its claims be substantiated and its effects replicated? *Journal of Autism and Developmental Disorders*, *28*, 5-13.

Gresham, F. M., Beebe-Frankenberger, M. E., & MacMillan, D. L. (1999). A selective review of treatments for children with autism: Description and methodological considerations. *School Psychology Review, 28*, 559-575.

Griffiths, H., & Craighead, W. E. (1972). Generalization in operant speech therapy for misarticulation. *Journal of Speech and Hearing Disorders*, *37*, 485-494.

Guralnick, M. J. (1998). Effectiveness of early intervention for vulnerable children: A developmental perspective. *American Journal on Mental Retardation*, *102,* 319-345.

Handleman, J. S. (1979). Generalization by autistic-type children of verbal responses across settings. *Journal of Applied Behavior Analysis*, *12*, 273-282.

Handleman, J. S., & Harris, S. L. (1980). Generalization from school to home with autistic children. *Journal of Autism and Developmental Disorders*, *10*, 323-333.

Handleman, J. S. (1981). Transfer of verbal responses across instructional settings by autistic-type children. *Journal of Speech and Hearing Disorders*, *46*, 69-76.

Handleman, J. S., & Harris, S. L. (1983). Generalization across instructional settings by autistic children. *Child & Family Behavior Therapy, 5*, 73-83.

Haring, N. G. (1998). A technology for generalization. In N. G. Haring (Ed.), *Generalization for students with severe handicaps: Strategies and solutions* (pp. 5-11). Retrieved from http://books.google.com/books?hl=en&lr=&id=fpJU0UMYqb0C&oi=fnd&pg=PA15&ots=fbt2cq78WV&sig=h_NXf_W7cZ0H5l0d1hU2SALYiUI#v=onepage&q&f=false

Harris, S. L., Handleman, J. S., Gordon, R., Kristoff, B., & Fuentes F. (1991). Changes in cognitive and language functioning of preschool children with autism. *Journal of Autism and Developmental Disabilities, 21*, 281-190.

Harris, S. L., & Handleman, J. S. (2000). Age and IQ at intake as predictors of placement for young children with autism: A four- to six-year follow up. *Journal of Autism and Developmental Disorders, 30*, 137-142.

Hart, B., & Risley, T. R. (1975). Incidental teaching of language in preschool. *Journal of Applied Behavior Analysis, 8*, 411-420.

Herbert, J.D., Sharp, I.R., & Gaudiano, B.A. (2002). Separating fact from fiction in the etiology and treatment of autism: A scientific review of the evidence. *Scientific Review of Mental Health Practice*, *1*, 23‑43.

Horner, R. D. & Baer, D. M. (1978). Multiple-probe technique: A variation of the multiple baseline. *Journal of Applied Behavior Analysis*, *11*, 189-196.

Horner, R. H., Bellamy, G. T., & Colvin, G. T. (1984). Responding in the presence of nontrained stimuli: Implications of generalization error patterns. *Journal of the Association of Persons with Severe Handicaps*, *9*, 287-295.

Howard, J. S., Sparkman, C. R., Cohen, H. G., Green, G., & Stanislaw, H. (2005). A comparison of intensive analytic and eclectic treatments for young children with autism. *Research in Developmental Disabilities*, *26*, 359-383.

Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2004). Adult outcome for children with autism. *Journal of Child Psychology and Psychiatry*, *45*, 212-229.

Hughes, C., Harmer, M. L., Killian, D. J., & Niarhos, F. (1995). The effects of multiple-exemplar self-instructional training on high school students' generalized conversational interactions. *Journal of Applied Behavior Analysis*, *28*, 201-218.

Hurth, J., Shaw, E., Izeman, S. G., Whaley, K., & Rogers, S. J. (1999). Areas of agreement about effective practices among programs serving young children with autism spectrum disorders. *Infants and Young Children*, *12*, 17-26.

Ingersoll, B., & Schreibman, L. (2006). Teaching reciprocal imitation skills to young children with autism using a naturalistic behavioral approach: Effects on language, pretend play, and joint attention. *Journal of Autism and Developmental Disabilities*, *36*, 487-505.

Iovannone, R., Dunlap, G., Huber, H., & Kincaid, D. (2003). Effective educational practices for students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, *18*, 150-165.

