4-9-2019

Rule-Governed Behavior: Teaching Essential School Readiness Skills via Rule-Following to Children with Autism

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RULE-GOVERNED BEHAVIOR: TEACHING ESSENTIAL SCHOOL READINESS SKILLS VIA RULE-FOLLOWING TO CHILDREN WITH AUTISM

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
Requirements for the degree of
Doctor of Philosophy

in

The Department of Psychology

by
Rachel Lorraine Bradley
B.S., Valdosta State University, 2014
M.A., Louisiana State University, 2016
August 2019

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Abstract

Rule-governed behavior (RGB) is behavior that is controlled by verbal descriptions of contingencies rather than by direct contact or a history of direct contact with the contingencies. Humans rely on RGB to navigate a multitude of life experiences, and in doing so, we avoid direct contact with destructive or harmful contingencies or contingencies that would be inefficient to contact. However, individuals with autism spectrum disorders (ASD) do not naturally demonstrate RGB, leaving them at increased risk of contacting dangerous consequences. Thus, acquiring RGB is a critical concern that affects the development and well-being of individuals with ASD. The current study examined the effectiveness of intervention programs designed to promote acquisition and generalization of RGB in children with ASD. Multiple exemplar training (MET) resulted in increased performance of target behaviors as well as successful discrimination. Furthermore, training resulted in generalized performance to untrained exemplars, natural settings, and unfamiliar others demonstrating acquisition and generalization of RGB.

Review of Literature

Since the passage of the Individuals with Disabilities Education Act, policymakers and practitioners have directed their efforts toward identifying and providing students with disabilities individualized services designed to support their pursuit of continued education, future employment, and ultimately independence. As of the 2013-2014 school year, the number of students receiving services in special education totaled 6.5 million, (U.S. Department of Education, 2015). Approximately eight percent of these students served have a diagnosis of autism spectrum disorder (ASD), making ASD one of the fastest growing groups of individuals served under IDEA. With such a significant percentage of the special education population having an ASD diagnosis, there is an increased need for research that promotes understanding of the disorder as well as best practices for treating ASD.

ASD is classified as a developmental disorder. As such, symptoms of ASD, particularly personal and social functioning deficits, are evident early in an individual's life (American Psychiatric Association, 2013). The range of deficits across developmental disorders varies from specific limitations in learning to global impairment. Developmental disorders frequently co-occur, making managing their treatment a multi-faceted endeavor. ASD is characterized by restrictive, repetitive patterns of behavior and difficulty with verbal and nonverbal communication, but ASD can also be associated with intellectual impairment (American Psychiatric Association, 2013).

These characteristics of ASD can lead to difficulties with school readiness. Children with ASD have been shown to perform above the population mean on pre-academic skills (i.e., identifying letters and quantitative concepts), but two standard deviations below the population mean in demonstration of preschool social skills (i.e., interpersonal skills, rule following, and accepting decisions made by adults) (Carlson et al., 2008). Furthermore, children with ASD have been shown to demonstrate significantly higher rates of problem behavior, indicating greater concern about defying teachers and caregivers and levels of independence and self-control (Carlson et al., 2008).

Such early deficits in school readiness can have consequences for long-term academic achievement. Lloyd, Irwin, and Hertzman (2009) examined longitudinal data comparing kindergarten school readiness scores to fourth-grade academic scores for children with a variety of special needs. Researchers discovered that 88% of children with an ASD diagnosis did not demonstrate school readiness upon entering kindergarten. Furthermore, 86% of these children did not meet academic expectations in fourth grade evaluations. These results suggest a relationship between early school readiness and ultimate academic success in school for this population.

In order to best prepare students with ASD to be effective in a mainstream classroom or the least restrictive environment, professionals who work with this population should identify important skills to target and evidence-based methods for teaching these skills. Content analysis revealed that among the most influential targets of intervention for promoting independent classroom behavior in children with ASD were skills related to communication and social interaction, compliance with classroom routines and rules, and engagement in tasks (Wong et al., 2014).

Social Skills in ASD

The conceptualization of social skills has important implications for the assessment and treatment of social skills deficits. Elliott and Gresham (1987) proposed a social validity definition of social skills, in which behaviors demonstrated in social situations are used to predict important outcomes. Important outcomes for children in school might include socially-mediated consequences such as peer acceptance, which in turn may impact other measurements of success, such as a positive self-concept, peer group membership, and having friends.

In an effort to inform social skills treatment aimed at promoting social skills proficiency, and by extension, addressing crucial social outcomes related to child and adolescent development, Caldarella and Merrell (1997) created a taxonomy of child and adolescent prosocial behaviors. Behavioral dimensions in the taxonomy include: peer relations skills, self-management skills, academic skills, compliance skills, and assertion skills. In developing this taxonomy, researchers were able to identify typical social patterns as well as develop a system for evaluating social strengths and weaknesses. Additionally, the taxonomy can be used to inform intervention development as well as serve as a measure for progress monitoring of intervention effectiveness.

The ability to effectively interact with others has been a long-standing cornerstone that defines social competency, and as a result, plays a significant role in predicting healthy psychological and social adjustment (Parker & Asher, 1987; Kupersmidt, Coie, & Dodge, 1990). Unfortunately, social skills such as those outlined by Caldarella and Merrell (1997), peer relations skills, self-management skills, academic skills, compliance skills, and assertion skills, have been well documented in the literature to be deficient in children with ASD (Attwood 1998; Rogers, 2000; Myles et al., 2005). The practical implications of such social problems are extensive and severe. Individuals with social impairments are more likely to experience peer rejection and poor social support, contributing to feelings of loneliness (Bauminger & Kasari, 2000). The finding that children with ASD report feelings of loneliness is of critical importance because it counters previous clinical findings that suggest children with ASD demonstrate a "basic desire for aloneness" (Kanner, 1943, p. 5). On the contrary, children with ASD appear to desire social involvement with others. Ironically, integration of children with ASD into mainstream classrooms with their typically developing peers can result in an elevated risk for rejection by typically-developing peers, ultimately leading to further social isolation (Chamberlain, 2001). Additionally, the presence of severe social impairments and resulting isolation may lead to the development of anxiety, depression, and an increased likelihood of substance abuse (La Greca & Lopez, 1998; Tantam, 2000; Bellini, 2006). Tantam (2000) attributes the increased prevalence of emotional disorders in individuals with ASD to the disorder itself, as well as relational factors including family tension, broken relationships, increased levels of stress, unfavorable life circumstances, and high rates of victimization.

Alternatively, individuals with adequate social skills are more likely to be accepted in mainstream classrooms and integrated work environments. They are more likely to ultimately demonstrate a greater degree of independence than those with significant social skills deficits (Scheuermann & Webber, 2002). However, effectively treating the social deficits that are characteristic of ASD has been difficult (Weiss & Harris, 2001). Because social skills deficits do not typically remit with development (White, Keonig, & Scahill, 2007), children with ASD require extensive treatment in order to remediate deficits. Unfortunately, the majority of children receiving services targeting social skills do not receive adequate programming (Gresham, Sugai, & Horner, 2001; Hume, Bellini, & Pratt, 2005) due to inappropriate intervention strategies, insufficient exposure to the intervention, or inadequate treatment integrity (Gresham et al., 2001). Furthermore, research regarding the effectiveness of social skills treatments for producing behaviors of social significance that are long-lasting and generalize to a variety of natural environments of students with disabilities is inconclusive (Höher Camargo, Rispoli, Ganz, Hong, Davis, & Mason, 2016; January, Casey, & Paulson, 2011). Gresham et al. (2001) found that possible reasons for failed social skills training programs include insufficient dosages of prescribed interventions, treatment in unnatural settings, lack of treatment fidelity, and inappropriate treatment for the presenting deficit. Problem behaviors are likely to compete with trained social skills if problem behaviors are more successful in producing more powerful or immediate reinforcers. Potential moderators of social skills programming effectiveness include the age of the student at the time of intervention, with early intervention being most effective; amount of exposure to the intervention, with greater exposure leading to more positive effects on overall social competence; and modality of the intervention, with interventions favoring more experiential approaches being more effective than those focusing solely on discussion or academic instruction (January et al., 2011). Treatment programs should be designed with these effects in mind in order to increase the efficiency of socially-desirable alternative behaviors in obtaining reinforcement to increase the likelihood that they will be demonstrated in the future.

The importance of matching treatment to specific deficits has been repeatedly emphasized in the social skills literature (Quinn, Kavale, Mathur, Rutherford, & Forness, 1999; Gresham et al., 2001; Bellini, 2006; Camargo, Rispoli, Ganz, Hong, Davis, & Mason, 2014; Bellini, Peters, Benner, & Hopf, 2007). Most researchers agree that difficulties associated with navigating social situations commonly observed in children with ASD can result from incompetency in either response acquisition or response performance (Bandura, 1977). Researchers have since expanded upon this original distinction to include four general areas of social skills concerns: social skills deficits, social performance deficits, self-control social skill deficits, and self-control social performance deficits (Elliott & Gresham, 1987).

Children with social skills deficits either have a skill deficit, in which they have not developed the skills needed in order to participate in social interactions, or they fail to demonstrate adequate performance of skills they have learned. For example, a child may not have acquired the appropriate response to receiving help from an adult (i.e., saying “thank you”), therefore having a skill deficit. Alternatively, if a child has learned the appropriate response to receiving help and has demonstrated it in context but fails to do so across settings, the child has a performance deficit. A variety of interventions have been shown to be effective in teaching skills to children with social skills deficits (Elliott and Gresham, 1987).

Social performance deficits occur when the appropriate social skill is in the child's behavioral repertoire, but the child fails to perform the skill at acceptable levels. These deficits manifest as a result of lack of opportunity or lack of motivation to perform the desired behavior. For example, despite having learned all the necessary prerequisite skills involved in saying 'thank you' upon receiving help, a child may still demonstrate difficulty generalizing the skill to a variety of settings. Social performance deficits have been shown to be effectively addressed by manipulating contingencies in the natural environment. A variety of interventions have been shown to be effective for remediating social performance deficits, including reinforcement of peer initiations (Strain, Shores, & Timm, 1977), contingent social reinforcement (Allen, Hart, Harris, & Wolf, 1964), and group contingencies (Gamble & Strain, 1979).

Emotional arousal has the ability to interfere with acceptable demonstration of social skills. Self-control social skill deficits are common in children who have not developed a skill due to uncontrolled emotional arousal. For example, anxiety is an emotional arousal response known to interfere with acquisition of appropriate behaviors. Due to social anxiety symptoms, a child may not have ever had mastery experiences interacting with others due to the inhibition of social interactions as a result of the anxiety. Two criteria suggest a self-control social skill deficit: the presence of an emotional arousal response and lack of skill performance. Effective interventions for self-control social skills deficits target the emotional arousal component of the deficit. Strategies might include evidence-based techniques targeting reduction of the emotional arousal including, but not limited to, systematic desensitization and/or various self-control strategies (Kendall & Braswell, 1985; Meichenbaum, 1977).

Self-control social performance deficits are characterized by having acquired a social skill, however, appropriate performance of the skill is blocked by arousal. In order to verify that a performance deficit is a result of a deficit in self-control, the child needs to have an emotional arousal response as well as erratic demonstration of the learned skill. Treatment strategies for addressing self-control social performance deficits require effective instruction of behavioral inhibition associated with the emotional arousal and shaping of appropriate social behavior through delivery systematic reinforcement (Bolstad & Johnson, 1977; Kendall & Braswell 1985; Rosenbaum & Drabman, 1979).

Evidence-Based Social Skills Interventions

Considering this heuristic organization of social skills deficits in case conceptualization is a potentially useful step to designing effective treatment for these underlying social weaknesses. Reviews of the social skills intervention literature have extensively examined the effectiveness of such interventions for children with ASD (Hwang & Hughes, 2000; Rogers, 2000; McConnell, 2002; Bellini et al., 2007). Hwang and Hughes (2000) concluded from their research that social skills interventions demonstrate "considerable promise for increasing social and communicative skills" (p. 340) for children with ASD. Similar to Hwang and Hughes, Rogers (2000) concluded that children with ASD have shown success in acquisition and performance of appropriate social skills as a result of a myriad of intervention strategies. Based on reviews of the literature, several effective social skills interventions for pre-school and school age children with ASD have been documented.

Prompting and Reinforcing Target Behaviors

Prompts are antecedent stimuli that cue a target behavior (Cooper, Heron, & Heward, 2007). Prompting would most commonly be used as part of a skill acquisition strategy targeting an acquisition deficit. Previous behavior analytic studies have demonstrated prompting to be an effective strategy to remediate social skills deficits in children with ASD (Rogers, Herbison, Lewis, Pantone, & Reis, 1986; Malmberg, Charlop, & Gershfeld, 2015; Swaggart et al 1995; Krantz & McClannahan, 1993; Nikopoulos & Keenan, 2007). However, in regard to prompts, particularly in the natural setting, the following limitations should be considered. Written or verbal instructions can be distracting to others in the environment and may result in unwanted attention directed toward the child using such instructions (Anson, Todd, & Cassaretto, 2008). Additionally, newly learned behaviors may not persist once programmed prompts are faded (Odom, Hoyson, Jamieson, & Strain, 1985). Recent research has found tactile prompting to be one possible solution to overcoming the aforementioned limitations, while also effectively teaching social skills to children with ASD (Tzanakaki, Grindle, Dungait, Hulson-Jones, Saville, Hughes, & Hastings, 2014; Anglesea, Hoch, & Taylor, 2008; Taylor, Hughes, Richard, Hoch, & Rodriquez Coello, 2004; Anson et al., 2008). Additionally, practitioners can model desired behavior as a response prompt. The use of modeling is an effective strategy for behavior change in general, but particularly for children with developmental disabilities (Cooper et al., 2007), and has been used to teach social skills to students with ASD (Bellini & Akullian 2007; Mason, Ganz, Parker, Burke, & Camargo, 2012). Modeling in conjunction with prompting and reinforcement has been shown to result in larger effects in inclusive settings (Apple, Billingsley, & Schwartz, 2005). Findings suggest that interventions employing prompting and reinforcement alone (without modeling) are just as effective for targeting social skills deficits, and thus may be more cost-effective in terms of resources saved as compared to when modeling is also utilized (Camargo et al., 2016).

