

**THE EFFECTS OF PEER TO PEER MAND TRAINING ON UNPROMPTED MAND
FREQUENCY FOR CHILDREN WITH AUTISM AND INTELLECTUAL/
DEVELOPMENTAL DISABILITIES**

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Rachel Kittenbrink, PhD

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Students with autism spectrum disorders (ASDs), by nature of diagnosis, demonstrate qualitative differences in communication and social interaction. Current post-secondary outcomes for individuals with autism highlight the need for intensive interventions to prepare students for improved quality of life, access to employment, and post-secondary education options. The inability to communicate one's wants and needs effectively to adults and peers significantly limits the likelihood for independent successful navigation of one's community and of the larger society. Interventions grounded in applied behavior analysis and designed to teach requesting or manding behaviors to individuals with autism and intellectual/developmental disabilities (IDD) are strongly supported in the literature. The wealth of current research in this area focuses strongly on teaching requesting behaviors from children with autism or IDD to adults. As individuals with autism and IDD age, the need to communicate wants and needs to peers, as well as to develop social skills continues to grow. The current study used a peer manding treatment package, embedding the use of differential reinforcement, controls for motivation, and time delay procedures to assess the effects on peer manding and reinforcer delivery rates in elementary school students with autism and IDD. A multiple probe across dyads design (Horner

& Baer, 1978) was used to evaluate effectiveness of the peer manding treatment package on unprompted peer mands and unprompted reinforcer deliveries during 12 min mand sessions. All participants were active in the baseline, intervention, withdrawal, generalization, and maintenance phases of the investigation. All participants demonstrated increased unprompted mands and unprompted reinforcer deliveries following exposure to the treatment package, demonstrating a functional relation between the treatment package and increased response levels. Participants' response levels in the phases following the intervention phase were more variable, but as a whole, response levels maintained throughout the investigation. Considerations for interpreting the results are included and recommendations for future research and practitioners are discussed.

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1.0 INTRODUCTION

Current estimates of the prevalence of children with autism spectrum disorders (ASDs) have risen significantly in recently years from 1 in every 150 children in 2002, to 1 in 68 in 2010 (Center for Disease Control, 2014). Individuals with autism, by nature of diagnosis, demonstrate qualitative differences in communication and social interaction (American Psychiatric Association, 2013).

Significant deficits in communication and social skills present a variety of barriers, which have the potential to adversely affect many domains of functional success and quality of life. Language and social deficits often limit students' abilities to acquire more advanced skills and to excel in traditional academic instructional content and formats (Sundberg, 2007). These limitations make success in a traditional general education curriculum and classroom difficult. Data from the Pennsylvania Department of Education, Bureau of Special Education for the 2012-2013 school year shows that 19% of all students receiving special education services in Pennsylvania in separate educational placement facilities have an autism diagnosis, and over 5,000 students with autism throughout the state in district schools spend less than 40% of their instructional day in the general education classroom (U.S. Department of Education, 2013). Without remediating these skill deficits, the negative effects will continue to compound over time resulting in concerning post-secondary outcomes.

Recent large-scale research on post-secondary education and employment found that when compared to other populations previously receiving special education services, “Young people with ASD had the highest risk of being completely disengaged from any kind of postsecondary education or employment” (Shattuck, Carter, Narendorf, Cooper, Sterzing, Wagner, Lounds, & Taylor, 2012, p. 1046). Youth with ASD also had a lower rate of employment than all of the other disability categories assessed, including individuals with intellectual and developmental disabilities. (Shattuck et al., 2012). More than 50% of youth with ASD had no participation in employment or education in the two years following departure from high school. (Shattuck et al., 2012).

In 2006, Michael Ganz, professor at Harvard University, noted \$35 billion dollars as an underestimated annual cost of providing direct and indirect medical services for individuals with ASDs (Ganz, 2006). Recent research from Autism Speaks highlights that the estimated costs to society for supporting individuals with ASD have tripled in the past six years, with a current annual estimate of \$126 billion dollars per year (Autism Speaks, 2012).

Increases in population rates, an analysis of post-secondary challenges for this population, and a review of the financial costs of serving this group, highlight the importance of working towards the development of strong research validated instructional procedures geared towards meeting the crucial needs of this population. Autism, by definition, requires qualitative differences in social interaction and communication (American Psychiatric Association, 2013). Designing strong replicable procedures to address social and communication deficits could develop skill sets likely to improve quality of life, participation in general education activities, and preparation for employment. Teaching peer manding and reinforcer delivery behaviors

needed for social skill development should be a priority for researchers, families, and practitioners.

2.0 LITERATURE REVIEW

Language interventions grounded in applied behavior analysis (ABA) have been shown to be very successful in developing language and communication skills for children with autism (National Autism Project, 2009; Sundberg & Michael, 2001; Prelock, Paul, & Allen, 2011). B.F. Skinner's book, *Verbal Behavior* (1957) serves as the field's guide for the application of behavioral principles to language. Skinner uses an operant analysis to explain various elements of language based on functional relations, analyzing the antecedent, behavior, and consequence in communicative acts. This approach is different from other widespread models, which typically use structural linguistic, syntactic, or semantic explanations of language elements (Sundberg, 2008). Using an operant analysis, Skinner labels types of communication into categories. The elementary categories include tacts (labels), intraverbals (conversational speech/ questions/ associations), mands (requests), and echoics (repeating or echoing another). All of the operants outlined above fall under the traditional "expressive" language umbrella.

Skinner also defines the importance of responding as a listener in communicative interactions. Listener behavior includes things like following directions and selecting items out of an array based on a descriptor. Other operants defined by Skinner include textual behavior (reading), transcription (spelling), and copying-a-text (writing words seen). Another relevant category of behavior needed for learning many other skills is motor imitation (doing the same motor movements as another). Often individuals with autism and developmental disabilities

demonstrate deficits in one or more of the elementary operant categories. A communicative area of particular relevance when assessing quality of life is the ability to request. In behavioral terms, a request is referred to as a mand. In *Verbal Behavior*, Skinner defined the mand as, “a verbal operant in which the response is reinforced by a characteristic consequence and is, therefore, under the functional control of relevant conditions of deprivation or aversive stimulation” (Skinner, 1957, pp. 35-36).