Jackson, D. A., & Wallace, F. (1974). The modification and generalization of voice loudness in a fifteen-year-old retarded girl. *Journal of Applied Behavior Analysis*, *7*, 461-471.

Jones, E. A., Feeley, K. M., & Takacs, J. (2007). Teaching spontaneous responses to young children with autism. *Journal of Applied Behavior Analysis*, *40*, 565-570.

Johnson, K. R., Joe Layng, T. V. (1996). On terms and procedures: Fluency. *The Behavior Analyst*, *2*, 282-288.

Klinger, L. G., Dawson, G., & Renner, P. (2003). Autistic disorder. In E. J. Mash & R. A. Barkley (Eds.), *Child Psychopathology* (pp. 409-454). New York, NY: Guilford Press.

Kocovska, E., Fernell, E., Billstedt, E., Minnis, E., & Gillberg, C. (2012). Vitamin D and autism: Clinical review. *Research in Developmental Disabilities*, *33*, 1541-1550.

Koegel, R. L., Koegel, L. K., Brookman, L. I. (2003). Empirically supported pivotal response interventions for children with autism. In A. E. Kazdin (Ed.), Yale University School of Medicine, & Child Study Center (Eds.), *Evidence-based Psychotherapies for Children and Adolescents: Evidence-based Psychotherapies for Children and Adolescents* (pp. 341-357). New York, NY: Guilford Press.

Koegel, R. L., Koegel, L. K., & McNerney, E. K. (2001). Pivotal areas in intervention for autism. *Journal of Clinical Child Psychology, 30,* 19-32.

Koegel, L. K., Koegel, R. L., Shoshan, Y., McNerney, E. K. (1999). Pivotal response intervention II: Preliminary long-term outcome data. *Journal of the Association for Persons with Severe Handicaps, 24,* 186-198.

Koegel, R. L., O'Dell, M. C., & Koegel, L. K. (1987). A natural language teaching paradigm for nonverbal autistic children. *Journal of Autism and Developmental Disabilities, 17,* 187-200.

Koegel, R. L., & Rincover, A. (1977). Research on the difference between generalization and maintenance in extra-therapy responding. *Journal of Applied Behavior Analysis, 10,* 1-12.

Landa, R. (2007). Early communication development and intervention for children with autism. *Mental Retardation and Developmental Disabilities Research Reviews, 13,* 16-25.

Lerman, D. C. & Iwata, B. A. (1996). Developing a technology for the use of operant extinction in clinical settings: An examination of basic and applied research. *Journal of Applied Behavior Analysis, 29,* 345-382.

Losh, M., Esserman, D., Anckarsater, H., Sullivan, P. F., & Lichtenstein, P. (2012). Lower birth weight indicates higher risk of autistic traits in discordant twin pairs. *Psychological Medicine, 42*, 1091-1102.

Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55,* 3-9.

Lowther, R. M., & Martin, G. L. (1980). Multiple settings and trainers for programming generalization of a social response of severely retarded persons. *Behavior Research of Severe Developmental Disabilities, 1,* 131-145.

Luiselli, J. K., Cannon, B. O., Ellis, J. T., & Sisson, R. W. (2000). Home-based behavioral intervention for young children with autism/pervasive developmental disorder. *Autism, 4*, 426-438.

Matson, J. L., Sevin, J. A., Box, M. L., Francis, K. L., & Sevin, B. M. (1993). An evaluation of two methods for increasing self-initiated verbalizations in autistic children. *Journal of Applied Behavior Analysis*, *26*, 389-398.

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal on Mental Retardation*, *97*, 359-372.

McEvoy, M. A., Nordquist, V. M., Twardosz, S., Heckaman, K. A., Wehby, J. H., & Kenton Denny, R. (1988). Promoting autistic children's peer interaction in an integrated early childhood setting using affection activities. *Journal of Applied Behavior Analysis*, *21*, 193-200.

Miyazaki, K., Narita, N., & Narita. M. (2005). Maternal administration of thalidomide or valproic acid causes abnormal serotonergic neurons in the offspring: Implication for pathogenesis of autism. *International Journal of Developmental Neuroscience*, *23*, 287-297.