The provision of frequent and meaningful reinforcement plays a crucial role in engaging students with ASD in social interactions, potentially due to a lack of motivation to engage in such interactions when the available social interactions are not reinforcing for the child (Dunlap

& Fox, 1999). Programmed reinforcement is likely to be necessary until such time that participants consistently demonstrate the target skill in context and can contact natural contingencies that are reinforcing. Then programmed reinforcement may be faded out and more naturalistic reinforcing consequences will be able to take the place of programmed artificial reinforcers (Hundert & van Delft, 2009; Leach, 2010).

Charlop-Christy, Le, and Freeman (2000) have found that video modeling is generally superior to live modeling as a social skills intervention for children with ASD. Several hypotheses regarding this finding have been proposed including compensating for stimulus over-selectivity by promoting attending to the target behavior rather than to miscellaneous cues that children may otherwise encounter in their natural environment. Another possible explanation is that video modeling is more reinforcing for children with ASD as compared to in vivo modeling. Video modeling provides a change from the typical work environment (Dowrick, 1986) and children usually do not have the potentially negative learning history for video modeling that they might have for in vivo modeling. Finally, video modeling' s superiority over in vivo modeling may also be related to the social deficits characteristic of children with ASD (Charlop & Milstein, 1989). Not only do children with ASD tend to relate better to objects than to people (e.g., Rimland, 1968; Schreibman, Koegel, & Koegel, 1989), but they display skills deficits in areas critical for observational learning in the natural environment (i.e., attending, imitating, and discriminating contingencies) (Taylor & DeQuinzio, 2012). Therefore, video modeling may compensate for these social deficits because children viewing the videotape are not expected to participate in social interactions, as they would with in vivo modeling, resulting in less impairment as a consequence of these deficits (Koegel, Koegel, Hurley, & Frea, 1992).

Social Games and Social Skills Groups

Typical classroom activities such as games, story time, and conversation time are ideal opportunities to incorporate lessons targeting social behavior. Sessions vary from structured instructional time in a cooperative group setting or can be oriented toward play behaviors. Kamps et al. (1992) followed structured social skills instruction by a free play period during which students received instructor feedback regarding social skills behaviors that coincided with the lessons. As a result, target students increased their length and consistency of social interactions with peers. Capitalizing on naturalistic play activities, Goldstein, Wickstrom, Hoyson, Jamieson, and Odom (1988) also demonstrated increases in independent child interaction during free play periods following training. Children were provided with scripts and guided through scenes of typical peer-to-peer interaction during a role-play game. However, effects of both studies were largely dependent on continued teacher prompts and feedback and results did not generalize to social interactions in other settings within the school.

Peer-Mediated Interventions

An important theme in the literature is the role of typically-developing peers in effective social skills programming for children with ASD. Progress with regard to peer-mediated interventions has been strongly influenced by the work of Strain, Odom, and Goldstein. In their peer-mediated approach, typically-developing peers are coached to and reinforced for initiating appropriate prosocial behaviors, including sharing, praise, and helping. Peers are trained via role-playing appropriate social interactions with adults. The adults then cue peers to initiate a social interaction with the target children. Peer behavior is reinforced by coordinating adults, and reinforcers are then systematically faded out. These practices have been shown to be effective for increasing the number and quality of social interactions of pre-school age children with ASD (Strain et al., 1977; Strain, Kerr, & Ragland, 1979; Hoyson, Jamieson, & Strain, 1984; Odom &

Strain, 1986; Goldstein, Kaczmarek, Pennington, & Shafer, 1992; Odom et al., 1999).

Specific Instruction

Perhaps one of the simplest interventions for promoting social skills in children with ASD is specific instruction of the skills themselves using behavior modification strategies. A variety of specific behavior modification strategies have been successful in promoting appropriate social skills in children with disabilities (Whitman, Mercurio, & Caponigri, 1970; Whitman, Burish, & Collins, 1972; Cone, Anderson, Harris, Goff, & Fox 1978; Matson, Kazdin, & Esveldt-Dawson, 1980; Gaylord, Haring, Breen, & Pitts-Conway, 1984; Matson et al., 1988; Taras, Matson, & Leary, 1988). Programs emphasize evidence-based treatment strategies (Schreibman, 1988; Newsom & Rincover, 1989; Smith, 1993) based on operant conditioning to include shaping and chaining, and antecedent and consequence management, among others. Instruction typically takes place via discrete trial training, however, such instructional formatting can lead to rigidity in responding (Amaral, Dawson, & Geschwind, 2011). Some specific instruction methods have capitalized on the child's natural environment in order to address potential rigidity in responding. Targeted instruction utilizing role-play and rehearsal strategies, as well as reinforcing rule-following during naturalistic activities have been shown to be particularly effective for improving verbal and nonverbal social skills in the child's naturalistic environment (Coe, Matson, Fee, Manikam, & Linarello, 1990; Baker, Koegel, & Koegel, 1998). Behavior analytic strategies are extensively supported as effective interventions for children with ASD (Bondy & Weiss, 2013; Virues-Ortega, 2010; Foxx, 2008; Remington et al., 2007) and they are widely implemented in clinical settings. Given the general availability and procedural clarity of direct instruction, implementing behavior analytic and direct instruction interventions to target social skills provides a readily accessible and effective treatment method for clients and practitioners.

Discrete Trial Training

Discrete trial training (DTT) is a widely-recognized evidence-based intervention strategy commonly-utilized for children with ASD (National Autism Center, 2010), and has been shown to be effective for teaching appropriate language development, social and academic development, and reducing the number of observed problem behaviors (Smith, 2001; Matson & Smith, 2008; Gutierrez et al., 2009; Dib & Sturmey, 2007; Paul, Campbell, Gilbert, & Tsiouri, 2013; Weiss et al., 2017). DTT utilizes systematic cues and prompting strategies as well as differential reinforcement of successive approximations to promote learning of a target skill in discrete units (Smith, 2001). Key components behind the effectiveness of DTT include frequent practice opportunities, rapid and consistent repetition of skills to be learned (Weiss et al., 2017), and the ability to individualize interventions to support the needs of the child (Weiss, Hilton, & Russo, 2017). Because many individuals with ASD require frequent repetitions of practice and exposure to materials to learn effectively (Smith, 2001), DTT is a particularly effective intervention strategy for this population.

A number of social skills have been shown to be effectively taught to individuals with ASD using DTT (Gena, Couloura, & Kymissis, 2005; DeQuinzio, Townsend, Sturmey, & Poulson, 2007), including increasing the number of social initiations and interactions with peers (Garfinkle & Schwartz, 2002; Garcia-Albea, Reeve, Reeve, & Brothers, 2014), teaching appropriate helping behaviors (Harris, Handleman, & Alessandri, 1990), perspective taking (LeBlanc et al., 2003), and increasing joint attention (Jones, Carr, & Feeley, 2006; Kasari, Freeman, & Paparella, 2006; Krstovska-Guerror & Jones, 2013). Research has shown that a critical component of effective social skills interventions is strategic planning of generalization of skills learned (Smith, 2001). While teaching social skills in the natural environment promotes generalization of skills learned (Weiss, Hilton, & Russo, 2017), there may not be enough practice opportunities when skills are only taught in the natural environment without any means of supplemental instruction (Weiss, Hilton, & Russo, 2017). DTT allows for such additional practice opportunities. In order to promote generalization of skills learned, DTT interventions can be systematically programmed within the natural context in order to promote generalization of the skill to appropriate settings (Weiss, Hilton, & Russo, 2017).

Despite its long-standing history of treatment effectiveness, particularly with regard to individuals with autism, DTT is seldomly implemented within school settings (Peters-Scheffer, Didden, Mulders, & Korzillus, 2010). DTT is a time- and resource-intensive intervention strategy (Bellini, Peters, Benner, & Hopf, 2007) requiring much training and supervision in order to be implemented with integrity (Eikeseth, 2010; Skokut et al., 2008). For these reasons, DTT interventions are typically implemented in tightly controlled instructional setting which limits the potential for generalizability of the skill to novel individuals or environments (Miranda-Linne & Melin, 1992; Steege, Mace, Perry, & Longnecker, 2007). However, parents of children with ASD are increasingly requesting school-based DTT as a special education service for their children with ASD (Choutka, Doloughty, & Zirkel, 2004). As a result, it is crucial that researchers and practitioners identify barrier to DTT implementation in school settings as well as strategies to overcome such barriers in order to successfully implement this vital intervention within the school setting.

DTT can be introduced and implemented in the child's natural environment, resulting in both more frequent practice opportunities as well as promoting generalization of skill application to a variety of environments and with a variety of individuals. Weiss et al. (2017) recommend that discrete trials be interspersed throughout the child's daily schedule and in the natural environment in order to best program for generalization. Furthermore, current research suggests that varying the language used to present trials as well as modality of intervention presentation (e.g., video models, computer programs, teacher implementation, etc.) increases the likelihood of generalization of skills (Weiss et al., 2017).

In an attempt to increase generalization of skills taught, Freeman (2016) trained general education classroom teachers to implement discrete trials within the context of the daily classroom routine. In this study, DTT was first implemented by researchers in a one-to-one instructional arrangement. Verbal instructions were paired with picture cards, and picture cards were systematically faded using a constant time delay schedule. Once students responded to each rule presentation with the target behavior specified in the rule at 89% accuracy (mastery criterion), students were transitioned into a mainstream kindergarten classroom. Subsequent to transition, researchers observed students' responses to confederate delivery of classroom rules in order to determine rates of accurate rule-following in the natural setting. If rates of accurate responding remained stable, no further intervention was implemented. However, if rates of accurate responding fell below mastery criterion, researchers trained mainstream classroom teachers to incorporate the DTT protocol during the regularly-scheduled classroom activities. Results of the study indicated effective generalization of classroom rule following for children with ASD.

Another way to reduce rote responding and promote generalizability of skills learned is by incorporating DTT within the context of multiple exemplars. Multiple exemplar training (MET) is a specific method of instruction that encourages responding to a variety of stimuli within a stimulus class. Additionally, MET can be used to promote variety in response variations and topographies in order to gain appropriate stimulus control. In these ways, MET promotes both stimulus and response generalization rather than differentiation of responding according to each individual stimulus (Miranda-Linne & Melin, 1992), thereby making learning more efficient (Cooper et al., 2007). With regard to social skills, MET has been used to teach individuals with ASD a variety of social skills, including sharing materials and preferred items (Marzullo-Kerth et al., 2011) and taking the perspective of others (Charlop-Christy & Daneshvar, 2003). The effects of MET have the potential to more adequately prepare learners for the infinite stimulus conditions they may encounter in the natural environment.

Classroom Skills in ASD

The social deficits that are characteristic of ASD make children with the disorder less likely to naturally acquire skills vital to success in a classroom environment. The Pre-Elementary Longitudinal Study (PEELS) identified four areas of school readiness that contribute to the success of young children with special needs at the time of school entry: adequate academic skills such as emergent literacy and math proficiency, motor performance within normal limits such that students are better able to function independently in a classroom setting, and social behavior similar to that of typically-developing peers (National Center for Special Education Research, 2006). Students with ASD show inconsistent skill development across these domains, however, the greatest skill deficit is in the domain of social behavior. Children with ASD perform significantly more poorly than their typically-developing peers in behaviors such as “follows rules,” “accepts decisions made by adults” (PKBS-2), and personal responsibility (ABAS-II), and significantly higher in noncompliance and dependence on teachers and caregivers (Carlson, et al., 2008). Given these findings, among the most influential targets of intervention for promoting independent classroom behavior in children with ASD are compliance and following instructions and classroom routines (Wong et al., 2014), all of which can be conceptualized as applications of conditional rule-following.

While unconditional rule-following does not require higher-order reasoning, conditional rule-following would be impossible without deductive reasoning (Markovits & Barrouillet, 2002). Conditional rule-following requires the rule-follower to modify his or her behavior in conjunction with a particular premise that is subject to change (Markovits & Barrouillet, 2002). Although the ability to follow conditional rules has been identified as a key component of advanced cognitive development (Braine, 1978; Cohen, 1981; MacNamara, 1986), the ability to behave according to changing premises along with the ability to make inferences necessary to inform behavior varies greatly across individuals as a result of a variety of developmental variables (Markovits & Barroulliet, 2002). Framing conditional rule following from a behavior analytic perspective, it requires individuals to discriminate the changing contingencies that are signaled by fluid stimulus conditions. This is a particularly challenging form of learning given the reality that it requires learning many contingencies, associating them varying stimulus conditions, and accomplishing this in a context in which consequences may occur intermittently and with delay.

Conditional rule-following skills have implications for long-term success in school. The literature on school readiness finds that difficulties with rule following are correlated with fewer positive interactions with teachers and peers and more long-term academic difficulties (Ladd, Kochenderfer & Colemand, 1997; Shores & Wehby, 1999). Alternatively, children who enter school with conditional rule-following skills or those who are able develop these skills quickly are more likely to develop additional skills essential to independent functioning, establish positive relationships with their teachers and other students (Walker et al., 1992), and achieve academic success at the same pace as their peers (O'Shaughnessy, Lane, Gresham, & Beebe-Frankenberger, 2003). As a result, early intervention strategies for problem behaviors are critical, as early intervention leads to greater cumulative results, thus minimizing difficulties over time (Tremblay, Mass, Pagani, & Vitaro, 1996; Snyder, 2001; Webster-Stratton & Reid, 2004).

Kindergarten can be a difficult transition for children due to the concentration of new social and academic demands (Perry & Weinstein, 1998; Stormont, Beckner, Mitchell, & Richter, 2005). Furthermore, it is often the case that students with social skills deficits or behavior concerns receive less educational support than their peers, resulting in a disadvantage in adapting to formal school during this time (Webster-Stratton, 1997; Stormont et al., 2005). These students need early intervention strategies to bolster social development, ultimately increasing their chances at future success in school. A number of intervention strategies have been identified to promote the use of appropriate classroom skills, particularly for children with ASD (Morgan, Hooker, Sparapani, Reinhardt, Schatschneider, & Wetherby, 2018; Laghi, Lonigro, Pallini, Baiocco, 2018; Ming, Mulhern, Stewart, Moran, & Bynum, 2018; Niwayama & Tanaki-Matsumi, 2016).