2.1 MAND TRAINING

Literature throughout the recent decades has consistently highlighted the importance of mand training for individuals with autism and other developmental disabilities (Michael, 1988; Sundberg, 1993; Sigafoos, Kerr, Roberts, & Couzens, 1994; National Autism Project, 2009; Kane, Connell, & Pellecchia, 2010). The National Autism Center’s meta-analysis investigating evidenced-based practices for children with Autism’s Standards Report (2009) noted “Mand training” as one of 11 “established” behavioral treatment packages.

Some benefits of mand training include increased access to desired items (Hartman & Klatt, 2005; Taylor, Hoch, Potter, Rodriguez, Spinnato, & Kalaigan, 2005; Pellecchia & Hinline, 2007; Charlop, Schreibman, & Thibodeau, 1985), decreased problem behavior (Charlop-Christy, Carpenter, LeBlanc & Keller, 2002; Carr & Durrand, 1985), and increased social initiations (Pellecchia & Hinline, 2007; Taylor, Hoch, Potter, Rodriguez, Spinnato, & Kalaigan, 2005; Kodak, Paden, & Dickes, 2012). Michael (1988) notes that mands are likely more than 50% of adult verbal interactions. Given that such a significant portion of adult communication consists of mand behaviors, it is of importance to establish sufficient procedures

for the development of mand skills for individuals with autism likely to be successful across all contexts and individuals.

2.1.1 Teaching Procedures

Manding can be quite complex. Not only do people mand for basic items, but people also regularly mand for more complex things, like information from others (Betz, Higbee, & Pollard, 2010; Marion, Martin, Yu, & Buhler, 2011), the removal of undesired things (Yi, Christian, Vittimberga, & Lowenkron, 2006), and items missing from the environment (Sweeney-Kerwin, Carbone, O'Brien, Zecchin, & Janecky, 2007; Hall & Sundberg, 1987). Researchers have found a repertoire of validated procedures for developing and strengthening complex mand skills in individuals presenting deficits in these specified areas. Recognizing the importance of developing manding skills, researchers have proposed a number of strategies for teaching and strengthening mand behaviors in individuals with autism and other developmental disabilities. A brief review of these procedures unveils the frequent use of combined procedures and some overlap in procedural descriptions.

2.1.1.1 Interrupted chain procedure.

A common procedure used in mand training is the interrupted chain procedure (Hall & Sundberg, 1987; Sigafoos, Kerr, Roberts, & Couzens, 1994; Albert, Carbone, Murray, Hagerty, & Sweeney-Kerwin, 2012). During an interrupted chain procedure, activities are taught using a series of items for a task that when combined result in a terminal reinforcer. Once the items are strongly conditioned as a part of the activity, one of the items is removed prior to the session resulting in an interrupted chain and providing a naturalistic opportunity for a mand (Betz,

Higabee, & Pollard, 2010). The interrupted chain procedure has many benefits. This procedure is most commonly used when attempting to build mands for information or mands for missing items skills (Hall & Sundberg, 1987; Sigafoos, Kerr, Roberts, & Couzens, 1994). The interrupted chain is used to teach a particular subset of manding skills. It requires contriving motivation through manipulation of the environment. The introduction to the use of the interrupted chain procedure to increase mands for missing items was demonstrated in Hall & Sundberg (1987). This initial demonstration taught mand behaviors to two deaf adolescents with severe intellectual disabilities using the interrupted chain procedure targeting a series of functional chains that resulted in terminal reinforcers (examples included soup preparation and the use of the vending machine). Results of the investigation found that the interrupted chain procedure was effective in teaching generalized mand responding for missing items for both participants across multiple items (participant one = 4 items; participant two = 3 items). The success of the interrupted chain procedure in teaching mands for missing items and information has since been replicated across diverse populations and conditions (Albert et al., 2012; Betz, Higabee, & Pollard, 2010; Endicott & Higbee, 2007; Lechago, Carr, Grow, Love, & Almason, 2010; Rosales & Rehfeldt, 2007; Sigafoos, Kerr, Roberts, & Couzens, 1994; Ziomek & Rehfeldt, 2008). The interrupted chain procedure is evidenced with individuals with and without intellectual disabilities and/ or autism. These results have been verified across a variety of age populations from ages 3 through 58 and these results are strong for a variety of tasks (Albert et al., 2012; Betz, et al., 2010; Endicott & Higbee, 2007; Lechago, et al., 2010; Rosales & Rehfeldt, 2007; Sigafoos, et al., 1994; Ziomek & Rehfeldt, 2008). Examples of mands mastered through the interrupted chain procedure include materials for making pudding, listening to music, making art projects, setting the table, and building a puzzle. Developing these skills falls outside the scope of this investigation and

generally would not provide the most efficient and parsimonious approach to cultivating basic mands among peers.

2.1.1.2 Incidental teaching.

Incidental teaching, and related naturalistic approaches such as Milieu teaching (Hart & Risley, 1975; Kaiser & Hester, 1994; McGee, Almedia, Sulzer-Azaroff, & Feldman, 1992; Shafer, 1994) provide a naturalistic alternative to more contrived language interventions. Hart and Risley (1975) describe incidental teaching as “the interaction between an adult and a single child, which arises naturally in an unstructured situation such as free play and which is used by the adult to transmit information or give the child practice in a developing skill” (p. 411). One generally noted benefit of incidental teaching is that the skills are practiced in a natural environment, thereby promoting the likelihood of relevant use of language in the natural environment and potentially increasing the likelihood for generalization. The use of incidental teaching procedures has been shown to increase the use of compound sentences in generalized play situations with peers for preschool children from low income families (Hart & Risley, 1975), to increase the use of specific language targets (including mands) and the frequency of spontaneous utterances in children ages 3 to 6 years old with language delays (Kaiser & Hester, 1994), and to increase peer initiations and peer reciprocal interactions in preschool participants with autism (McGee et al., 1992). In all of the noted investigations the authors reflect upon moderate levels of maintenance following the fading or removal of the incidental teaching procedures for at least one participant (Hart & Risley, 1975; Kaiser & Hester, 1994; McGee, et al., 1992). In the recent review of language intervention literature for children with autism, Kane, Connell, and Pellecchia (2010), found that contrary to popular opinion, naturalistic approaches to language intervention were actually less supported in promoting language skill generalization than contrived approaches.