Myers, S. M., & Johnson, C. P. (2007). Management of children with autism spectrum disorders. *Pediatrics*, *120*, 1162-1182. doi: 10.1542/peds.2007-2362

National Institute of Child Health and Development, National Institutes of Health, U. S. Department of Health and Human Services. (2005). *Autism overview: What we know*. (NIH Publication No. 05-5592). Retrieved from National Institute of Child Health and Development website: http://www.nichd.nih.gov/publications/pubs/upload/introduction_autism.pdf

National Institute of Mental Health. (2004). *Autism Spectrum Disorders (Pervasive Developmental Disorders), With Addendum January 2007*. Retrieved October 3, 2012 from http://wwwapps.nimh.nih.gov/health/publications/autism/complete-publication.shtml

National Research Council (NRC), Committee on Educational Interventions for Children with Autism. (2001). *Education Children with Autism*. Retrieved from http://www.nap.edu/openbook.php?record_id=10017&page=R1

Nelson, C., & Huefner, D. S. (2003). Young children with autism: Judicial responses to the Lovaas and discrete trial training debates. *Journal of Early Intervention*, *26*, 1-19.

Newschaffer, C. J., Falb, M. D., & Gurney, J. G. (2005). National autism prevalence trends from United States special education data. *Pediatrics*, *115*, 277-282. doi: 10.1542/peds.2004-1958.

Noland, R. M., & Gabriels, R. L. (2004). Screening and identifying children with autism spectrum disorders in the public school system: The development of a model process. *Journal of Autism and Developmental Disorders*, *34*, 265-277.

Openden, D., Whalen, C., Cernich, S., & Vaupel, M. (2009). Generalization and autism spectrum disorders. C. Whalen (Ed.), *Real life, real progress for children with autism spectrum disorders*. Baltimore, MD: Paul H. Brookes Publishing Co.

Partington, J. W. (2006). *Assessment of Basic Language and Learning Skills-Revised*. Pleasant Hill, CA: Behavior Analysts, Incorporated.

Pellecchia, M., & Hineline, P. N. (2007). Generalization of mands in children with autism from adults to peers. *The Behavior Analyst Today*, *8*¸ 483-491.

Pierce, K. L., & Schreibman, L. (1994). Teaching daily living skills to children with autism in unsupervised settings through pictorial self-management. *Journal of Applied Behavior Analysis*, 27, 471-481.

Powers, M. D. (1992). Early intervention for children with autism. In D. E. Berkell (Ed.), *Autism: Identification, education and treatment* (pp. 225-252). Hillsdale: NJ: Erlbaum.

Reeve, S. A., Reeve, K. F., Townsend, D. B, & Poulson, C. L. (2007). Establishing a generalized repertoire of helping behavior in children with autism. *Journal of Applied Behavior Analysis*, *40*, 123-136.

Rincover. A., & Koegel, R. L. (1975). Setting generality and stimulus control in autistic children. *Journal of Applied Behavior Analysis*, *8*, 235-246.

Rogers, S. J. (1996). Brief report: Early intervention in autism. *Journal of Autism and Developmental Disorders*, *26*, 243-246.

Rogers, S. J. (1998). Empirically supported comprehensive treatments for young children with autism. *Journal of Clinical Child Psychology*, *27*, 168-179.

Rutter, M. (2005). Aetiology of autism: Findings and questions. *Journal of Intellectual Disability Research*, *49*, 231-238.

Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal on Mental Retardation*, 6, 417-438.

Scheeren, A. M., & Stauder, J. E. A. (2008). Broader autism phenotype in parents of autistic children: Reality or myth? *Journal of Autism and Developmental Disorders*, *38*, 276-287.

Schopler, E., Short, A., & Mesibov, G. (1989). Relation of behavioral treatment to "Normal Functioning": Comment on Lovaas. *Journal of Consulting and Clinical Psychology*, *57*, 162-164.

Schreibman, L. (1997). Theoretical perspectives on behavioral intervention for individuals with autism. In D. J. Cohen & F. R. Volkmar (Eds.), *Handbook of autism and pervasive developmental disorders* (2nd ed., pp. 920–933). New York: Wiley.