Manualized Training Packages

Multiple manualized training programs have been used to promote classroom readiness skills for children with ASD in mainstream classroom settings (Arick, Loos, Falco, & Krug; 2004; Mesibov, Shea, & Schopler, 2005; Prizant, Wetherby, Rubin, Laurent, & Rydell, 2006; Morgan, Hooker, Sparapani, Reinhardt, Schatschneider, & Wetherby, 2018;). For example, Mandell et al. (2013) carried out the first randomized control trial study of manualized treatment programs designed to promote effective transitions to mainstream classrooms for children with ASD in a public school setting. Classrooms were randomly assigned to either use the Strategies for Teaching based on Autism Research (STAR; Arick, Loos, Falco, & Krug, 2004) or Structured Teaching (Mesibov, Shea, & Schopler, 2005). Both treatment packages included frequent teacher training, coaching, and feedback during the school year. Results of the study indicated that students with ASD made marked gains on tests of cognitive ability as a result of both treatment packages.

In a more recent study, Morgan et al. (2018) utilized the Classroom Social, Communication, Emotional Regulation, and Transactional Support (SCERTS; Prizant et al., 2006) Intervention to specifically examine its impact on the interpersonal and adaptive functioning skills that contribute to success in mainstream classrooms. The SCERTS model specifies social communication, emotion regulation, and the implementation transitional supports as targets for intervention. Trained coaches identified student goals based on the SCERTS Assessment Process, and goals were subsequently used to guide intervention strategies and supports. Teachers were provided with practices opportunities, coaching, and feedback, which were systematically faded out as teachers met mastery criterion for implementing interventions in the classroom. The study results indicated that students receiving the SCERTS intervention had significantly greater degrees of active classroom engagement and social interaction as compared to students receiving the treatment as usual package. Additionally, results demonstrated overall better outcomes in social skills and executive functioning as compared to the treatment as usual package, providing support for the efficacy of classroom-based intervention strategies to promote independent functioning of children with ASD in mainstream classrooms.

Peer-Mediated Interventions

Peer-mediated interventions have been identified in the research literature as a viable option for overcoming difficulties related to limited resources commonly found in schools (Carr & Darcy, 1990; Laushey & Heflin, 2000; McConnell, 2002; Naylor, 2002; Radley, Dart, Furlow, & Ness, 2015). Young et al. (2016) trained typically-developing peers to implement interventions to teach academic curriculum to children with ASD. Classroom teachers used behavioral skills training (Steward, Carr, & LeBlanc, 2007) to train peers via didactic instruction and performance feedback prior to each instructional session with peers. Typically-developing tutors were specifically taught to: obtain an attentional response, present the S^D, provide least-to-most prompting as necessary in order to obtain a correct response, deliver reinforcement consequent to correct responding, and collect data during DTT sessions. Researchers found that peer mediated

DTT resulted in overall participant improvement in academic performance both immediately after training and at six-month follow up. Additionally, results demonstrated effective skill generalization across novel peer tutors. While not targeted for intervention directly, researchers noted marked increases in social interactions subsequent to DTT, suggesting peer-mediated DTT may contribute to both academic and social gains for children with ASD.

Discrete Trial Training

In addition to its role in remediation of social skills deficits, DTT has been shown to be effective in facilitating acquisition of crucial classroom readiness skills in children with ASD (Russo & Koegel, 1977; Krantz & McClannahan, 1999; Freeman, 2016). DTT is commonly used as an intervention targeting skill acquisition in children with ASD because it allows for ample opportunities to rehearse skills taught, encouraging mastery and ultimately skill acquisition (Weiss, Hilton, & Russo, 2017). Additionally, DTT is a flexible intervention strategy that allows for individualization. Students requiring additional supports during teaching may demonstrate more gains with errorless prompting, whereas students who independently demonstrate a greater skill set may benefit and progress more quickly from less intrusive prompting methods (Long, 2017). DTT is a particularly important intervention strategy to consider for students requiring supports in acquiring foundational classroom readiness skills. Evidence-based intervention strategies implemented early are of the utmost importance for this population so that students are able to make meaningful gains from the general education curriculum in the least restrictive environment (Fox, Dunlap, & Crushing, 2002).

Several studies have explored the utility of DTT in promoting classroom readiness skill acquisition in children with ASD (Russo & Koegel, 1977; Krantz & McClannahan, 1999; Freeman, 2016). In an attempt to replicate previous research, Freeman (2016) utilized the Verbal Behavior Milestones Assessment and Placement Program (Sundberg, 2008) Barriers and

Transitions assessments in order to identify skill deficits as well as individual strengths to determine targets of intervention. Specific classroom readiness skills evaluated included social skills, rule following, and stereotypy reduction (Russo & Koegel, 1977; Krantz & McClannahan, 1999; Freeman, 2016). After identifying skills in need of remediation prior to entry into school, researchers utilized errorless learning techniques and least-to-most prompting within the context of DTT to teach target behaviors.

In teaching classroom readiness skills to children with ASD, Freeman (2016) delivered differential reinforcement in the form of verbal praise or the delivery of tangible reinforcers (identified via a pre-treatment preference assessment) according to the level of prompt necessary to achieve correct responding in a one-to-one instructional environment. After students had met mastery criterion, researchers then trained each child's classroom staff to implement the discrete trial intervention within the context of the natural school environment. DTT sessions in the classroom were faded subsequent to reaching mastery criterion in the natural classroom setting. Results of the study indicated that appropriate demonstration of target skills generalized from intensive one-to-one discrete trial instruction to the natural classroom setting, promoting successful transitions into mainstream classrooms.

These studies illustrate the importance of teaching social skills within school settings, however, educational institutions largely tend to focus primarily on teaching academic content at the expense of targeting other social skills crucial to navigating the school environment (Hayes, 2002). Of those studies that have explicitly examined school-based interventions for social skills, the majority have primarily focused on training a broad scope of content followed by teaching generalization techniques in order to maintain and apply the skills learned across novel circumstances (Hayes, 2002). One way to efficiently and effectively program for generalization of skills is by training conditional rule-following behavior (Tarbox et al., 2011). In doing so, learned behaviors can then be applied to any range of stimuli within a relational frame (Hayes, 2010). In this way, RGB can be a natural context for the development of conditional rule following and generalized behavior change.

Rule-Governed Behavior

Conditional rule-following and self-management based on rules is, without a doubt, a critical skill to successful adaptation for children (McAuliffe, Hughes, Barnes-Holmes, 2014). However, directly training all rules that a child may contact in his or her daily life is a practical impossibility. Rather than contacting contingencies directly and repeatedly in order to pair stimulus-response relationships, rule following allows individuals to behave according to rules specified either by themselves or others (Hayes, 1993). Such rules have the ability to outline contingencies across stimulus-response relationships (Galizio, 1979; Zettle & Hayes, 1982; Hayes, 1989; Reese, 1989; Hayes & Hayes, 1992; Hayes, Barnes-Holmes, & Roche, 2001). In this way, rule-governed behavior (RGB) is one way that individuals navigate the complexities of infinite putative contingencies in the environment.

RGB is developed as a result of reinforcement for following rules that describe contingencies rather than a history of direct contact with described contingencies (Skinner, 1969). RGB is described as absolutely essential for humans to exist and prosper (Skinner,1974). RGB allows humans to respond to a tremendous number of circumstances effectively without needing to experience contingencies that may be dangerous or harmful to human well-being. Rules also boost human efficiency in that they allow generations to benefit from the experience of previous generations by behaving in accordance with rules established as a result of those generations' experiences with direct contingency contact. The ability to follow rules is a cornerstone of verbal behavior (Catania, 1998), and without RGB, modern life would crumble.

Skinner (1969) suggested that there are significant differences between contingency-shaped behavior and RGB. He argued that contingency-shaped behavior results from direct encounters with environmental consequences. With RGB rules come to control behavior as a result of the verbal descriptions of contingencies specified in the rules either explicitly or implicitly. Rules or instructions function as antecedents (Skinner, 1966), and in specifying a behavior and a consequence, rules prescribe behavior necessary to contact reinforcement or avoid punishment. Furthermore, RGB allows individuals to behave according to contingencies that may not be explicitly stated or that have never been contacted directly.

One of the unique abilities of RGB is that of overriding behavior governed by reinforcement schedules, resulting in greater instructional control despite conflicting environmental contingencies (Galizio, 1979). However, the mechanisms underlying this uniquely human ability have been debated for decades. One perspective advocates that instructions or rules can be considered discriminative stimuli that evoke particular patterns of responding (Schutte & Hopkins, 1970; Skinner, 1957). Still others argue that overriding of schedules of reinforcement can be attributed to a reduced control by physical contingencies exhibited by humans; where, instead of contacting contingencies directly, stimuli specified in rules can be considered sources of vicarious reinforcement powerful enough to affect behavior following rule delivery (Bandura 1971, 1974). A fundamental agreement across theoretical discussions of RGB is that the controlling stimulus is ultimately an instruction or rule (Skinner, 1974; Urcuioli & Nevin, 1975; Urcuioli, 1977).

Skinner (1974) argued that rules come to control behavior more quickly and consistently than contact with direct contingencies. Skinner went on to say that behaviors governed by rules are themselves controlled by the consequences associated with rules. That is, histories of reinforcement for rule-following result in an increased rate of behavior consistent with those consequences outlined in rules. In an attempt to further distinguish the blurred lines that separate contingency-shaped instructional control from instructional control established via a system of rule-following, Galizio (1979) studied each step in Skinner's argument in succession. Galizio proposed that in order for instructions to be controlled by consequences, instruction-following should be controlled by schedules of reinforcement, susceptible to extinction procedures, and subject to discriminative control.

In the first experiment, participants were informed that when a 'loss light' flashed, five cents would be deducted from participants' earnings, however, turning a lever would delay flashing of the loss light for a variable amount of time. A series of amber lights were arranged such that when each light flashed, flashing of the loss light would be delayed for either 10-sec, 30-sec, 60-sec, or No Loss would occur. Participants were not provided with any instructions regarding loss avoidance in the first phase of the experiment. In the second phase of the experiment, the placement of amber lights was randomized, and participants were provided with instructions regarding schedules of reinforcement. In the third phase of the experiment, lights were again randomized, and instructions were withdrawn.

Galizio's (1979) original experiment was designed to empirically determine whether delivery of verbal rules specifying contingencies would contribute to faster discrimination of a multiple reinforcement schedule. Results demonstrated that despite extended exposure to contingencies, initial instruction delivery was powerful enough to promote effective discrimination between conditions. In the absence of explicit instruction delivery, only one of five participants demonstrated effective discrimination between conditions. Findings support existing literature regarding the emergence of insufficient schedule control without instructions under some conditions, and better rates of schedule discrimination with the addition of accurate instructions (Baron et al., 1969).

In an attempt to more fully examine the application of Skinner's analysis, Galizio (1979) furthered his studies to examine whether rules in and of themselves serve as salient reinforcers. In this study, the same four-part schedule of reinforcement was utilized, however the instruction lights were not lit unless an observing response occurred. That is, in the first experiment, the physical movement of turning the lever to the right was reinforced. In this study, participants were similarly reinforced for turning the lever to the right, however, participants were also reinforced for turning the lever to the left (the observing response) which had no effect in the first study. Results demonstrated that novel observing behavior was consistently exhibited when the delivery of accurate instructions depended on such behavior. Galizio concluded that rules have reinforcing properties in and of themselves: rates of target behaviors were higher when delivery of accurate instructions were made contingent on demonstration of the target behavior. Further support for the reinforcing value of accurate rules was provided when extinction of the target behavior was observed when the behavior ceased to produce accurate rules. Results of the final experiment lend support to the conceptualization of rules as discriminative stimuli signaling the availability of reinforcement.

Results of Galizio's work lend support to the position that instructional control can be established as a result of rule-governed behavior. Furthermore, findings suggest that instructional control can be impacted by delivery of rules, and the accuracy of such rules. Galizio's analysis is consistent with Skinner's (1974) conceptualization of RGB, arguing that the strength of instructional control represents the history of reinforcement influencing RGB, rather than a demonstrated weakness of reinforcement control.

While operant in nature, RGB is fundamentally different from behavior shaped by contact with direct contingencies (Hayes, Barnes-Holmes, & Roche, 2001). Relational framing augments the traditional ABC sequence by providing another pathway by which stimuli can acquire operant functions. In a traditional sequence, the antecedents obtain their stimulus functions by an individual's experience with the consequences of behavior in the presence of that antecedent. However, in order for a rule to function as an antecedent, it is not sufficient that listeners are able to relate stimuli presented in rules arbitrarily. Rather, listeners need to be able to relate stimuli in coordination, so that the different parts of the rule – the words representing the antecedent, behavior, and consequence – are meaningful. If the rule is to be meaningful and understandable, it is necessary for the listener to relate stimuli temporally and causally, so that he or she may be able to identify the relationship between the behavior stated in the rule, and the described (or implicit) consequence (Hayes et al., 2001).

Relational frame theory (RFT) has posited an alternative explanation for how behaviors come to be rule-governed. RFT argues that humans learn to associate stimuli arbitrarily, and not necessarily based on physical characteristics of the stimuli, very early in development (Healy, Barnes-Holmes, & Smeets, 2000). Stimulus-stimulus relations come to be controlled by contextual cues that specify the relation. In this way, any stimulus may come to be associated with any other stimulus. This relating can in turn govern which stimulus functions are cued in a given moment. For example, consider food as a potential relational frame. Despite the physical dissimilarities across foods items (e.g. pasta noodles, cookies, steak, etc.), when conceptualized according to their function (i.e., edible), rather than according to their physical properties, stimuli that have never been contacted can come to be associated as food, as when one encounters a novel dish while traveling. Such relational framing can be accomplished in a variety of ways.