Although there is support for naturalistic approaches, the use of contrived approaches with dense opportunities to practice skills may result in stronger generalized responding following the removal of the teaching procedures.

2.1.1.3 Script training.

The use of script training, multiple exemplar training through the use of scripts, (Charlop, Schreibman, & Thibodeau, 1985), or use of script training plus extinction (Betz, Higabee, Kelley, Sellers, Pollard, 2011) provide other alternatives to mand training procedures. Script training is a format for teaching mands that typically embeds a request enveloped in a multiple word phrase. Often these multiple word phrases are referred to as carrier phrases. Common scripts include “I want the _____,” “I want _____ please,” and “_____(name), can I have the _____(item).” Script training is often combined with other teaching procedures.

Charlop, Schreibman, and Thibodeau (1985), required the “I want” carrier phrase in order to record a particular response as a mand. This investigation used a time delay procedure and required the “I want _____” phrase in order to deliver the desired item (Charlop et al., 1985). The seven participants ages 5 to 10 with autism all learned to spontaneously request items without verbal stimuli in the antecedent and saw generalized success across environments and unfamiliar people. Although the investigators were successful in freeing the mand from an intraverbal prompt in the antecedent (i.e. “what do you want”), the use of carrier phrases like “I want,” promote the development of language skills based on a basic extension of the mean length utterance, without consideration of a functional extension of language. Mand development in neurotypical children does not follow a formulated pattern for requesting using the same single phrase or few standard phrases with a request. The expansion of the length of utterances typically

develops naturally and with functional purpose for example, expanding from a request for “ball”, to “throw”, and eventually to “throw ball” (Sundberg, 2007).

Betz, Higbee, Kelley, Sellers, and Pollard (2011) used script-training procedures to increase the variability of carrier phrases used to request preferred items for three preschool participants with autism. The use of multiple carrier phrases was implemented in attempt to increase novel request patterns for generalization and the use of faded prompt procedures plus extinction was designed to promote variation in responding. Script training plus extinction was successful in teaching up to six phrases or novel mand frames instead of the one mand frame observed in baseline for two of the three participants. The third participant demonstrated difficulty with the set script training plus extinction procedures and an alternative intervention was implemented which still resulted in limited improvements in generalization. The rote presentation of trained carrier phrases even if multiple are available within the participant’s repertoire presents an issue. Depending on the level of the learner, the use of single word mands as seen in typically developing learners at early stages of manding (Sundberg, 2007), may be more functionally appropriate, less effortful to learn, and more natural in presentation across settings, people, and items.

Script training is also used to teach mands for information (Marion, Martin, Yu, & Buhler, 2011; Marion, Martin, Yu, Buhler, & Kerr, 2012; Roy-Wsiaki, Marion, Martin, & Yu, 2010). When using scripts to teach mands for information, the investigators designed scripts for the facilitator to present to the participants in combination with set environmental conditions in attempt to develop conditioned motivative operations (CMO) for a particular mand. Roy-Wsiaki et al. (2010) implemented a script training package which combined, CMO manipulation, time delay, prompt fading, and consequences for responding to teach mastery of the mand “what is it”

across a variety of conditions to a 5-year-old participant with autism. The treatment package was effective in achieving mastery and generalization of the “what is it,” mand across four CMO conditions. The results of Roy-Wsiaki et al. (2010) provided a framework for replication in which Marion et al., (2011) were able to replicate the effects of the scripted CMO manipulation treatment package to teach the mand “what is it” to three participants with autism ages 4 to 8. Mastery of the “what is it” mand was evidenced by participants across all four CMO conditions and throughout generalization probes (Marion et al., 2011). Marion et al. (2012) used a script training package combining, CMO manipulation, time delay, prompt fading, and consequences for responding to teach the mand “where” across four CMO conditions. All three participants with autism ages 3 to 5 mastered the mand for “where”/ “where is it” in the training phase, and all participants demonstrated increased rates of appropriate use of the mand “where” in the generalization phases (Marion et al., 2012).

2.1.1.4 Time delay.

Delayed assistance, otherwise known as a time delay (Charlop, Schreibman, & Thibodeau, 1985; Hall & Sundberg, 1987; Halle, Marshall, Spradlin, 1979; Sigafoos, Kerr, Roberts, & Couzens, 1994; Sweeney-Kerwin, Carbone, O’Brien, Zecchin, & Janecky, 2007) offers an additional approach to mand training. Time delay procedures as outlined in Charlop, Shreibman, and Thibodeau (1985) have evidence to support mand skill acquisition and generalization. In the time delay procedure, prompts are provided to the participant after a period of time has passed, often allowing the participant to respond prior to the provision of prompts. There are two general time delay formats: a constant time delay and a progressive or “rolling” time delay. When using a progressive time delay or rolling time delay, instructors gradually increase the amount of time between the presentation of the stimulus and the delivery of a prompt (Neitzel & Wolery, 2009).

When using a constant time delay procedure, there is often no time between the presentation of the stimulus and the delivery of the prompt when a learner is first learning a skill. As the learner becomes proficient with the new skill, a fixed amount of time is used between the presentation of the stimulus and the prompt (Neitzel & Wolery, 2009). Time delay procedures apply careful attention to fading prompts through a progressive passage of time prior to the prompt (Charlop, Schreibman, & Thibodeau, 1985). A participant response prior to the prompt indicates that stimulus control has transferred from the prompt to the target (Charlop, Schreibman, & Thibodeau, 1985).

Halle, Marshall, and Spradlin (1979) also saw strength in use of the time delay procedure, but required a “want” or “please” to accompany a response in order to categorize it as a request. The use of a set 15 s time delay was successful in increasing meal-time request skills among three of the six participants with autism ages 11 to 15. Two participants demonstrated an increase in the percentage meal-time requests when the 15 s time delay was combined with modeling. For the final participant, Joel, intensive training including repeated opportunities to practice skills was added to the time delay and modeling procedures, which resulted in an increased percentage of meal-time mands (Halle et al., 1979). The time delay procedure and time delay as part of a treatment package were effective in increasing meal-time requests for all six participants. As outlined in the preceding sections, the time delay procedure is frequently combined with other strategies to increase mand behaviors and is a vital component to many mand training interventions (Albert et al., 2012; Charlop et al., 1985; Endicott & Higbee, 2007; Hall & Sundberg, 1987; Lechago et al., 2010; Marion et al., 2011; Marion et al., 2012; Roy-Wsiaki et al., 2010).