Schreibman, L. (2000). Intensive behavioral/psychoeducational treatments for autism: Research needs and future directions. *Journal of Autism and Developmental Disorders*, *30*, 373-378.

Schreibman, L., Stahmer, A. C., & Suhrheinrich, J. (2009). Enhancing generalization of treatment effects via pivotal response training and the individualization of treatment protocols. In C. Whalen (Ed.), *Real life, real progress for children with autism spectrum disorders*. Baltimore, MD: Paul H. Brookes Publishing Co.

Schroeder, C. M., Schuster, J. W., & Hemmeter, M. L. (1998). Efficiency in programming for generalization: Comparison of two methods for teaching expressive labeling to preschoolers with developmental delays. *Journal of Developmental and Physical Disabilities*, *10*, 109-131.

Secan, K. E., Egel, A. L., & Tilley, C. S. (1989). Acquisition, generalization, and maintenance of question-answering skills in autistic children. *Journal of Applied Behavior Analysis*, *22*, 181-196.

Seltzer, M. M., Shattuck, P., Abbeduto, L., & Greenberg, J. S. (2004). Trajectory of development in adolescents and adults with autism. *Mental Retardation and Developmental Disabilities Research Reviews*, *10*, 234-247.

Sheinkopf, S. J., & Siegel, B. (1998). Home-based behavioral treatment of young children with autism. *Journal of Autism and Developmental Disorders*, *28*, 15-23.

Simpson, R. (2005). Evidence-based practices and students with Autism Spectrum Disorders. *Focus on Autism and Other Developmental Disabilities*, *20*, 140-149.

Sindelar, P. T., Rosenberg, M. S., & Wilson, R. J. (1985). An adapted alternating treatments design for instructional research. *Education & Treatment of Children*, *8*, 67-76.

Smith, T. (1999). Outcome of early intervention for children with autism. *Clinical Psychology: Science and Practice*, *6*, 33-49.

Smith, T. (2001). Discrete trial training in the treatment of autism. *Focus on Autism and Other Developmental Disabilities*, *16*, 86-92.

Smith, T. (2008). Empirically supported and unsupported treatments for autism spectrum disorders. *The Scientific Review of Mental Health Practice*, *6*, 3-20.

Smith, T (2010). Early and intensive behavioral intervention in autism. In J. R. Weisz & A. E. Kazdin (Eds.), *Evidence-Based Psychotherapies for Children and Adolescents* (pp. 312-326). New York, NY: Guildford Press.

Smith, T., Buch, G. A., & Gamby, T. E., (2000). Parent-directed, intensive early intervention for children with pervasive developmental disorder. *Research in Developmental Disabilities*, *21*, 297-309.

Smith, T., Eikeseth, S., Klevstrand, M., & Lovaas, O. I. (1997). Intensive behavioral treatment for preschoolers with severe mental retardation and pervasive developmental disorder. *American Journal on Mental Retardation*, *102*, 238-249.

Smith, T., Groen, A. D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation*, *105*, 269-285.

Sprague, J. R., & Horner, R. H. (1984). The effects of single instance, multiple instance, and general case training on generalized vending machine use by moderately and severely handicapped students. *Journal of Applied Behavior Analysis*, *17*, 273-278.

Steege, M. W., Mace, C., Perry, L., & Longenecker, H. (2007). Applied behavior analysis: Beyond discrete trial teaching. *Psychology in Schools*, *44*, 91-99.

Stewart, G., Van Houten, R., & Van Houten, J. (1992). Increasing generalized social interactions in psychotic and mentally retarded residents through peer-mediated therapy. *Journal of Applied Behavior Analysis*, *25*, 335-339.

Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis*, *10*, 349-367.

Stokes, T. F., Baer, D. M., & Jackson, R. L. (1974). Programming the generalization of a greeting response in four retarded children. *Journal of Applied Behavior Analysis*, *7* 599-610.

Stokes, T. F., Fowler, S. A., & Baer, D. M. (1978). Training preschool children to recruit natural communities of reinforcement. *Journal of Applied Behavior Analysis*, *11*, 285-303.

Stokes, T. F., & Osnes, P. G. (1989). An operant pursuit of generalization. *Behavior Therapy*, *20*, 337-355.