Previous research has examined the acquisition of arbitrary relationships via multiple exemplar training (MET). Through MET, the contextual cues for relating stimuli are manipulated and then these cues are able to be similarly applied to novel, untrained stimuli. In this way, a person can relate stimuli which have never been reinforced for being related in the past. The newly established relations are then able to change the functions of the stimuli, such as discriminative functions or reinforcing functions. Which functions of the stimuli are established as equivalent is dependent on the reinforcement history for the stimuli that come to be associated through MET (Hayes et al., 2001; Luciano, Valdivia, Cabello & Hernandez, 2009). A wide variety of relationships can be relationally framed for learners who have the necessary linguistic competence and relational operants. As a result, relational frames have been described as emerging from learning history that includes multiple exemplars, ultimately resulting in a greater degree of generalized performance of acquired skills. Relational framing provides a procedure that can contribute to the emergence of hierarchical concepts, regulation of listening behavior, emergence of perspective-taking, identification of relationships, rule following, and, ultimately, a greater degree of understanding of verbal functions (Hayes, n.d.).

Like arbitrarily applicable relational responding, reinforcement of multiple exemplars can also result in the ability to respond to conditional relations between a wide variety of stimuli (Hayes, Fox, Gifford, Wilson, Barnes-Holmes, & Healy, 2001). For example, a teacher may say to a student, ‘‘If you finish your worksheet, then you can go to recess,’’ ‘‘If you eat all of your lunch, then you can have a cookie,’’ ‘‘If you tutor a peer for five minutes, then you can play on the computer for five minutes,’’ and so on, for many exemplars, all of which contain the ‘‘If / then,’’ component and a specified consequence for following the rule. After consistent reinforcement of responding to exemplars, the child comes to develop generalized responding to conditional relations in such a way that he or she can then respond appropriately to novel rules stated with the “If/then” cue and ultimately contact the reinforcing consequence, despite never having been reinforced for following that rule. That is, after a history of MET, the “If/then” prompt develops discriminative control over all other novel rules with the same “If/then” component.

Tarbox and colleagues (2011) evaluated MET procedures for establishing the generalized ability to respond to novel rules specifying antecedents and associated target behaviors. Researchers presented cards depicting an antecedent stimulus. The stimulus described was available during half of the trials, and during the other half of trials, a different stimulus not described in the target rule, but described in rules from previous trials was presented. Correct behavioral responses to stimuli were followed by a preferred item, and behavioral prompts were faded out. Contingent on an incorrect response, the experimenter neutrally stated ‘‘no’’ and provided descriptive feedback. Most-to-least prompt fading was continued until participants demonstrated correct independent responding on both a trial in which the stimulus was present and a trial in which the stimulus was absent.

When mastery criterion was reached, a generalization probe was conducted on untrained rules to determine whether behavioral responses had generalized to novel rules. Although the initial procedure needed to be modified for a few participants, after training all participants were able to generalize behavior to novel rules. These results lend support to the idea that rule-following can be conceptualized and taught as generalized operant behavior to children with ASD.

Wymer and colleagues (2016) replicated the work of the Tarbox et al. study and extended the scope of the study to include rules containing both preferred and non-preferred consequences for engaging in the target behavior. Prior to the start of each session, experimenters conducted a preference assessment for the purpose of identifying salient reinforcers to be used in that session. Interaction with preferred items and interaction with non-preferred items served as consequences for emitting behaviors specified in rules delivered by the experimenter. If the child exhibited the target behavior, the researcher delivered the consequence specified in the rule. If the child did not exhibit the target behavior, the researcher did not deliver the specified consequence, and instead physically prompted the target behavior when the consequence was preferred or, when the consequence was a non-preferred consequence, the researcher prompted an acceptable alternative behavior. After mastery criteria was reached, generalization probes were embedded during each phase in order to determine generalizability of rule-following behavior to untrained rules.

Prior to any training, participants tended to comply with provided instructions whether specified consequences were preferred or not, however after training via MET all participants complied with novel rules only for those rules which specified a preferred consequence; they did not comply with rules specifying a non-preferred consequence. Of note, in both studies, participants only responded appropriately after dense schedules of prompting and praise were added during pre-session training, possibly due to a lengthy history of reinforcement for rule-following behavior. Additionally, correct responding to rules with non-preferred consequences may have further complicated rule-following behavior due to the need to inhibit behavioral responding to stated rules, necessitating a prerequisite repertoire of self-control (Kanfer & Karoly, 1972). Prompting alternative behavioral responses resulted in higher rates of engagement in the target behaviors than when participants were required to avoiding engaging in the stated behavior. Despite necessary methodological modifications, overall these results extend the work of Tarbox et al. (2011), lending further evidence to suggest that MET may be a viable strategy for helping children with ASD to acquire a repertoire of rule following.

Previous research has examined the acquisition of arbitrary relationships through the use of the go/no-go procedure in children with ASD (Silva & Debert, 2017). A go/no-go task can require that participants inhibit a behavioral response, rather than demonstrating an appropriate alternative behavioral response. Inhibitory control is one’s ability to delay or completely inhibit a behavioral response that is incongruent with achieving a goal (Dagenbach and Carr 1994; Nigg

2000; Carlson and Moses 2001), and it is often considered to be more difficult than emitting an appropriate alternative behavioral response (Drewe, 1975). Various cognition-based perspectives of ASD link observed social deficits characteristic of the disorder to core deficits of executive function (i.e., those abilities that allow for actions related to achieving a goal; Welsh & Pennington 1988; Russell 1997; Hill 2004), including those responsible for inhibitory control. Furthermore, a variety of studies have demonstrated impairments with regard to social and motor behavior delay or inhibition congruent with those required in a go/no-go task in children with ASD (Ozonoff et al., 1994; Geurts et al., 2004; Goldberg et al., 2005; Henderson et al., 2006; Ames & Jarrold, 2007; Christ et al., 2007; Adams & Jarrold, 2009; Lemon et al., 2011).

The traditional go/no-go task requires that participants respond to the majority of visual stimuli presented and inhibit responding to a small set of visual stimuli presented. Participants are then required to make a rapid motor response to the majority of stimuli presented (the go stimuli) and withhold the specified behavioral response to a select number of pre-determined stimuli (the no-go stimuli). Due to the contrast in presentation rates between go and no-go stimuli, participants develop a response tendency for the specified go behavior. Participant level of inhibitory control is measured by the number of behavioral responses exhibited when no-go stimulus is presented.

The go/no-go task can be used to train abstract and arbitrary relationships. Sidman (1971) demonstrated the emergence of derived transitivity relationships subsequent to conditional relationship training using a matching-to-sample task. Research findings support the idea that explicit teaching of conditional relations can be used as a foundation for establishing complex and socially valid relationship in individuals with significant learning challenges that may be more efficient than explicit instruction of each individual relationship (Rehfeldt, 2011). Unfortunately, such intervention strategies have been associated with significant position biases when implemented with children with ASD (Galloway, 1967) necessitating the development of modified instructional strategies (Eikeseth & Smith, 1992; McLay, Sutherland, Church, & Tyler-Merrick, 2013). Significant deficits in the ability to inhibit behavioral responding in the absence of a specified desired behavior have also been noted in this population (Drewe, 1975) making the study of rule-following in individuals with ASD difficult. Further research regarding behavioral inhibition and general rule-following behavior in this population in particular is essential, as the ability to consistently adhere to rules is a skill necessary to navigate daily life for all humans (Skinner, 1974).

Rationale

The dramatically increasing prevalence rate of autism spectrum disorders has prompted researchers to search for best practices for promoting the social emotional development of children with ASD. Given the multidimensionality of social, behavioral, and academic deficits characteristic of ASD, it is possible that explicit training of discrete skills may result in limited and rigid responding to stimuli and may not generalize to novel stimuli in natural contexts (Carey & Stoner, 1994; DuPaul & Eckert, 1994; Gresham, 1994; Haring, 1992; Scott & Nelson, 1998; Gresham et al., 2001). Rather, targeting rule-governed behavior may allow for independent adherence to rules in the absence of direct training, which more closely mimics rule-following behavior in typically developing peers (Tarbox et al., 2011). Although rule-governed behavior has been examined and established in the existing literature, there are few studies to date examining the acquisition of RGB in individuals with ASD. Furthermore, while research has begun to explore the acquisition of RGB in children with ASD, no study has yet examined the application of interventions targeting RGB to problems of social importance in this population.

Experiment 1 Hypotheses

The current study was designed to advance the literature regarding interventions to support effective social adaptation in young children with ASD across two experiments. The first experiment employed DTT within a MET session design to establish socially conventional "thank you" responding across a range of relevant antecedent stimuli and the omission of "thank you" across social interactions that would not call for this response. The anticipated results were that MET across diverse go and no-go stimuli would result in generalization of correct responding to relevant stimuli that were not instructed, while maintaining discrimination such that "thank you" did not begin emerging following irrelevant social interactions.

Hypothesis 1

Targeting social skills using MET will result in an increase in saying “thank you” in socially-appropriate contexts.

Hypothesis 2

Targeting social skills using MET will result in not saying “thank you” in socially-inappropriate contexts, indicating successful discrimination between social cues.

Experiment 2 Hypotheses

The second experiment examined the utility of MET provided through a DTT instructional format to teach conditional rule following to young children with ASD. The instructional task required the participants to discriminate whether the condition specified in the rule statement (e.g., if you have a marker) applied to the current environmental context and respond (e.g., raise your hand) or omit the response called for. This type of interaction, if/then requests, are exceedingly common in schools and require responding that is discriminated based on these linguistic constructions. As described above (Tarbox et al., 2011; Wymer et al., 2016), children with ASD often have difficulty with responding to if then requests. The experimental hypotheses for Experiment 2 are provided below.

Hypothesis 1

DTT will be effective for establishing correct responding to directly instructed conditional rule statements.

Hypothesis 2

Arrangement of DTT within a MET format will result in the emergence of correct responding to conditional rules that were not instructed.

Hypothesis 3

Establishment of conditional rule-following using MET will result in generalization of conditional rule-following behavior to natural settings.

General Method

Participants

The participants were five children diagnosed with ASD who were identified by their treating Board Certified Behavior Analysts™ (BCBAs) as having difficulty with rule following. Prior to being recruited for the experiments, children's current scores on the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) were examined in order to determine that they had achieved a degree of functional language appropriate for the demands of the studies. See Tables 1 and 4 for VB-MAPP verbal operant scores for each participant. Inclusion criteria included VB-MAPP scores updated within the past six months in the Level 2 or Level 3 ranges on the Echoics, Intraverbal, Listener Responding, and Motor Imitation subscales. This assessment criterion was chosen in order to ensure that participants were able to respond to the experimenter's verbal behavior, imitate modeled responses, and participate in verbal interactions with experimenters. Further inclusion criteria included failure to respond appropriately to at least 50 percent of rules presented in pre-treatment assessments (see Methods for descriptions of pre-treatment assessments for each experiment).

Informed consent was obtained from participants' parents prior to study enrollment. Assent was obtained from all participating children. The procedures used in this study were reviewed and approved by the IRB at the authors' institutional affiliation.

Materials

Materials for the studies included the following items for each child participating in the study: pre-academic worksheets, a marker, a pencil, and a folder. Each child's preferred toy items and play activities, determined via a pre-session free-operant preference assessment, were also utilized as reward for correct responding. Prior to each data collection session, the experimenter allowed each participant to choose a variety of preferred play items and activities from the clinic toy closet that he may interact with as a reward following accurate responding (Ortiz & Carr, 2000). This type of choice-based stimulus preference assessment was chosen because research has repeatedly confirmed the predictive validity of choice-based stimulus preference assessments (Cannella, O'Reilly, & Lancioni, 2005; Gwinn et al., 2005). Students provided with contingent access to a highly preferred stimulus exhibit a higher rate of target behaviors than when provided with a less preferred stimulus.

Setting

Sessions with students were conducted in a one-to-one instructional arrangement in vacant therapy rooms at a treatment center for language and developmental disorders in south Louisiana. Sessions were conducted with each child five days per week. Total treatment duration was determined by when each child met mastery criterion (see below).

Session Frequency and Duration

Sessions were conducted with participants once per day, five times per week during participants' regularly-scheduled ABA therapy. Following participant absence, sessions were conducted twice per day (once in the morning and once in the afternoon) in order to make up for lost treatment time. Treatment continued in this manner until each rule was mastered to at 100 percent correct responding criterion across four consecutive sessions.

Social Skills Training

Participants

Three children with ASD participated in the study. Participant demographic information can be found in Table 1. Oliver was a 7-year-old Hispanic male. Tyler was a 6-year-old Caucasian male. Leonard was a 4-year-old Caucasian male. Students were identified by their BCBA as having difficulty with rule following and verbal behavior commensurate with children ages 19-30 months.

Table 1. Experiment 1 Participant Demographic Information

Participant	Gender	Age	Ethnicity	VB-MAPP Echoics Score	VB-MAPP Intraverbal Score
Oliver	Male	7	Hispanic	6	6
Tyler	Male	6	Caucasian	10	11
Leonard	Male	4	Caucasian	10	8

Method

Pre- and Post-Treatment Video Assessment

As a component of the study's inclusion criteria, participants were assessed prior to treatment and formal data collection to determine participant rule-following behavior related to social interactions. After caregiver informed consent and participant assent were obtained, participants watched a short video of a typically-developing peer playing with an adult. The adult in the video presented opportunities for the child in the video to respond appropriately by saying "thank you". Adults in the video also randomly delivered control statements in order to account for inappropriate "thank you" responses. The responses of the child in the video were not shown to participants. The video was paused, and the adult experimenter asked the participant, "What should the child do or say?" Participant responses were recorded. Children who indicated that the model in the video should say "thank you" for fifty percent or fewer of the video trials that called for this response were eligible to participate in the study. This video assessment was also conducted after meeting mastery criterion for each instructional phase and prior to termination from the study. This measure served as a pre-post treatment assessment of the possible acquisition of rules regarding appropriately saying “thank you”.

Response Definitions and Data Collection

The target response for this experiment was saying “thank you” following a relevant discriminative stimulus. Correct statements were “thank you” or “thanks” statements made within 5-s of a discriminative stimulus. Errors of omission included any occurrence of a discriminative stimulus that was not followed by a “thank you” or “thanks” response within 5-s. Incorrect occurrences of “thank you” or “thanks” were also recorded to test for the possibility of over-generalization of the trained response. Incorrect occurrences were any “thank you” or “thanks” statement that occurred within 5-s of a control statement. Adult experimenters recorded the accuracy of the participant’s responses separately for target stimuli and control stimuli. The target stimuli and control stimuli are presented in Table 2.