One benefit of the time delay procedure, as well as many incidental teaching procedures, is that it frees the mand from the intraverbal control of another speaker (Hall & Sundberg, 1987). One extremely important element of manding is to be able to request an item at any time it is desired. Often mands are taught as a part of a communicative exchange starting with a facilitator asking the participant, “what do you want.” This phrase and similar phrases frequently come to serve as discriminative stimuli for mand behavior, signaling that when asked the individual can mand. Often individuals learning to request are then limited to manding only when asked “what do your want,” associating the vocal verbal phrase of “what do you want” as needed in order to request desired items. In these circumstances, pure motivation and even the presence of the item are not guiding mand behavior, the request comes only as an intraverbal response when a third party asks the individual, “what do you want,” or a similar phrase. Time delay procedures eliminate the variable of intraverbal control of mands by the facilitator (Hall & Sundberg, 1987).

Just as it is important for manding skills to be free from intraverbal control, allowing the learner to make requests without facilitator initiation, it is also important for the learners to develop requesting skills that are free from dependency on the presence of the item. Requests made in the presence of the item are multiply controlled responses, partially guided by the presence of an item (tact), and partially guided by motivation (mand) (Hall & Sundberg, 1987). It is of importance for all to be able to actively communicate desires and needs regardless of whether or not an item is present. Time delay procedures can also be an effective procedure for developing motivating operation (MO) controlled mands, without the item(s) present.

Sweeney-Kerwin, Carbone, O’Brien, Zecchin, and Janecky (2007) implemented the use of a rolling time delay procedure and prompt fading to increase MO controlled mands for two participants with autism ages 3 and 7. The use of a rolling time delay and prompt fading was

effective in establishing the mastery of MO controlled mands through a cold probe procedure (Martin = 4 mands; Jeff = 2 mands) and was effective in maintaining unprompted MO controlled mands for all mastered mands in the generalization and maintenance phases (Sweeney-Kerwin et al. 2007). Time delay procedures have the benefit of teaching mands in a format that protects the learner from controls other than motivation that may limit the learner's fluent production of mands in the natural environment.

The selection of relevant mand teaching procedures is of significant importance in ensuring efficient mastery of mand skills. Other variables that frequently influence the success of functional mand development for learners in manding programs include issues with motivation, prompt procedures, and difficulties with generalization.

2.2 MOTIVATION

Effective use of establishing operations (EOs) is a key variable in mand training (Hartman & Klatt, 2005; Sundberg, 1993; Sundberg, 2005; Sweeney-Kerwin et al., 2007; Taylor, et al., 2005). An establishing operation as defined by Michael (1993), "is an environmental event... that affects an organism by momentarily altering (a) the reinforcing effectiveness (value) of other events, and (b) the frequency of occurrence of that part of the organism's repertoire relevant to those events and consequences" (p. 192). "Effective application of the EO, like the effective application of other behavioral principles and concepts, requires special training" (Sundberg, 2005, p. 9). In 2003, Michael and colleagues suggested a transition from the term establishing operation to the term motivating operation (Laraway, Snyckerski, Michael, & Poling, 2003). This slight change in terminology is because the term "establishing" implies an increase in the

effectiveness of a consequence as a reinforcer and does not provide a clear term that allows for the decrease in the effectiveness of consequences (Laraway et al., 2003). Use of the term motivating operation allows for both increasing effects (MO) and decreasing effects (Abolishing Operation – AO). The terms establishing operation and motivating operation will be used interchangeably throughout the remainder of the paper.

It is of primary importance when facilitating mand training to ensure to the greatest extent possible that responses made by participants are controlled by the EO and that the response is not being controlled by a discriminative stimuli (S^D). Both the S^D and EO evoke behavior, but for different functional reasons (Sundberg, 2005). For mand training it is crucial that the EO controls the response. Sundberg (2005) highlights the importance of the trainer's ability to tact the presence and strength of an establishing operation (Sundberg, 2005). Without the ability to read motivation an individual could easily mistake a tact for a mand. For example a student might respond with the vocal response, of “apple” when the instructor holds up the apple, but when handed an apple does not consume the apple and instead pushes the apple to the side. This response of “apple” is more of a tact than a mand, but could easily be misinterpreted by an instructor who has not been sufficiently trained in identifying establishing operations and gauging strength of establishing operations.

Procedures designed by the instructor to manipulate motivation are of significant relevance when assessing mand research and results. To teach manding, instructors must be able to not only tact the presence and strength of EOs, but instructors must also have strategies in place to ensure that items integrated into mand training are those most likely to have strong motivation that maintains across time and is protected from the effects of repeated exposure.

Manipulation of motivation is needed to develop mand behaviors in individuals that do not develop sufficient mand skills in the natural environment (Michael, 1988).

Motivation is also affected by the frequency and duration of access to items. Free access to target mand items prior to teaching sessions can influence mand frequency and the EOs of targeted items. Hartman and Klatt (2005) indicated that pre-session exposure to mand target items resulted in slower rates of mand acquisition than items targeted after a 23 hr deprivation period. The authors assessed mand acquisition rates for two participants with autism both 2.5 - years-old and found that both participants mastered targeted mands more quickly if the mand sessions were directly preceded by a 23 hr deprivation period from the targeted mand items (Hartman & Klatt, 2005). Careful attention to the motivational value of items throughout instruction is key to successful mand training. The results indicate that items only accessible during teaching sessions can increase motivational value thereby increasing mand frequency (Hartman & Klatt, 2005). Limiting the availability of target items being used in mand sessions to “session-only” access can increase motivation for preferred items, increasing the mand frequency and strengthening EO for target items. Having a variety of preferred items to protect against habituation is also of key importance. If mand training is conducted without sufficient diversity in available preferred items, problems with fleeting EO are likely. Because of frequently changing conditions, the relative value of items in well executed mand training requires the instructor to be able to assess and identify changes in motivation in the teaching session and make adjustments to teaching procedures and materials as indicated (Sundberg, 2005). Although formal preference assessments provide valuable information on the general relative ranking of preferences, the use of formal preference assessment procedures without the ability to read immediate EO changes is problematic (Sundberg, 2005).