Stone, W. L., & Yoder, P. J. (2001). Predicting spoken language level in children with autism spectrum disorders. *Autism*, *5*, 341-361. doi: 10.1177/1362361301005004002

Sundberg, M. L., & Partington, J. W. (1998). Teaching language to children with autism or other developmental disabilities. Pleasant Hill, CA: Behavior Analysts, Inc.

Tarbox, R. S. F., & Najdowski, A. C. (2008). Discrete trial training as a teaching paradigm. In J. K. Luiselli, D. C. Russo, W. P. Christian, & S. M. Wilczynski (Eds.), *Effective practices for children with autism* (pp. 181-194). Oxford, NY: Oxford University Press.

Trottier, G., Srivastava, L., & Walker, C. D. (1999). Etiology of infantile autism: A review of recent advances in genetic and neurobiological research. *Journal of Psychiatry & Neuroscience*, *24*, 103-115.

Vismara, L. A., & Rogers, S. J. (2010). Behavioral treatments in autism spectrum disorder: What do we know? *Annual Review of Clinical Psychology*, *6*, 447-468. doi: 10.1146/annurev.clinpsy.121208.131151

Wadman, M. (2007). Autism speaks: United States pays up. *Nature*, *448*, 628-629. doi: 10.1038/448628a

Walker, D. R., Thompson, A., Zwaigenbaum, L., Goldberg, J., Bryson, S. E., Mahoney, W. J., …Szatmari, P. (2004). Specifying PDD-NOS: A Comparison of PDD-NOS, Asperger Syndrome, and Autism. *Journal of American Academy of Child and Adolescent Psychiatry*, *43*, 172-180.

Walters, K. L., Holborn, S. W., & Ediger, J. (2007). General case programming of compliance to instructions for individuals with developmental disabilities. *Journal of Developmental and Physical Disabilities*, *19*, 51-64.

Weiss, M. J., & LaRue, R. H. (2009). Enhancing the generalization of skills taught through discrete trial instruction. In C. Whalen (Ed.), *Real life, real progress for children with autism spectrum disorders*. Baltimore, MD: Paul H. Brookes Publishing Co.

Whalen, C. (Ed.). (2009) *Real life, real progress for children with autism spectrum disorders*. Baltimore, MD: Paul H. Brookes Publishing Co.

White, R. O., Liberty, K. A., Haring, N. G., Billingsley, F. F., Boer, M., Burrage, A., …Sessoms, I. (1998). Review and analysis of strategies for generalization. In N. G. Haring (Ed.), *Generalization for students with severe handicaps: Strategies and solutions* (pp. 15-45). Retrieved from http://books.google.com/books?hl=en&lr=&id=fpJU0UMYqb0C&oi=fnd&pg=PA15&ots=fbt2cq78WV&sig=h_NXf_W7cZ0H5l0d1hU2SALYiUI#v=onepage&q&f=false

Wolery, M., & Gast, D. L. (1984). Effective and efficient procedures for the transfer of stimulus control. *Topics in Early Childhood Special Education*, *4*, 52-77.

Wolery, M., Gast, D. L., & Hammond, D. (2010). Comparative interventions design. In D. Gast (Ed.), *Single Subject Research Methodology in Behavioral Sciences* (pp. 329-381). New York, NY: Taylor & Francis.

Young, J. M., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (1994). Generalized imitation and response-class formation in children with autism. *Journal of Applied Behavior Analysis*, *27*, 685-697.

APPENDIX

Institutional Review Board
Dr. Robert Mathews, Chair
131 David Boyd Hall
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ACTION ON PROTOCOL APPROVAL REQUEST

TO: George Noell
Psychology

FROM: Robert C. Mathews
Chair, Institutional Review Board

DATE: April 15, 2013
RE: **IRB#** 3384

TITLE: Programming Generalization: The Use of Sufficient Exemplars within a Discrete Trial Training Early Intervention Program for Children with Autism Spectrum Disorders

New Protocol/Modification/Continuation: New Protocol

Review type: Full ___ Expedited _X_ **Review date:** 4/16/2013

Risk Factor: Minimal _X_ Uncertain ___ Greater Than Minimal___

Approved _X_ **Disapproved** ___

Approval Date: 4/16/2013 **Approval Expiration Date:** 4/15/2014

Re-review frequency: (annual unless otherwise stated)

Number of subjects approved: 6

Protocol Matches Scope of Work in Grant proposal: (if applicable)___

By: Robert C. Mathews, Chairman [signature]

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING – Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. SPECIAL NOTE:

**All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb*

Application for Approval of Projects Which Use Human Subjects

This application is used for projects/studies that cannot be reviewed through the exemption process.