In order to maintain novelty in sessions and more closely simulate typical social interactions, the presentation of target and control stimuli varied across sessions. Randomization cards specified the order in which six of the possible nine target stimuli as well as six of the possible nine control stimuli were to be delivered in session. Stimuli presented on each randomization card included two target stimuli for each of the three target rules: When someone gives you a compliment, you should say ‘thank you’; When someone helps you, you should say ‘thank you’; and When someone gives you something, you should say ‘thank you’.

During each session, the experimenter presented six opportunities for the child to respond appropriately with “thank you” or “thanks” as well as six control statements for which a “thank you” or “thanks” response would be inappropriate. Adult experimenters recorded the accuracy of the participants' responses as either correct or incorrect. At the end of each session, experimenters determined the frequency of correct "thank you" responses. Instructional phases were discontinued once the participant reached 100 percent accuracy to trained rules across four consecutive sessions. That is, mastery criterion was reached when the participant appropriately said "thank you" or "thanks" to both of the presented target stimuli related to rules for which the participant had a learning history. For example, mastery criterion in the first training phase required participants to respond to both presented compliments with "thank you" or "thanks", but did not require participants to respond to target stimuli related to helping or giving scenarios, since participants had not yet had rule training related to these scenarios. In the second training phase, mastery criterion was achieved when participants responded to both presented compliment scenarios and both presented giving scenarios at 100 percent accuracy since the participants had had rule-training related to both these rules. Finally, mastery criterion in the final training phase was achieved when participants responded to all presented target stimuli at 100 percent accuracy since the participants had been trained for all rules.

Table 2. Experiment 1 Target Stimuli and Control Stimuli

Possible Target Stimulus Statements	Target Stimulus Category	Possible Control Statements
You're such a smart boy.	Compliment	That works.
I love your shoes.	Compliment	I'm tired.
You are so good at that.	Compliment	Alright.
Let me get that for you.	Helping	Hmmm.
I'll help.	Helping	Oops!
I can do that for you.	Helping	*Laugh*
I brought you a snack.	Giving	Neat.
I colored you a picture.	Giving	Oh!
I have a special toy for you.	Giving	It's cloudy today.

Note: A total of six target stimuli and six control statements were delivered in session such that two statements from each target stimulus category were in each session. The order of statement presentation was randomized.

Inter-Observer Agreement and Treatment Integrity

Trained researchers collected treatment integrity and inter-observer agreement (IOA) during 30% of sessions across studies. Treatment integrity and IOA were collected for all participants and across all phases. Treatment integrity and IOA ranges for each participant can be found in Table 8. Across participants, treatment integrity and IOA was 99%. IOA was calculated using a point-by-point method: number of agreements divided by number of agreements plus disagreements multiplied by 100.

Table 8. *Treatment Integrity and IOA Across Participants*

Participant	Experiment	Treatment Integrity Low	Treatment Integrity High	IOA Low	IOA High
Oliver	1	66%	100%	92%	100%

(table cont'd.)

Participant	Experiment	Treatment Integrity Low	Treatment Integrity High	IOA Low	IOA High
Tyler	1	100%	100%	100%	100%
Leonard	1	100%	100%	100%	100%
Tyler	2	100%	100%	66%	100%
Max	2	100%	100%	100%	100%
Chris	2	66%	100%	100%	100%

Experimental Design

A multiple baseline across participants design was used to examine the relationship between treatments and acquisition of rule-governed behavior related to saying "thank you" when presented with a variety of exemplars in which saying "thank you" is a socially conventional response. Phases for the experiment are described below.

Baseline

Across sessions, experimenters participated in the child directed interaction play activity as outlined by McNeil and Hembree-Kigin (2017). Play activities consisted of those identified in the pre-session preference assessment. During play, the experimenter initiated six interactions with the participant in which a "thank you" response was appropriate. Each interaction began with the researcher delivering an exemplar, that is, a specific example of one of several types of social interactions to which a "thank you" response would be appropriate. If the participant did not attend to the exemplar, the researcher blocked access to the play item and obtained an attentional response by saying the child's name. That is, when the researcher said the participant's name, the researcher used a least-to-most prompting hierarchy (defined below) to obtain eye contact. When the participant attended, the researcher presented the exemplar again. Delivery of exemplars and control verbalizations were randomized. Verbalizations were delivered at an approximate rate of one per minute. Session length varied according to time necessary to complete all six exemplar interactions and control verbalizations with the participant. Average session length across participants was twelve minutes, and sessions ranged between 10 and 15 minutes. No feedback was provided regarding the accuracy of responding, however, experimenters said "you're welcome" whenever a participant said "thank you" to a target stimulus. "Thank you" responses to control stimuli were ignored.

Training: Compliment

Instructional sessions targeting responding to compliments followed the baseline procedures except as described below. Sessions began with the instruction, "When someone gives you a compliment, you should say 'thank you'". Exemplars were delivered at a rate of approximately one per minute. During each session, the adult experimenter and the participant engaged in the child's preferred play activity. During play, the researcher engaged in conversational dialogue with the participant and delivered six exemplars to which a "thank you" response was appropriate. Exemplars included two compliments, two scenarios in which the experimenter assisted the child with a task, and two scenarios in which the experimenter delivered a toy or gift to the participant. However, the researcher only trained "thank you" responses to compliments in this phase. When a compliment was delivered, if it was unclear whether the participant attended to the compliment or the participant did not respond, the experimenter obtained an attentional response by saying the child's name, obtaining eye contact using a least-to-most prompting hierarchy, and blocking access to the play item. When the participant attended, the researcher presented the compliment again. If the participant independently responded to a compliment by saying "thank you", the researcher responded by saying "you're welcome", praised the response, and provided access to preferred play items chosen during the free operant preference assessment prior to the session. If the participant did not independently respond to a compliment within 5-s the researcher stated the rule, explained to the participant why his response or nonresponse was inappropriate, and the researcher modeled the appropriate response. For example, if the participant did not independently respond to a compliment within 5-s, the researcher said, “When someone gives you a compliment, you should say ‘thank you.’ I said, ‘I like your shoes.’ That is a compliment. You say ‘thank you.’” The researcher waited an additional 5-s for the participant to imitate the verbal model, and then delivered verbal praise. If the participant inappropriately responded by saying “thank you” to a statement made by the researcher that did not warrant a “thank you” response, the researcher stated the rule, explained to the participant why his response was inappropriate, and the researcher modeled an appropriate response. The researcher waited an additional 5 s for the participant to imitate the verbal model, and then delivered verbal praise. If the participant responded “thank you” to an exemplar related to an untrained rule, the experimenter said, “you’re welcome” and provided no feedback regarding the accuracy of the participant’s response.

After demonstrating inconsistent target responding to initial implementation of MET delivered via naturalistic instruction, a pre-session specific instruction component was added to teach the target rules for all participants. The following procedure was implemented for Tyler beginning on the fifteenth session of the Compliment phase and was implemented throughout the remainder of the study. The procedure was implemented for Leonard beginning on the seventh session of the Compliment phase and was implemented throughout the remainder of the study. Prior to the start of sessions, the experimenter stated each previously-trained rule and engaged the participant in an intraverbal exchange requiring the participant to state the “thank you” response for each rule. For example, in the Compliment phase the experimenter informed the participant that before they played together, the experimenter and the participant needed to review their rule(s). Then, the experimenter delivered the compliment rule and said, “Tyler, when someone gives you a compliment what should you say?" The researcher then used a least-to-most prompting hierarchy to prompt the correct response in the following manner: (1) partial verbal: the researcher said "tha-," and (2) full verbal: the researcher said "thank you." The researcher delivered verbal praise for correct responding regardless of the prompt level necessary to gain a correct response. The experimenter then began the session as designed. The above procedure was implemented for Oliver beginning on the twenty-second session, however, due to inconsistent responding during pre-session instruction, Oliver was also provided an edible reinforcer contingent on correct responding.

After each exemplar was delivered, the experimenter and the participant engaged in the child's preferred play activity for approximately one minute before the next exemplar was presented. Once the participant had correctly responded to compliments at mastery criterion across four consecutive sessions, the instructional phase was discontinued.

Training: Help

Instructional sessions targeting the rule, "When someone helps you, you should say 'thank you'", followed the Compliment instructional phase. Experimenters contrived scenarios in which participants required help (e.g., opening a preferred toy item, reaching an item from a tall shelf, etc.). Experimenters independently offered to help participants with tasks; participants were not required to ask for help. Experimenters provided help with the contrived tasks. Procedures during the Help phase were otherwise identical to those utilized in the Compliment phase.

Training: Giving

Instructional sessions targeting the rule, "When someone gives you something, you should say 'thank you'", followed the Help instructional phase. Experimenters delivered novel toys to participants during the instructional session. Toy items for each participant were chosen based on reports from each participant's respective BCBA regarding preferred toys. Procedures during the Giving phase were otherwise identical to those utilized in the Compliment phase.

Results

Participant responding is presented in Figure 1. For Leonard and Tyler, responding was zero (with the exception of one data point) in the initial baseline phase demonstrating that participants did not exhibit appropriate "thank you" in this play context. Initial implementation of MET delivered resulted in inconsistent "thank you" responses across participants, so a pre-session specific instruction component was added to teach the target rules. Following the addition of pre-session specific instruction, appropriate "thank you" responses to target stimuli increased for target stimuli pertaining to trained rules only with substantially greater responding as compared to baseline levels. Responding for Tyler and Leonard followed similar patterns of increasing number of "thank you" responses to target stimuli in each instructional phase. Prior to specific rule-training, "thank you" responses related to untrained rules largely remained at zero. Additionally, Tyler and Leonard required fewer training sessions before meeting the mastery criterion as training phases progressed. In the first training phase, Tyler and Leonard required approximately 18 sessions to reach mastery criterion. Both Tyler and Leonard also began spontaneously responding to target stimuli related to receiving items from the experimenter during the compliment phase despite never having had any explicit training regarding the rule. In the second phase, they required approximately 14 sessions, and in the third phase, both boys reached the mastery criterion after approximately seven training sessions.

Responding for Oliver differed from the other participants in that "thank you" responses to target stimuli were highly variable. Furthermore, frequency of inappropriate "thank you" responses to control stimuli was higher than that of the other participants. There are several reasons Oliver's response pattern might be different from that of the other participants.

While Oliver met the study's verbal behavior inclusion criteria, he used an Augmentative and Alternative Communication (AAC) device to communicate. Oliver had been using the AAC device to communicate using complete sentences for two years. However, Oliver often used the device inappropriately as a medium for engaging in self-stimulatory behavior by pressing icons rapidly in order to watch the screen flash bright colors. Oliver demonstrated significant competing problem behaviors (e.g., aggression, self-injurious behavior, elopement) which researchers needed to block and redirect, likely compromising the quality of the rule-teaching sessions. Additionally, because an edible reinforcer was used to promote correct independent responding during pre-session instructions, it is possible that "thank you" was used as a mand for the edible rather than as a response to the target stimuli statements the researchers delivered.

A video assessment was administered prior to participating in the study, after each rule was mastered, and prior to termination from the study in order to evaluate the extent to which participants could state the rule for saying "thank you" response to an observational stimulus. Participant responding to video assessments are presented in Table 3.

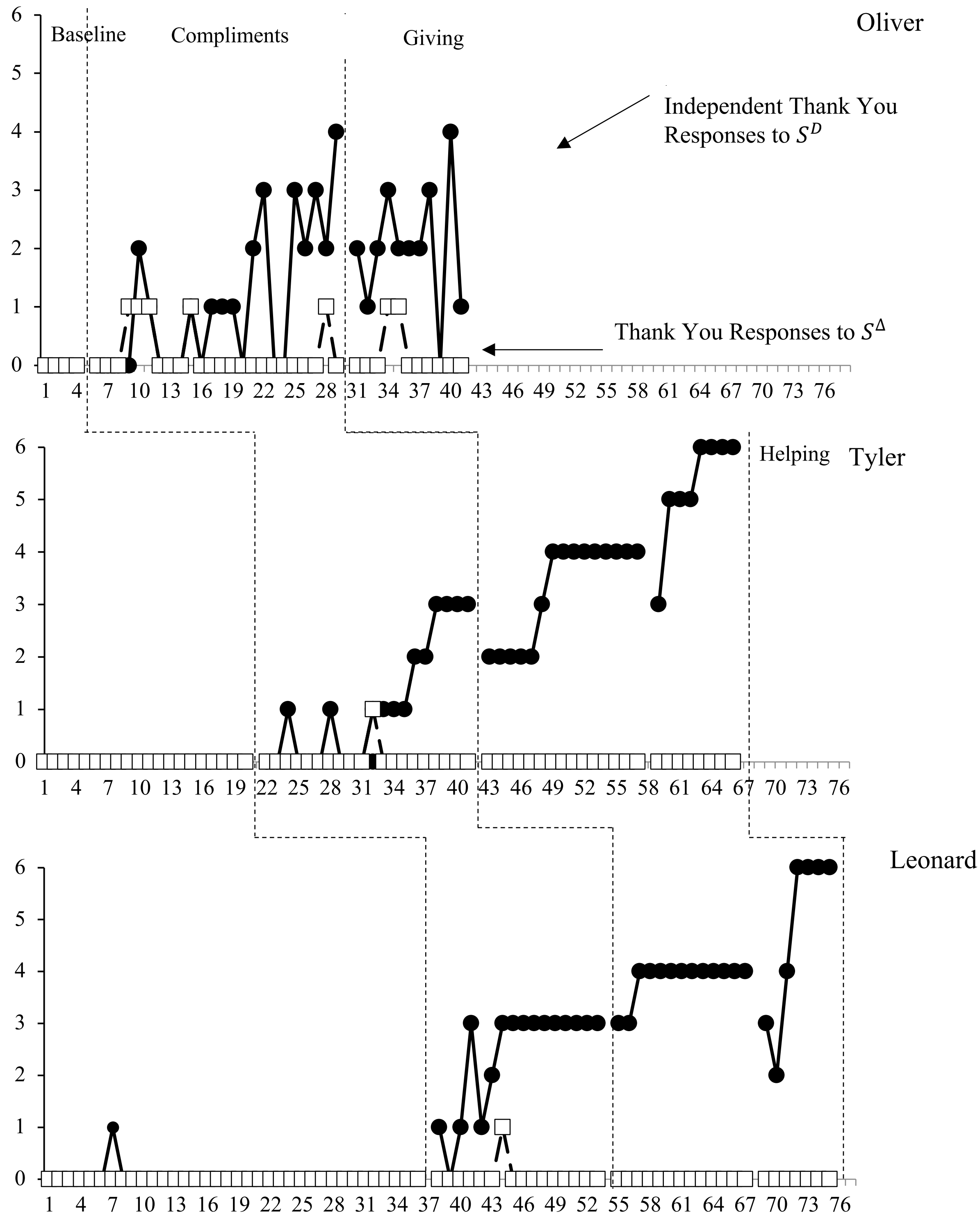

Figure 1. Frequency of accurate independent "thank you" responses to contrive scenarios for each participant.