2.2.1 Preference Assessments

The use of preference assessments to identify preferred items to be targeted during mand training helps protect against fleeting motivation and weak establishing operations when teaching manding. There are four main types of preference assessments, paired stimulus, multiple stimulus without replacement, multiple stimulus, and free operant. The selection of reinforcing items for mand training is of significant importance for successful mand programming. The use of preference assessments can help guide instructors to the selection of reinforcing items.

2.2.1.1 Paired stimulus.

Paired stimulus (PS) preference assessments require a forced choice through presenting only two items at the same time. The session continues until each item is paired with all other items (DeLeon & Iwata, 1996). The use of PS assessments has resulted in higher rates of problem behavior than the free operant preference assessment format (Roane, Vollmer, Ringdahl, & Marcus, 1998). An additional limitation of the PS assessments is that they may identify items as potential reinforcers that would not be identified as preferred in a free operant condition (DeLeon & Iwata, 1996). The items identified as preferred based on the PS preference assessment may not actually serve as reinforcers at all. The PS format can present in a similar manner as instructional demands. For students with a limited tolerance for demands, the PS presentation of potentially preferred items could be potentially problematic or counterproductive (Roane, Volmer, Ringdahl, & Marcus, 1998).

2.2.1.2 Multiple stimulus without replacement.

An alternative to the PS preference assessment is the use of multiple stimulus presentation formats. When using a multiple stimulus without replacement (MSWO) procedure, items are lined up in an array and sequenced randomly. After a selection is made the item is removed from the assessment area, no replacement item is introduced. The items are selected from until all items are selected or 30 s ends without a selection (DeLeon & Iwata, 1996). The MSWO procedure has been shown to have the same predictive validity in identifying preferred items as the paired stimulus procedure, but taking only half of the time to administer (Hagopian, Rush, Lewin, & Long, 2001).

2.2.1.3 Multiple stimulus.

The multiple stimulus preference assessment (MS) procedure is the same as outlined above for the MSWO procedure, but in the MS procedure the items selected are replaced after each selection with the same item or an identical item. Some items not selected during the MS condition actually served as a reinforcer when tested (DeLeon & Iwata, 1996). A common issue with the standard MS format is that the participants will often pick the same one or two items. Both multiple stimulus preference assessments were faster to administer than paired stimulus preference assessment (DeLeon & Iwata, 1996).

The multiple stimulus without replacement preference assessment format has shown to more consistently identify reinforcers over administrations and provides some protection for the limitations of forced choice often seen with standard paired stimulus preference assessment (Iwata & DeLeon, 1996). MSWO procedure is more efficient than traditional paired stimulus preference assessments and it presents ease in implementation in natural environments (Carr, Nicholson, & Higbee, 2000).

2.2.1.4 Free operant.

The use of the free operant checks prior to teaching sessions allows instructors to account for the immediate value of preferred items (Sundberg, 2005), and also results in less problem behaviors than the paired stimulus format (Roane, Volmer, Ringdahl, & Marcus, 1998). A limitation Roane et al. (1998) found with the free operant preference assessment format was that most participants selected only one item during the entire session, limiting the ability to gather a variety of potential reinforcers for use. The problem with only completing a free operant assessment is that it can provide little if any information for the instructor on the relative ranking of preferred items (Roane, Volmer, Ringdahl, & Marcus, 1998). Another issue with using solely a free operant preference assessment is that many participants picked one item for all sessions and the format of presentation does not encourage selection of an array of items (Roane, Volmer, Ringdahl, & Marcus, 1998).

Preference assessment procedures provide instructors with some protection against the frequent issues with motivation, which often hinder mand program success. Implementing a combination of preference assessment procedures may provide instructors with extra assurance that items identified in the preference assessment process are likely to serve as reinforcers during mand training. Careful consideration of the prompt procedures is another key variable in successful mand programming.

2.3 PROMPT PROCEDURES

In the ongoing classroom environment there is almost always a combination of variables interacting that when combined serve as a signal for a specified response(s). In an effort to

ensure that the generalization of mand behavior to peers is occurring under the right circumstances, attention to adult prompting procedures is needed. The structure of teaching sessions should incorporate procedures that promote peers as the strongest stimulus for the response, and facilitator prompts must be as minimally invasive in the communicative exchange as possible. Instructor manipulation of materials and even prompt rate can also effect the development and maintenance of functional peer mand skills (Falcomata, Ringdahl, Christensen, & Boelter, 2010; Sweeney-Kerwin et al., 2007; Hartman & Klatt, 2005; Charlop et al., 1985). Clear prompt procedures and management of environmental cues must be carefully controlled to ensure that EO and peer presence are serving as the controlling stimuli for participant responses and not instructor behavior (Falcomata, Ringdahl, Christensen, & Boelter, 2010). If instructor prompts and instructor environmental manipulation of materials are controlling variables for the participant's mand response, then the peer presence and EO for items alone are not likely strong enough to reliably produce the same peer mand response in the absence of the instructor. In practice it may appear that the participant has mastered mands through instructor-facilitated sessions, but the mands are not likely to generalize to natural opportunities.

2.4 GENERALIZATION

Frequently noted barriers to functional mand use for children with autism include difficulties with the generalization of mands to different people, places, exemplars, and the transference of skills to unprompted environments (Stokes & Baer, 1977; Prelock, Paul, & Allen, 2011, p. 125; Charlop et al., 1985). The generalization of mands cannot be evaluated without also taking careful consideration of motivation. As Fragale, O'Reilly, Aguilar, Pierce, Lang, Sigafoos, and

Lancioni (2012) note, if motivation for the object of a mand is fleeting, it may appear that mands have not been acquired or generalized, when this is not really the issue. Different instructional approaches are often noted as potential reasons for issues with generalization. Naturalistic approaches to language interventions are often contrasted to contrived approaches (Kane, Connell, & Pellechina, 2010). One frequently noted concern with language interventions for children with autism is the failure to transfer skills taught in contrived instructional sessions to naturally occurring situations. A recent meta-analysis evaluating the generalization of language interventions for children with autism found that despite the intent naturalistic interventions, this format demonstrated less generalization than contrived interventions (Kane, Connell, & Pellechina, 2010).