LSU

Institutional Review Board
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– Applicant, Please fill out the application in its entirety and include two copies of the competed application as well as parts A-E, listed below. Once the application is completed, please submit to the IRB Office for review and please allow ample time for the application to be reviewed. Expedited reviews usually takes 2 weeks. Carefully completed applications should be submitted 3 weeks before a meeting to ensure a prompt decision.

– A Complete Application Includes All of the Following:

(A) Two copies of this completed form and two copies of part B thru F.
(B) A brief project description (adequate to evaluate risks to subjects and to explain your responses to Parts 1&2)
(C) Copies of all instruments to be used.
*If this proposal is part of a grant proposal, include a copy of the proposal and all recruitment material.
(D) The consent form that you will use in the study (see part 3 for more information.)
(E) Certificate of Completion of Human Subjects Protection Training for all personnel involved in the project, including students who are involved with testing or handling data, unless already on file with the IRB. Training link: (http://phrp.nihtraining.com/users/login.php)
(F) IRB Security of Data Agreement: (http://research.lsu.edu/files/item26774.pdf)

1) Principal Investigator*: George Noell **Rank** Professor
*PI **must be** an LSU Faculty Member

Dept: Psychology **Ph:** (225) 578-4119 **E-mail:** gnoell@lsu.edu

2) Co Investigator(s): please include department, rank, phone and e-mail for each
Carolyn Barahona
Psychology Department
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IRB# 3384 LSU Proposal #
Full
✓ Expedited
✓ Human Subjects Training
✓ Complete Application

3) Project Title: Programming Generalization: The Use of Sufficient Exemplars within a Discrete Trial Training Early Intervention Program for Children with Autism Spectrum Disorders

4) Proposal Start Date: 4/29/13 **5) Proposed Duration Months:** 12

6) Number of Subjects Requested: 6 **7) LSU Proposal #:**

8) Funding Sought From: N/A

Study Approved By:
Dr. Robert C. Mathews, Chairman
Institutional Review Board
Louisiana State University
203 B-1 David Boyd Hall
225-578-8692 | www.lsu.edu/irb
Approval Expires: 4/15/2014

ASSURANCE OF PRINCIPAL INVESTIGATOR named above
I accept personal responsibility for the conduct of this study (including ensuring compliance of co-investigators/co-workers) in accordance with the documents submitted herewith and the following guidelines for human subject protection: The Belmont Report, LSU's Assurance (FWA00003892) with OHRP and 45 CFR 46 (available from http://www.lsu.edu/irb). I also understand that copies of all consent forms **must be maintained at LSU for three years after the completion of the project.** If I leave LSU before that time, the consent forms should be preserved in the Departmental Office.

Signature of PI [signature] Date 4/8/2013

ASSURANCE OF STUDENT/PROJECT COORDINATOR named above. If multiple Co-Investigators, please create a "signature page" for all Co-Investigators to sign. Attach the "signature page" to the application.

I agree to adhere to the terms of this document and am familiar with the documents referenced above.

Signature of Co-PI (s) [signature] Date 4/8/13

VITA

Carolyn Barahona graduated from Louisiana State University in Baton Rouge with a Bachelor's of Science in Psychology in 2004. Carolyn spent two years working as an ABA therapist for an early intervention program for children with autism. She continued to pursue her educational career in psychology, and in 2010 she earned her Master's degree in Psychology at Louisiana State University. She supervised an early intervention program for children with autism from 2009 to 2011 in Baton Rouge. Carolyn was also a consultant in a specialized school for children with autism and traumatic brain injuries in Boston, Massachusetts during her pre-doctoral internship. She was later certified as a Board Certified Behavior Analyst in 2012. Carolyn is a doctoral candidate in Psychology at Louisiana State University and will be awarded her Doctor of Philosophy degree in May 2014.