Table 3. Thank You Responses to Target Stimuli in Pre- and Post-Treatment Video Assessments

Participant	Pre-Treat. Compliments	Pre-Treat. Helping	Pre-Treat. Giving	Post-Treat. Compliments	Post-Treat. Helping	Post-Treat. Giving
Oliver	0	0	0	-	-	-
Tyler	0	0	0	1	1	2
Leonard	0	0	0	1	1	2

Note: A total of six opportunities in which the participant should indicate that the child in the video should say "thank you" were presented: two opportunities per category. No post-treatment video assessment data is provided for Oliver due to his being discharged from the clinic prior to the end of treatment.

Post-treatment video assessment data was not collected for Oliver due to being discharged from the treatment center prior to termination of the study. Prior to participating in the study, Tyler and Leonard did not identify any scenarios in the video for which the child in the video should say "thank you." During the post-treatment video assessment, Tyler and Leonard both identified four out of six possible scenarios in the video in which the child should say "thank you", each neglecting to identify one compliment and one helping interaction. These data demonstrate an overall increase from zero-level identification of scenarios in which a child should say "thank you" prior to treatment, indicating successful generalization and application of rules taught (research question 1). Furthermore, the distinction between levels of responding for target stimuli and control stimuli suggest that training resulted in successful discrimination between social cues (research question 2).

Experiment 1: Discussion

This study examined the effectiveness of a MET instructional model in establishing saying "thank you" for children with ASD who did not already demonstrate this behavior. Results were consistent across two of the three participants with these participants demonstrating appropriate "thank you" responses to trained scenarios as well as refraining from saying "thank you" when it would be considered inappropriate, indicating successful discrimination. While demonstrating increased levels of the target response as compared to Baseline, Oliver's data display a weak treatment effect characterized by variability in responding to target stimuli and control stimuli. The researcher hypothesized that variation in responding was likely due to competing problem behavior and to use of "thank you" as a mand for a preferred edible (delivered contingent on appropriately demonstrating a "thank you" response to exemplars). Overall, these findings replicate previous studies demonstrating the effectiveness of MET for teaching social skills to children with autism (Gould, Tarbox, O'Hora, Noone, & Bergstrom, 2011; Radley, Dart, Moore, Lum, & Pasqua, 2017; Radley, Dart, Moore, Battaglia, & LaBrot, 2017). Furthermore, these results extend the findings of previous research demonstrating the effectiveness of MET to establish appropriate behavioral responses to novel rules in children with ASD (Tarbox et al., 2011) by targeting social interactions.

In regard to the video assessment, although all participants attended to the videos and Tyler and Leonard made a number of statements about the video, none of their statements were relevant to responding "thank you." Post-training video assessment data was only available for Tyler and Leonard, both of whom identified that "thank you" comments following target stimuli. Results of the video assessments suggest that not only did participants develop generalized "thank you" behavior, but they also developed a verbal rule regarding when it is appropriate to say "thank you" (Noell et al., 2017) Additionally, participant responses suggest that they were able to generalize what they learned in training sessions to the peer models in the video.

The specificity of the target behavior analyzed in this study also presents a limitation and direction for future research. The study examined appropriate "thank you" responses to contrived scenarios for children with ASD who did not already appropriately say "thank you".

Although the procedure was clearly effective in this regard, additional research is needed to examine the generalization of this new skill to a wider range of social skills. Specifically, future research could examine the generalization of this instruction to other social contexts requiring polite responding (e.g., initiation and response to greetings). Additionally, more research is needed examining more complex social skills such as empathetic responding and recognition of boredom and disinterest (Peters & Thompson, 2015).

Additionally, Oliver's idiosyncratic pattern of responding can be considered a limitation of the study. While Tyler and Leonard demonstrated consistent and substantially-increased levels of appropriate "thank you" responding subsequent to training, Oliver's responding to target stimuli was highly variable. It is possible that there are children with ASD for whom a play based instructional format is less effective for teaching, as appeared to be the case for Oliver. In this sense, naturalistic teaching strategies may be useful for some children with ASD, without being structured enough for the other children in need of supplemental instructional. Future research should revisit this question by systematically screening for and targeting participants who were unresponsive to naturalistic instructional strategies. Future studies should examine the acquisition of rule-following behavior particularly for children who utilize electronic devices or other means of communication to demonstrate verbal behavior.

Finally, the intensity of training in this study introduces an opportunity for future research examining the role of various instructional strategies on acquisition of RGB related to social skills in children with ASD. While pairing specific instruction with MET resulted in appropriate generalization of skills, training took place in a one-to-one arrangement daily. Future research could modify the instructional strategies of the study to be conducive to application in a small group setting or adjusted for use during typical classroom instruction.

The most important finding from this study for practice is that targeting rules for appropriate social responding via MET is an effective means of teaching social skills to children with ASD. RGB provides practitioners and interventionists a potentially efficient and generalizable means for providing scaffolding for teaching behavior that can be quite complex in naturalistic settings, when clients possess the prerequisite skills to acquire verbal rules. Furthermore, intervention targeting RGB provides a relatively simple method for systematically fading control from the instructor to the natural setting, and allowing the individual to manage his or her own social behavior.

Classroom Readiness Training

Participants

Three children with ASD participated in the study. Participant demographic information can be found in Table 4. Tyler was a 6-year-old Caucasian male. Chris was a 6-year-old African American male. Max was a 4-year-old Caucasian male. All children had a formal diagnosis of ASD, and Chris had a co-morbid diagnosis of apraxia. Students were identified by their BCBA as having difficulty with rule following and verbal behavior commensurate with children ages 19-30 months. Sessions with students were conducted in a one-to-one instructional arrangement in vacant therapy rooms at an early intervention treatment center for language and developmental disorders in south Louisiana.

Table 4. Experiment 2 Participant Demographic Information

Participant	Gender	Age	Ethnicity	VB-MAPP Listener Responding	VB-MAPP Motor Imitation
Tyler	Male	6	Caucasian	14	10
Chris	Male	6	African-American	7	10
Max	Male	4	Caucasian	10	9

Method

Pre- and Post-Treatment Conditional Rule-Following Assessment

A total of 12 rule statements were created in order to assess and train appropriate responding to conditional rules common within a classroom setting. During Baseline, experimenters presented a total of 24 if-then statements specifying a behavioral response that was required if a stimulus was present. The experimenter arranged for the described stimulus to be present for 12 statements, such that the child should emit the described behavioral response. The experimenter also arranged for the stimulus described in the rule to be absent for the remaining 12 statements such that the described behavioral response would be inappropriate for the child to perform.

Consider the rule “If you have a marker, then raise your hand”. For this rule, the experimenter presented a total of three trials in which a marker was present and three trials in which the marker was absent. A total of 18 probes were embedded within the child’s daily DTT such that three rule statements were delivered in each baseline session. Each rule was delivered a total of three times in which the target item described in the rule was present and three times in which the target item described in the rule was absent. Trials were interspersed on a variable schedule such that one trial was presented after correct responding to a variable number of previously mastered item, with a range of 1-4 previously mastered items. After a trial was presented, researchers allowed the child five seconds to initiate a behavioral response. If a response was initiated, the child was permitted to complete the behavioral response. After completion of a response, researchers set up materials needed for the next probe and delivered the probe. Rules presented in baseline sessions were randomized across participants. Baseline session length varied according to the number of previously mastered items delivered. Session duration ranged from 10 – 20 minutes, with an average session duration of 16 minutes.

In order to be included in the study, the child must have responded correctly with the described behavior on no more than 50 percent of probes in the first three baseline sessions. Trials for which responding was not appropriate (i.e., item absent) were incorporated in the inclusion criteria in order to control for chance responding to rules regardless of the presence of the stimulus described in the rule. Participant responses were recorded. This assessment was chosen in order to ensure that participants did not already demonstrate generalized responding to if-then requests.

Data Collection

During each session, the experimenter presented three opportunities for participants to respond appropriately with behaviors specified in the rule when the stimulus in the rule was present (the "go" condition) and three opportunities for which the conditional stimulus was absent (the "no-go" condition). A correct response included the participant following the behavior specified in the conditional rule in the "go" condition. For example, if the rule were "If you have a marker, then raise your hand" and the experimenter had given the participant a marker, then a correct response included the child raising his hand. A correct response also included the participant demonstrating a different behavior than the behavior specified in the conditional rule in the "no-go" condition. Given the same rule, if the experimenter did not give the participant a marker, then a correct response included the child performing any behavior other than raising his hand. After inconsistent patterns of responding to "no-go" conditions, an alternative behavior was programmed for Chris during "no-go" conditions such that the experimenter instructed Chris to put his hands in his lap during "no-go" trials, and a correct response included Chris putting his hands in his lap. Incorrect responses included not demonstrating the target behavior when the stimulus in the rule was present or demonstrating the target behavior when the stimulus in the rule was absent. For example, if the rule were "If you have a marker, then raise your hand" and the experimenter had given the participant a marker, then an incorrect response included the child performing any behavior other than raising his hand. Given the same rule, if the experimenter did not give the participant a marker, then an incorrect response included the child raising his hand.

The experimenter recorded the prompt level necessary to obtain correct responding separately for rules in which the stimulus was present and absent (during treatment, see below). At the end of each session, a researcher calculated the percentage of correct independent responses as well as the percentage of correct independent nonresponses. The DTT phase was discontinued once the participant demonstrated correct responses and nonresponses to 100% mastery criterion over four consecutive sessions. In addition, the participant needed to respond correctly the first time the stimulus in the rule was present and the first time the stimulus in the rule was absent during each of the four mastery sessions. Once criteria had been met for any given rule, a generalization probe was conducted.

Inter-Observer Agreement and Treatment Integrity

Trained researchers collected treatment integrity and inter-observer agreement (IOA) during 30% of sessions across studies. Treatment integrity and IOA were collected for all participants and across all phases. Treatment integrity and IOA ranges for each participant can be found in Table 8. Treatment integrity and IOA were both 99%. IOA was calculated using a point-by-point method: number of agreements divided by number of agreements plus disagreements multiplied by 100.

Experimental Design

A multiple probe across participants design was used to examine the relationship between treatment and the acquisition and generalization of responding to if-then requests. Phases for the experiment are described below.

Baseline

During the child's regular ABA therapy, the experimenter delivered six trials containing an antecedent stimulus and a rule specifying a behavior to be performed. Tables 5, 6, and 7 depict the rules that were presented during baseline and training phases, as well as generalization probes for each participant. During three of the rule-trials, the stimulus described in the rule was presented, such that the child was expected to perform the target behavior (i.e., the "go" condition). During the other three of the rule-training trials, a stimulus that was not described in the rule was presented such that it would be inappropriate for the child to perform the specified behavior (i.e., the “no-go” condition). The order of rule presentation was random. When a rule-training trial was delivered, if it was unclear whether the participant attended to the trial or the participant did not respond, the experimenter obtained an attentional response by saying the child’s name. That is, when the researcher said the participant’s name, the researcher used a least-to-most prompting hierarchy (defined below) to obtain eye contact. When the participant attended, the researcher presented the rule-training trial again. No consequence was delivered for participant responses.

Table 5. Rules Delivered to Tyler During Baseline, Training, and Generalization Probes

Baseline	DTT	Generalization Probes
If you have a worksheet, then stand up.	If you have a worksheet, then raise your hand.	If you have a pencil, then sit on the floor.
If you have a worksheet, then raise your hand.	If you have a worksheet, then sit on the floor.	If you have a pencil, then raise your hand.
If you have a worksheet, then sit on the floor.	If you have a worksheet, then stand up.	If you have a marker, then sit on the floor.
If you have a marker, then stand up.	If you have your folder, then stand up.	If you have a marker, then raise your hand.
If you have a marker, then raise your hand.	If you have a marker, then stand up.	
If you have a marker, then sit on the floor.	If you have your folder, then raise your hand.	
If you have a pencil, then stand up.	If you have a pencil, then stand up.	
If you have a pencil, then raise your hand.	If you have your folder, then sit on the floor.	
If you have a pencil, then sit on the floor.		
If you have your folder, then stand up.		
If you have your folder, then raise your hand.		
If you have your folder, then sit on the floor.		

Trials of unrelated mastered items from the child's ABA therapy were interspersed and the child received verbal praise for correct responses to mastered items in order to maintain general compliance. Previously-mastered items were interspersed on a variable schedule such that approximately three previously-mastered items were presented between each presentation of rule-training trials. In the event that the child responded incorrectly to a previously-mastered item, the experimenter prompted the correct response following the least-to-most prompting hierarchy and a different mastered item was presented. No more than four previously-mastered items were delivered in succession. In the event that the child responded incorrectly to four previously-mastered items consecutively, the experimenter prompted correct responding to the fourth previously-mastered item, if necessary. Then, a 30-s break was initiated during which no demands were placed on the participant and access to reinforcement was withheld. Access to preferred toy items was utilized only for independent responses to previously-mastered items, thus encouraging future independent responding and limiting the likelihood of prompt dependency.

Table 6. Rules Delivered to Max During Baseline, Training, and Generalization Probes

Baseline	DTT	Generalization Probes
If you have a worksheet, then stand up.	If you have a worksheet, then raise your hand.	If you have a pencil, then sit on the floor.
If you have a worksheet, then raise your hand.	If you have a worksheet, then sit on the floor.	If you have a pencil, then raise your hand.
If you have a worksheet, then sit on the floor.	If you have a worksheet, then stand up.	If you have a marker, then raise your hand.
If you have a marker, then stand up.	If you have your folder, then stand up.	If you have a marker, then sit on the floor.
If you have a marker, then raise your hand.	If you have your folder, then raise your hand.	If you have your folder, then raise your hand.
If you have a marker, then sit on the floor.	If you have your folder, then sit on the floor.	