2.5 PEERS

Implementing contrived language interventions without careful consideration for generalization could result in skill acquisition data that does not represent a participant's functional ability to demonstrate language skills throughout diverse experiences. Issues with generalization could have effects on socialization if mand targets taught by instructors do not generalize to peers (Higbee & Sellers, 2011; Lorah, Gilroy, & Hinline, 2013; Pellecchia & Hinline, 2007; Taylor et al., 2005). Specific attention to ensure that manding is transferring across individuals to peers is needed. Failure to mand to peers significantly limits the opportunity to participate in social interactions and to gain access to desired items and activities (Kodak, Paden, & Dickes, 2012; Lorah, et al., 2013; Pellecchia & Hinline, 2007; Taylor et al., 2005). Manding to peers is a foundational skill needed for the development of other social skills (Kodak et al., 2012; Lorah et

al., 2014; Pellecchia & Hineline, 2007; Taylor et al., 2005). Students with autism can learn to mand for preferred items from their peers with careful manipulation of establishing operations (Hartman & Klatt, 2005; Taylor et al., 2005).

3.0 PEER MANDING EXISTING RESEARCH

A search for existing literature on peer-to-peer manding was conducted through PsychINFO and Educational Resources Information Center (ERIC) databases using the university online library system. The search included various combinations of the following terms: mand, mands, manding, peers, peer-to-peer manding, peer requests, requests, autism, and autism spectrum disorders. In addition, manual searches of the *Journal of Applied Behavior Analysis* (JABA) and the *Analysis of Verbal Behavior* were conducted to find related articles not captured by the original search. The results of the search were further narrowed through employing a focus on experimental interventions for teaching peer manding skills. From the review process only five studies remained. A brief review of the current literature provides a focus on the progress made in peer-to-peer manding procedures, the limitations in existing research, and the areas of need for future research.

3.1 STUDY ONE

Taylor, Hoch, Potter, Rodriguez, Spinnato, and Kalaigan (2005), provides a strong foundation for peer-to-peer manding in a naturalistic classroom environment. The purpose of the study was to assess the effects of manipulating the EO using deprivation of preferred snacks to assess the frequency of mands between peers with autism. Participants' preferred snacks were placed out

of the reach of the participant, but in the reach of the peer in attempt to manipulate motivation for peer requests. The focus of investigation centered heavily on EO manipulation rather than peer mand behaviors.

Taylor et al., (2005) used a reversal design to assess the number of independent mands directed towards peers during mand sessions for three participants with autism ages 4 to 12-years-old. Investigators introduced deprivation from preferred snacks, peer controlled reinforcers, and prompts using a time delay procedure with peers to increase independent peer directed mands in a school based setting. Two of the three participants demonstrated zero peer directed mands during the baseline peer condition and the third participant demonstrated eight requests to peers during this condition. Following adult mand training with manipulation of the EO, the participants experienced increases in unprompted mands, and through continued use of the time delay and EO manipulation in the peer condition, the results quickly generalized from adults to peers. The peer condition with manipulation of EO and time delay was effective for all three participants in increasing the unprompted mands to the maximum 10 unprompted peer directed mands per session.

Some areas for consideration when interpreting the results include that one of the three participants was a device user, which could affect rate of responding, prompt procedures, and response time by peer. Teaching basic mands not previously acquired with adults throughout the peer intervention phase also presents complexities that could likely affect the results. The procedures outlined for teaching mands with adults and transferring mands to peers lacks clarity for replication. The authors note that least-to-most prompting was used to teach mands, but an example of a model prompt request was given with the use of a carrier phase and use of a full sentence. The results of the investigation provide a foundation for future research. All of the

participants demonstrated increased initiations when the EO manipulation condition was in place.

3.2 STUDY TWO

Pellecchia and Hineline (2007) provides the research community with confirmation that mand training does not generalize to peers or siblings without specific training. The investigators introduced a mand treatment package comprised of differential reinforcement and a time delay procedure through a multiple baseline design to assess the percent of unprompted mands per session out of the total mand opportunities for three children with autism ages 4 and 5. The introduction of the mand treatment package was intended to increase unprompted mands to parents, siblings, and peers. Parent and sibling sessions were conducted in the home and peer sessions were conducted in a preschool environment. The implementation of differential reinforcement and the time delay procedure increased unprompted mands for all three participants with parents, siblings, and peers. All three participants demonstrated increased unprompted peer mands following intervention in the peer condition, with the final two data points for all three participants above 80% unprompted mands.

A consideration when interpreting the results includes that the authors provided little explanation of how EOs affect mand training and mand rates. Although PS preference assessments were completed, little attention was brought to this issue throughout the design and discussion. Unlike other similar studies, Pellecchia and Hineline (2007) utilized differential reinforcement for unprompted requests, by allowing the participants longer access to items for more independent responding. Although there are benefits to the use of differential

reinforcement to strengthen unprompted mands, extending the duration with items could affect participant response rates. Pellecchia and Hineline (2007) focused on mand generalization across parents, siblings, and peers. Developing peer mand skills is still only a small part of the overall investigation. The results provide an introduction to the use of differential reinforcement as a key component for selecting out desired behaviors during peer mand training. All participants demonstrated an increase in the percentage of unprompted peer mands in peer manding sessions.

3.3 STUDY THREE

Paden, Kodak, Fisher, Gawley- Bullington, and Bouxsein (2012) extends Taylor et al. (2005) by assessing peer-to-peer manding for students with autism by extending the population to include individuals with autism using the Picture Exchange Communication System (PECS) (Bondy & Frost, 2001) as their primary mode of communication. This investigation provides initial insight into peer-to-peer manding using PECS, but has considerable limitations in the extension of research due to procedural and methodological concerns.