(table cont'd.)

Baseline	DTT	Generalization Probes
If you have a pencil, then stand up.	If you have a marker, then stand up.	
If you have a pencil, then raise your hand.	If you have a pencil, then stand up.	
If you have a pencil, then sit on the floor.	If you have your folder, then raise your hand.	
If you have your folder, then stand up.		
If you have your folder, then raise your hand.		
If you have your folder, then sit on the floor.		

Table 7. Rules Delivered to Chris During Baseline, Training, and Generalization Probes

Baseline	DTT	Generalization Probes
If you have a worksheet, then stand up.	If you have your folder, then sit on the floor.	If you have your folder, then raise your hand.
If you have a worksheet, then raise your hand.	If you have your folder, then stand up.	If you have a marker, then sit on the floor.
If you have a worksheet, then sit on the floor.	If you have a marker, then raise your hand.	If you have a pencil, then raise your hand.
If you have a marker, then stand up.	If you have a marker, then stand up.	If you have a pencil, then stand up.
If you have a marker, then raise your hand.	If you have a pencil, then sit on the floor.	
If you have a marker, then sit on the floor.	If you have a worksheet, then raise your hand.	
If you have a pencil, then stand up.	If you have a worksheet, then stand up.	
If you have a pencil, then raise your hand.	If you have a worksheet, then sit on the floor.	
If you have a pencil, then sit on the floor.		
If you have your folder, then stand up.		

(table cont'd.)

Baseline	DTT	Generalization Probes
If you have your folder, then raise your hand.		
If you have your folder, then sit on the floor.		

Discrete Trial Training: *Rule 1*

Procedures during DTT were identical to those in baseline except participants were prompted to perform the specified behavior in the target rule and a preferred toy and verbal praise were delivered following performance of the appropriate behavior. Preferred toys were identified via a brief free operant preference assessment prior to the start of each session. Free operant preference assessments allow the child the opportunity to choose preferred items from a large array of possibly-reinforcing toys, edibles, or activities (Chazin & Ledford, 2016). This type of preference assessment was chosen in order to reduce the likelihood of evoking problem behavior in response to the removal of toys that can occur in multiple stimulus without replacement preference assessments (Kang et al., 2011). While rules during DTT sessions were delivered utilizing the same procedures as those in baseline, only one rule was targeted for training during each rule-training phase. Targeted rules were randomized across participants. Prompts for engaging or not engaging in the behaviors specified in the rules were provided according to the following least-to-most prompting hierarchy: (1) verbal prompt, (2) model: the experimenter demonstrated the motor response, and (3) physical: the participant was physically guided to emit the motor response. The experimenter began the prompting sequence if the participant did not respond within 5 s after the rule was delivered. The experimenter delivered the next prompt in the sequence if the participant had not responded to the previous prompt within 5 s of delivery of the prompt. Correct responses were followed by descriptive praise, and independent correct responses were followed by descriptive praise and a preferred item selected via a brief free-operant preference assessment (Ortiz & Carr, 2000) conducted prior to each session. Contingent on an incorrect response, the experimenter stated “no” in a neutral tone of voice and provided descriptive feedback, such as, “I said, if you have a marker then raise your hand. But look, you do not have a marker, so you should not raise your hand. Instead, you can put your hands in your lap”. Once the mastery criteria had been met for any given rule, a generalization probe was conducted.

Discrete Trial Training: *Rules 2-4*

DTT sessions targeting different conditional rules followed the first rule-training phase. Procedures during the remainder of the rule-training phases were identical to those utilized in the first rule-training phase. The target rule was presented a total of six times during the session: three times in which the stimulus specified in the rule was present (indicating the child should perform the behavioral response), and three times in which the stimulus specified in the rule was absent (indicating that the child should perform an appropriate alternative behavior). The order in which the target stimulus was presented or was absent in session were randomized. Once the participant had correctly responded to both “go” and “no-go” conditions with 100 percent accuracy across four consecutive sessions, the instructional phase was discontinued.

After Chris demonstrated inconsistent patterns of responding to “no-go” conditions in the originally designed format in baseline and the first and second rule-training phases of the study, the “no-go” conditions were re-framed such that statements specified a target behavioral response Chris was expected to perform rather than relying on Chris to derive an appropriate target behavior in the absence of the item specified in the rule. Due to his pre-existing apraxia, the researcher hypothesized that specifying an alternative behavior would be less difficult than response inhibition for Chris (Drewe, 1975). For example, consider the rule “If you have a marker, then raise your hand.” After rule modification, the statement in the “go” condition remained unchanged. However, in the “no-go” condition, a stimulus other than a marker (e.g., a pencil) was presented to Chris and the following statement was delivered: If you do not have a marker, then put your hands in your lap. “No-go” conditional statements were framed in this way for the remainder of his training and in his retention phase.

Generalization Probes

Generalization probes were identical to baseline and included the participants’ regular classroom teacher and teacher aides, with whom the participant had no training history for the rules in the study. Generalization probes were randomly assigned and consisted of rules probed in baseline but for which participants had never been directly trained. Probes were conducted at the beginning of the next session after the participant had reached mastery criterion. The teacher or teacher aide delivering the probe was positioned at the participant’s small group table with 3-4 students, including the participant. During small-group instruction, the teacher or teacher aide delivered the assigned generalization probe, and a trained experimenter collected participant behavioral data. No feedback regarding the accuracy of the participant’s or other students’ responses to the probe was delivered.

Results

Participant responding is presented in Figure 2. Responding for Tyler and Max followed similar patterns of increased accurate responding to both “go” and “no-go” conditions during the initial phases of the study, followed by 100% accurate responding to untrained conditions and stimuli after the second phase and during the retention phase. Responding for Chris differed from the other participants in that responses to “no-go” conditions were variable prior to reframing “no-go” conditions to specify an appropriate behavioral response. After re-framing “no-go” statements, Chris’ response pattern matched that of the other two participants with the exception of two sessions in which Chris’ accuracy in responding to “go” conditions decreased.

The researcher hypothesized that Chris' response pattern to "no-go" conditions might be different from that of the other participants due to apraxia, a pre-existing condition which impairs Chris' motor planning abilities. Despite having met VB-MAPP inclusion criteria for Listener Responding and Motor Imitation, it is possible that Chris required more explicit and extensive training than the other participants in order to perform the same tasks due to apraxia. For all participants, accurate responding was equal to or less than 60% (with the exception of two data points) in the initial baseline phase demonstrating that participants did not exhibit appropriate behavioral responses to conditional statements they might encounter in a classroom setting.

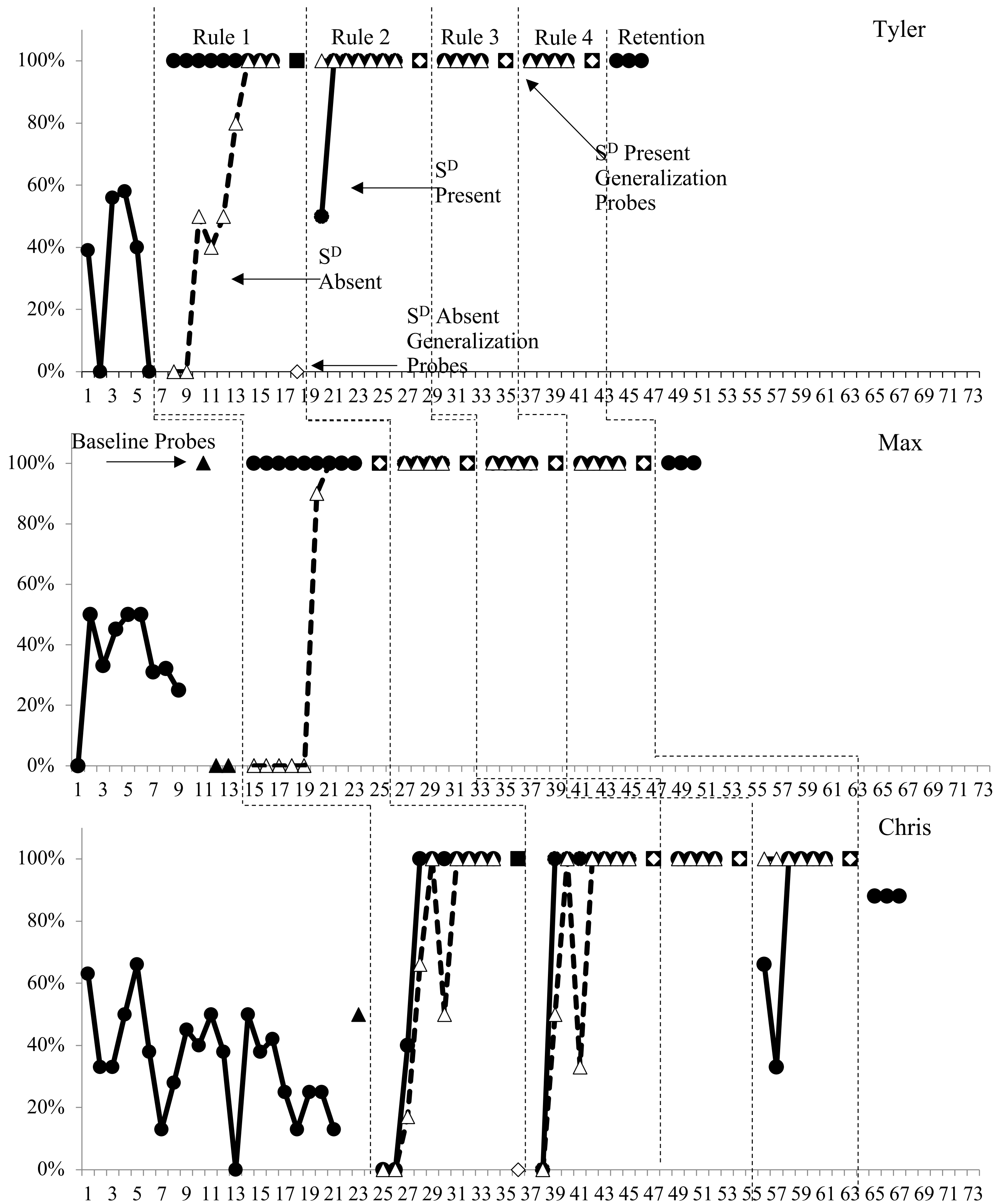

Figure 2. Percentage of accurate independent motor responses to rule presentation for each participant.

Implementation of MET delivered via DTT resulted in increased levels of accurate responding to conditional statements with substantially greater responding as compared to baseline levels. These data demonstrate that MET via DTT was effective for teaching appropriate behavioral responses to classroom rules (research question 3). Furthermore, behavioral responses to generalization probes indicate that classroom rule-following behavior generalized to the natural classroom setting (research question 4). Finally, for all participants, responding during the retention phase demonstrate successful generalization of classroom rule-following behavior to untrained rules (research question 5).

Experiment 2: Discussion

This study examined the effectiveness of MET via DTT in establishing conditional rule following for children with ASD who did not already demonstrate this behavior. This was investigated based on the call for research examining strategies designed to help children with ASD become ready for entry into the school environment and better prepare service delivery professionals to effectively teach these fundamental skills (Fleury, Thompson, & Wong, 2015). After re-framing conditional statements to specify the required behavioral response, results were similar across participants with these students demonstrating behavioral responses consistent with those specified in trained conditional statements, indicating successful discrimination. Furthermore, participants required fewer training sessions to reach mastery criteria as training phases proceeded, demonstrating successful generalization of acquired skills. Participants were also able to generalize appropriate responding to untrained conditional stimuli in the natural classroom setting, suggesting acquisition of RGB related to the classroom. Overall, these findings replicate previous studies demonstrating the effectiveness of DTT for teaching classroom readiness skills to children with autism (Lang, Rispoli, Sigafoos, Lancioni, Andrews, & Ortega, 2011). Furthermore, these results extend the findings of previous research demonstrating the effectiveness of MET to establish appropriate behavioral responses to novel rules in children with ASD (Tarbox et al., 2011).

Observed variability in responding across participants presents a limitation to the interpretation of the training data. Although two of the three participants successfully acquired correct target responding without experimenters needing to specify a particular behavioral response in "no-go" conditions, it is possible that there are children with ASD for whom rule presentation needs to be modified to specify a desired behavioral response, as in the case of Chris. In this sense, derived relational responding may be possible for some children with ASD, while being too complex to promote appropriate behavioral responding for others. Future research should revisit this question by systematically screening for impairments in motor planning and targeting participants who were unresponsive to conditional rule presentation not specifying appropriate behavioral responses.

Inclusion criteria for the current study required participants to have achieved a level of verbal behavior that would support success of the intervention. However, the ability to follow rules consistently is an important skill for children who have not yet achieved this level of verbal behavior. Future research should consider the feasibility and examine the effectiveness of this intervention with children with more severe verbal behavior deficits.

The specificity of rule presentation in this study also presents a limitation and direction for future research. The study examined participants' responses to conditional if/then statements associated with contrived scenarios. Additionally, altered rule presentation was necessary in order for Chris to meet mastery criterion, adding a potential confounding variable to the study. While there is no research regarding response inhibition to rules in children with ASD that the researcher could find, previous research examining the role of executive function as it relates to response inhibition finds that young children demonstrate a far greater degree of difficulty in inhibiting responses to rules than older children (Baker, Friedman, & Leslie, 2010). Specifically, when presented with novel stimuli, young children are less likely to resist interference from a competing response as well as more likely to behave according to a previously trained rule as compared to older children (Baker et al., 2010). Rule modification in this way made it possible for Chris to respond correctly to rules regardless of the target stimulus presented.