Paden et al. (2012) assessed the frequency of independent and prompted mands in two non-vocal, PECS using participants with autism ages 7 and 9 in a university-based early intervention program. Using a multiple baseline across participants with a reversal, Paden et al. (2012), introduced a mand training treatment package consisting of differential reinforcement of alternative behavior (DRA) plus prompting procedures in an effort to increase peer mands. Both participants displayed 0 peer mands in baseline and during intervention displayed as many as 4 mands per minute. The DRA plus prompts procedure consisted of blocking adult fulfillment of mands and providing access to reinforcement through prompted and unprompted peer mands.

Although the investigators demonstrated that DRA plus prompts was an effective treatment package for increasing peer mand behavior with PECS, the return to baseline levels indicate that peers were not serving a stimuli for mand behavior when the DRA plus prompts procedure was removed. Without the prompt procedure the participants immediately went back to asking the adults for desired items. Instructor arrangement of distracter cards on the PECS board, and facilitation of the delivery of the reinforcer to the peers are causes for concern. Such high levels of adult involvement are likely to interfere with the stimulus strength of the peer (plus the item(s)) as a signal for the mand response. An additional area for consideration is that peers accepting delivery of PECS cards and delivery of reinforcers to peers were not taught. These skills are vital to the communicative exchange and could affect rates of reinforcement and ultimately peer mand response rates. Paden et al. (2012) provides a framework for extending peer-to-peer manding work to PECS users. The results show increased manding when the DRA plus prompts conditions were in place, but very little sustained peer manding when the procedures were removed. Adult interaction so heavily embedded in the procedures may be a factor influencing the results. The communicative partner's ability to accept PECS and deliver the requested reinforcers with relative independence is another variable that may have influenced the results.

3.4 STUDY FOUR

Kodak, Paden, and Dickes (2012) extends the research of Paden et al. (2012) by assessing peer-to-peer manding procedures for PECS users requiring distance approach behaviors reflective of natural play situations. The treatment extension phase of the investigation required the

participants to travel a set distance to a novel peer interacting with an item while the peer's back was turned to simulate natural play environment. In similar form to Paden et al. (2012), the investigation had two elementary aged participants and both participants used PECS as their primary mand response mode.

Kodak et al. (2012) used a multiple baseline across participants design with a reversal and a treatment extension phase, to assess the frequency of independent peer directed mands for two non-vocal children with autism ages 5 and 9, using PECS as their communicative response mode in a university-based early intervention program. The investigators were successful in implementing a mand treatment package consisting of prompts plus extinction to increase independent peer mands in both participants, from baseline levels of 0 independent peer mands per minute to rates as high as 2 to 3 independent peer mands per minute following introduction to the intervention. The prompts plus extinction procedures included blocking the mand responses to adults and implementing a peer mand prompt procedure. The increase in independent peer mands gained in intervention, maintained throughout the treatment extension phase for one of the participants with rates of close to 2 peer directed mands per minute with novel peers and a distance approach.

As in Paden et al. (2012), adult prompting to accept the PECS card for the receiving partner and to give the requested item are problematic and are likely to have influenced peer mand behaviors. Another area for consideration, is that Kodak et al. (2012) fails to track adult directed mands during treatment. The prompt procedure used by investigators to prompt the peer mand directly following an adult mand could likely lead to a defective mand chain. In such a chain, the adult plus the items and PECS card are all likely serving as the relevant stimuli for the mand, and not the peer. The fulfillment of adult directed mands during baseline also likely

competes with the development of peers as a signal for reinforcement. Kodak, Paden, and Dickes (2012) provides an extension to the current peer-to-peer manding literature focusing on approach behaviors in addition to requesting behaviors. Both participants demonstrated increases in unprompted mands per min in the prompts plus extinction condition. One of the participants showed success in the novel peer distance approach extension without prompt procedures condition. The second participant needed additional training to reach the same level of success when prompt procedures were removed during the return to baseline.

3.5 STUDY FIVE

Lorah, Gilroy, and Hineline (2014) has taken peer-to-peer manding a step further, highlighting the importance of the listener role in a communicative peer exchange. Using a multiple baseline across participants, Lorah et al. (2014) assessed the effects of MO manipulation through the use of an interrupted chain, and a 5 s time delay on peer mands and delivery of reinforcers to peers for six participants with autism ages 4 and 5 in a center-based behavior program. The effects of the mand treatment package were measured based on the percent of independent peer mands, the percent of independent deliveries of reinforcers as a listener, and the numbers of trials to criterion. During intervention, all three speaker participants demonstrated an increase in independent peer mands, from zero independent peer mands during baseline to, 65% or greater of peer mand opportunities scored as independent in intervention. All three listening participants also demonstrated increases in the independent delivery of reinforcers as a listener throughout intervention. Unfortunately baseline data could not be collected on this measure because peer partners did not demonstrate any requests to fulfill. Although peer mand and listener response

results maintained strong for participants across maintenance probes, only one participant stayed above mastery level for both mand behavior and listener behavior when skills were assessed with a novel peer in the generalization phase (Lorah et al., 2014).

The investigators used simple puzzles with three to 12 pieces during peer manding sessions. Partners would construct puzzles at their instructional levels, and peer partners held the remaining piece(s) of the puzzle needed for completion. In baseline, no prompts were delivered to the “speaking” partner to mand for a piece, and no prompts were given to the listening partner to deliver the requested item. In intervention, when the “speaker” participant needed the remaining puzzle piece(s) a 5 s time delay was implemented to prompt for the mand, and likewise a 5 s time delay procedure was implemented to prompt for the delivery of the requested item for the listening participant.

Lorah et al. (2014) has brought attention to the relevance of listener behavior in peer mand programming, an important element largely overlooked in previous research. There are other elements of the investigation that also should be considered when interpreting the results and evaluating further research needs. One element of concern when interpreting the results of the investigation is the value of puzzle pieces as a preferred item for all participants. The use of the interrupted chain procedure provides some manipulation of MO that might increase the likelihood of motivation for an item, but generally speaking it is not likely that the puzzle pieces truly serve as a strong reinforcer likely for all participants to desire throughout a variety of environments. Without identifying reinforcers meaningful to the individual participants, mand behaviors are not likely to occur at high frequencies and are not likely to be relevant across environments.