Altered rule presentation was employed based on the observation that Chris often engaged in the behavior specified in the rule regardless of whether the stimulus in the rule was present. The researcher hypothesized that, due to a history of reinforcement for performance of a specific action when asked to do so, derived alternative behavioral responses necessary for correct responding in the original design of “no-go” conditions were not in Chris’ repertoire of behavior. Due to these concerns, altered rule presentation was modified such that an appropriate alternative behavior response was specified in the case that the stimulus in the rule was absent. Alteration of rule presentation seemed to improve Chris’ acquisition. However, altered presentation formatting only needed to be implemented with one participant. It is possible that Chris simply needed more training opportunities than either Tyler or Max in order to demonstrate appropriate responding through continuation of the standard procedure. Although the procedure was clearly effective in promoting accurate responding, instructions and rules are not always delivered in if/then statements. Future research should examine the effectiveness of the current procedure in regard to accurate responding to rules presented in various formats.

The most important finding from this study for practice is that targeting conditional request compliance via MET is an effective means of teaching conditional classroom rule following to children with ASD. Because school readiness behavior is correlated with later school outcomes for children with ASD (Lloyd, Irwin, & Hertzman, 2009), educational professionals must be able to identify vital skills and evidence-based practices for teaching these skills in order for children with ASD to succeed in the least restrictive environment. Successful rule-following behavior allows children with ASD to function more similarly to their peers in a mainstream classroom (Fleury et al., 2015), ultimately enhancing their chances of being successful in a general educational setting.

Conclusion

The current experiment replicated existing research by demonstrating the effectiveness of MET in promoting the acquisition of conditional rule following in children with ASD. Furthermore, the current study extended existing research by demonstrating behaviors acquired in training to the natural classroom setting. Participants also demonstrated increased accuracy of responding to trained and novel target stimuli, suggesting that MET via DTT was sufficient for teaching classroom readiness skills to these children. Additional research is needed examining the effectiveness of instruction targeting RGB when implemented with children with low-functioning ASD. Future research should also consider the effectiveness of instruction when rule presentation is varied.

General Discussion

It has been argued relatively extensively that few children with social skills deficits receive adequate programming (Hume et al., 2005; Gresham et al., 2001). This may be a particularly severe concern for children afflicted with ASD. In order to improve the effectiveness of social skills interventions, Gresham et al. (2001) recommend several strategies: increase the dosage of the intervention, provide social skills training in the client's natural setting, and match intervention strategies to the type of skills deficits. While not a one-size-fits-all strategy, interventions developed within an MET framework can address these areas of concern. Details regarding the conceptualization of MET in the context of effective social skills training for children with ASD can be found in the following sections. Further research should be conducted to more extensively determine participant characteristics relevant to the success of MET interventions targeting social skills in children with ASD.

Intervention Setting

Insufficient social skills treatment programs outcomes may also result from treatments that are carried out in "contrived, restricted, and decontextualized" settings, (Gresham et al., p. 340). Such artificial programming is may lead to poor maintenance and limited generalization (Bellini et al., 2007). White et al. (2007) found that while targeted social skills deficits remediated with intervention, remediation only applied to directly taught skills. Additionally, researchers discovered that skills demonstrated in highly-contrived settings did not generalize to the natural environment. In contrast, interventions implemented in the natural environment, such as a regular classroom, result in more significant treatment effects, and a greater degree of maintenance and generalization across stimuli, settings, and participants (Bellini et al., 2007). These findings have important implications for social skills treatment programs within the natural setting. Structuring social skills instruction around rule-following allows for every naturally-occurring exemplar to serve as a discriminative stimulus for promoting a behavioral response. While this preliminary research was conducted in separate therapy rooms, the current studies demonstrate procedures with the potential for incorporating similar interventions strategies into daily classroom routines. Such interventions would showcase the flexibility of using rule-following to target school-based skills, extending the findings of White et al. (2007).

Participants in the current studies also demonstrated generalization of social skills and conditional rule-following to novel exemplars and rules, novel settings, and novel adults, indicating better generalization and more adaptive skill use in natural environments than previous studies have shown in response to school-based social skills intervention (Williams, 1989; White, Keonig, & Scahill, 2010; Barnhill, Cook, Tebbenhamp, & Myles, 2002; Marriage, Gordon, & Brand, 1995; Webb, Miller, Pierce, Strawser, & Jones, 2004). Findings from the current study replicate generalization effects seen in preliminary research targeting the acquisition of RGB in children with ASD (Tarbox et al., 2011; Wymer et al., 2016). Together, these findings have important implications for how school readiness skills are taught to children with ASD. In organizing skills instruction around the rubric of verbally expressible general rules, teachers and other school personnel can reasonably be trained to implement intervention strategies in a variety of natural settings. Such considerations are especially critical for children with ASD, who often demonstrate difficulty implementing skills learned across settings.

Matching Strategy to Skill Deficit

A cornerstone of effective social skills intervention is the match between the treatment program and the particular skill deficit of the child (Gresham et al., 2001; Quinn et al., 1999). Yet many social skills interventions fail to effectively match treatment strategies (Bellini et al., 2007). Consider the following example: If a child lacks the skills necessary to respond appropriately to a social initiation, the treatment strategy selected should target skill acquisition related to appropriate responding, such as appropriate physical spacing, consistent eye contact, and acceptable verbal responses to initiations. In contrast, if a child possesses the prerequisite skills to respond appropriately to a social initiation but consistently fails to respond, treatment programs should instead focus on increased frequency in the demonstration of the skills possessed. MET targeting the acquisition of RGB has the advantage of being adaptable to according to the specific deficits of the client (Tarbox et al., 2011). MET can be used as the organizing structure of the treatment program, while the procedural content of specific trails are tailored to the specific needs of the individual. Rules can be tailored to specify antecedents, behaviors, and consequences related to navigating particular social interactions, classroom routines, problem solving strategies, etc. RGB may also be able to address deficits for children with various levels of adaptive functioning, however further research is still necessary in order to determine whether there are any prerequisite skills needed before MET can be considered an effective strategy for promoting rule-following in this population (Tarbox et al., 2011).

Multiple Exemplar Training

In terms of teaching generalized rule-following, the current studies replicate the work of Tarbox et al. (2011) and Wymer et al. (2016) in that they demonstrate that basic behavioral interventions, including specific instruction, MET, and DTT, can establish a generalized repertoire of rule-following. All five children participants across the two experiments successfully demonstrated generalization across either stimuli or responses and stimuli. These are two of a small number of experiments (Tarbox et al., 2011; Wymer et al, 2016) to establish RGB in children with ASD. The implications resulting from data obtained in the current studies contribute to a growing literature that supports the potential conceptualization of RGB as an operant behavior. Whereas initial research regarding RGB advocated that individuals adhere to rules due to a history of previous reinforcement for following specific rules, (Skinner, 1969) the

RFT conceptualization of RGB argues that RGB is made up of generalized operants that have come to develop relational frames with a variety of stimuli, all of which are similarly governed under the context of the antecedents which precede them (Tarbox et al., 2011).

The results of the current studies suggest that the RFT conceptualization of RGB may a useful framework for conceptualizing rule-following and patterns of behavior that follow verbal rules. Participants were able to respond appropriately to untrained rules when delivered by adults with whom participants had no prior history of reinforcement for following study rules. The results of these studies may also have significance for applied contexts. With the exception of preliminary conceptual investigations (Tarbox, et al., 2011), there is no research examining the effectiveness of intervention programs designed to target the establishment of RGB in activities of daily living in children with ASD. The current two experiments serve as initial attempts to develop procedures for establishing behavior that conforms to patterns described in verbal rules in children with ASD. Future research is still needed to determine whether MET is an effective strategy for establishing complex rule-following behaviors similar to those of typically-developing peers. For example, future research should extend the current studies by targeting rule-following for more dynamic social interactions between peers and classroom rule-following unrelated to tangible materials.

Furthermore, these studies extend previous research (Tarbox et al., 2011; Wymer et al., 2016) by applying MET to broader classes of skills, that is, social skills and conditional rule-following in a classroom setting. In initial investigations of establishing RGB for children with ASD, stimuli and associated rules chosen to teach responses were arbitrary (Tarbox et al., 2011; Wymer et al., 2016). For example, discriminative stimuli included pictures of articles of clothing, shapes, vehicles, and food items. Additionally, behavioral responses to such stimuli involved gross motor movements unrelated to practical use of the stimuli (e.g., “If this is a carrot, then clap"). Researchers also used pictures and written rules as cues for correct responding, prompts that are not likely to be provided in the natural environment. The current research furthered the current state of RGB literature by investigating strategies for establishing repertoires of rule-following that more closely resemble those of typically-developing peers. Researchers utilized targeted rules common to naturally occurring social encounters (e.g., saying "thank you" when receiving a compliment) and classroom routines (e.g., raising one's hand when supplies are delivered or missing) in order investigate the utility of rules to teach generalized responding in naturally-occurring contexts.

The rules included in previous research and in the current study were simple in that they only outlined two terms (i.e., the antecedent and corresponding behavior) of the four-term contingency widely recognized in the field of behavioral analysis. Future research should seek to examine the efficacy of MET for establishing rule following when additional terms of the four-term contingency are included in the rule. Additionally, future research should examine MET for training rules that do not explicitly specify antecedents and/or consequences, requiring further conditional discrimination in order to follow the rule (e.g., pick your battles; treat others how you would like to be treated; if you don't have anything nice to say, don't say anything at all; etc.).

Discriminated Operants and RGB

The nature of these studies poses an important question: Is participant responding more accurately characterized as simple discriminated operants or RGB? The concept of RGB was introduced initially as an example of discriminated responding characterized by the three-term relation of discriminative stimulus, response, and consequence.

Verbal rules have the ability to extend, transform, or modify the discriminative function of stimuli. In this sense, behavior that is rule-governed is assumed to be sensitive to contingencies of rule-following that shaped it, and potentially less sensitive to the direct consequences in the immediate environment. It can be argued that participants in the current studies learned appropriate response classes via a history of reinforcement of appropriate responding, which subsequently generalized to untrained rule presentation, making a case for discriminated responding. However, the novelty and variety in forms of instructed responses suggest that instructional control might have involved more than a collection of independent discriminations or a simple response class.

Simple discriminated responding in an instructional repertoire (the totality of instructions that one is capable of responding to correctly) would be extremely limiting (Cerutti, 1989). Instructions would only function to promote the corresponding response in the situations in which they were given; they could not control behavior under varied circumstances. Rather, combining previously-trained discriminative stimuli in novel ways occasions opportunities to respond correctly to entirely novel instructions solely by virtue of training with the discriminative stimuli. As a result, individuals are able to develop an overall broader and vastly more complex instructional repertoire with a fraction of the training required (Baer, Peterson, & Sherman, 1967; Catania, 1980; Catania & Ceruti, 1986; Foss, 1968; Garcia, Baer, & Firestone, 1971; Goldstein, 1983; Streifel, Wetherby, & Karlan, 1976).

Rules in the current studies functioned to elicit the corresponding behavioral responses under varied circumstances including novel rules, settings, and adults, resulting in a more versatile repertoire. Furthermore, participants in both studies were able to appropriately vary their responses according to novel combinations of stimuli in presented rules resulting in new and complex responses. Results of the current studies lend support to the conceptualization of RGB as generalized operant behavior (Tarbox et al., 2011). Individuals behave according to their histories of reinforcement, and responding to stimuli in the absence of relevant reinforcement histories for doing so would suggest that rules functioned as generalized discriminative classes capable of controlling novel responses to novel stimuli (Skinner, 1969; Malott, 1989; Tarbox et al., 2011).

These studies examined the use of MET to teach RGB related to skills that are necessary for young children to adapt effectively to common classroom expectations. Social skills and conditional rule following were chosen as target behaviors specifically because of their impact on the success of children with ASD in educational settings (Fleury et al., 2015). While there are a variety of studies using evidence-based practice to target classroom readiness skills in children with ASD (see Wong et al., 2014), no studies to date have examined the effectiveness of teaching these skills by targeting with an emphasis on verbal rules governing response classes. An objective of the current experiments was to examine the integration of verbal rules into a MET context to develop classroom readiness skills for children with ASD in a manner that would promote generalization of skills to novel rules, in novel settings, with novel instructors, resulting in more versatile instructional repertoires that more closely simulate response patterns characteristic of typically-developing children.

Future research should investigate whether additional behaviors shown to lend to the success of children with ASD in school, such as health and motor skill development, emergent literacy skills, and early math proficiency (National Center for Special Education Research, 2006) are amenable to instruction via RGB. Additionally, future research should seek to identify whether MET is effective for teaching RGB for children of various levels of functioning or if perhaps other strategies are more conducive to teaching classroom readiness skills at different levels of functioning.

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Appendix. IRB Form

ACTION ON PROTOCOL APPROVAL REQUEST

Institutional Review Board
Dr. Dennis Landin, Chair
130 David Boyd Hall
Baton Rouge, LA 70803
P: 225.578.8692
F: 225.578.5983
irb@lsu.edu
lsu.edu/research

TO: George Noell
Psychology

FROM: Dennis Landin
Chair, Institutional Review Board

DATE: June 8, 2017

RE: **IRB#** 3881

TITLE: Rule-Governed Behavior: Teaching Social Skills via Rule-Following to Children with Autism

New Protocol/Modification/Continuation: New Protocol

Review type: Full ____ Expedited _X_ **Review date:** 6/8/2017

Risk Factor: Minimal ___X___ Uncertain ______ Greater Than Minimal_______

Approved_____X_____ **Disapproved**__________

Approval Date: 6/8/2017 **Approval Expiration Date:** 6/7/2018

Re-review frequency: (annual unless otherwise stated)

Number of subjects approved: 4

LSU Proposal Number (if applicable)**:**

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

By: Dennis Landin, Chairman D.Landin

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: When emailing more than one recipient, make sure you use bcc.**

**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*

Vita

Rachel Lorraine Bradley, born in San Antonio, Texas, received her undergraduate degree in General Psychology from Valdosta State University in Valdosta, Georgia in 2014. Rachel's interest in school psychology and child development grew into a passion as a result of volunteering as a peer tutor and literacy mentor during her undergraduate studies. Subsequent to graduation, she entered the Department of Psychology at Louisiana State University, pursuing clinical practice and research interests to include educational policy, psychoeducational assessment, school-based consultation and intervention, and behavioral treatment for childhood disorders. Rachel plans to graduate with a Doctor of Philosophy degree in School Psychology in 2019.