An additional issue that limits the impact of the results is that the investigators did not collect baseline data on deliveries of reinforcers to peers. By using communicative partners that needed mand training, there was no way to assess the delivery of reinforcers to peers by listening partners during baseline. Another significant component of the intervention that presents concern is the failure to include multiple items to choose from for both the listener and the “speaker.” Discrimination must be embedded to ensure that picture selection is really serving as a specific mand for “speaking” partners and that item delivery is actually serving as listener response behavior for the listening partner.

4.0 CONCLUSIONS AND RESEARCH QUESTIONS

The research noted above provides some introductory investigation in peer-to-peer manding. These authors have identified a crucial area of needed development and have presented the research community with promising outcomes. All of the investigations show improved participant outcomes, but some methodological design issues leave the research community in need of additional investigations with attention to specific details.

One area of oversight in previous peer-to-peer manding research is the lack of methodological control and defined procedures for teaching peers to deliver reinforcers to one another. In the most recent article, Lorah et al. (2014) provides an introductory investigation into procedures for teaching individuals with autism to respond as a listener in peer-to-peer manding. However, the failure to ensure prerequisite mand skills of partners for baseline conditions and the lack of attention to mand and listener discrimination through use of multiple items, limits the impact of the results. None of the other peer manding articles reviewed address the issues of listener behavior or reinforcer delivery.

Another area of consideration is the peer's ability to interpret the response and response mode of the communicative partner and deliver the item selected. Of the five studies reviewed, Pellecchia and Hineline (2007) is the sole investigation with participants and communicative partners all responding vocally. Although there is value in continued research in peer manding for individuals with alternative and augmentative communication (AAC) systems, the

introduction of AAC systems to the procedures brings added complexity regarding prerequisite skills needed for participation as a speaker and listener, prompt procedures, and additional variables of multiply controlled responding (match-to-sample instead of pure mand or tact controlled mand).

The careful use of differential reinforcement in peer-to-peer manding procedures is another area of significant consideration when reviewing current research. Pellecchia and Hineline (2007) is the only study of the five reviewed, which included the use of differential reinforcement in shaping peer mand behaviors in the research design. The use of differential reinforcement is a key component for increasing peer mand behaviors and peer reinforcer delivery behaviors. Pellecchia and Hineline (2007) utilized differential reinforcement for unprompted mands by extending the duration of access to requested items for longer periods of time. Shorter periods of access to reinforcers were implemented for prompted mands. One issue with the application of differential reinforcement through increased duration of reinforcer access is that the rate of peer mands can become controlled by the instructor's resetting materials rates, and not the participant's actual mand rate. Instructor determined access to materials based on duration has the potential to control the frequency of mands.

Another significant limitation in current literature is that the recent investigations are removed from a standard elementary school classroom environment. Although classroom research presents many variables that can be difficult to control, there is also great value in demonstrating the successful implementation of research-validated teaching procedures in the natural environment. There is strength in the practicality and logistics of research supported in the classroom that cannot be assumed for research conducted in laboratory settings. Although Taylor et al. (2005) was conducted in a natural classroom environment, the other more recent

studies were conducted in more contrived, or what appear to be clinical or laboratory environments (university early childhood center for elementary aged students). Providing peer-to-peer manding instruction in the participants' typical classroom with peers seen every day has increased likelihood for maintenance of skills and generalization to other peers in the natural environment.

Following is a study designed to address some of the limitations identified in the current peer-to-peer manding literature. The study is an analysis of peer-to-peer manding skills, which focuses on the development of unprompted peer mands in elementary aged students with ASD/IDD in a public school setting. In this investigation, each participant served as both the speaker/requester and the listener communicative partner for his/ her peer. This investigation evaluated teaching the delivery of reinforcers to peers, the maintenance of peer manding skills over time, and the generalization of peer mands to novel general education peers. The specific research questions are: (1) What effect(s) will the introduction of a peer-to-peer manding treatment package consisting of the use of differential reinforcement and time delay procedures have on the rate of unprompted peer mands in individuals with autism and IDD and (2) What effect(s) will the use of time delay procedures and differential reinforcement have on the rate of deliveries of preferred items to peers in individuals with autism and IDD?

5.0 METHOD

5.1 PARTICIPANTS

The study consists of three different participant groups, the primary participants (child participants with an intellectual disability, language delay, or autism diagnosis), secondary participants (general education peers), and instructor participants.

5.1.1 Primary Participants

The primary participants consisted of three dyads for a total of six participants with autism or other intellectual/ developmental disabilities (see Table 1). All participants were ages 6-10 and all were vocal responders. Participants were required to have developed a basic manding repertoire of a minimum of 20 combined items or actions to adults prior to inclusion. Participants also had to present considerable language delays based on their *Verbal Behavior Milestones Assessment and Placement Program* (VB-MAPP)(Sundberg, 2007), demonstrated by missing skills that are equivalent to language/ developmental milestones acquired by typical learners at 18 to 30 months. All participants were required to demonstrate competency in receptively identifying basic items or pictures from a messy array of 6 for 40 different objects or pictures (VB-MAPP, LR, M-6). The participating instructors were highly trained in the administration and scoring of the VB-MAPP assessment through ongoing consultation in behavior analysis.

The instructor participants conducted VB-MAPP assessments with the scores used for participant selection within six months of the start of the investigation. To the greatest extent possible, participants included could readily give up reinforcers when asked throughout the instructional day based on teacher report. All participants were reported to have difficulty requesting items from peers and all participants recommended for participation by teachers were “free of problem behavior of significance” that might interfere with instruction or would warrant the active application of a behavior intervention plan. All participants attended a public school and were assigned for at least a portion of the day to classrooms that provided intensive language and behavioral interventions. All primary participants’ parents went through the recruitment and consent procedures approved by the Institutional Review Board (IRB) (see Appendix A).

Table 1. Primary Participants

<i>Student</i>	<i>Age</i>	<i>Gender</i>	<i>Primary Classification</i>	<i>VB-MAPP Score at Study Onset</i>
Bella	9	Female	Autism	124.5
Calvin	9	Male	Autism	117.5
Mark	7	Male	Autism	86
Caleb	6	Male	Autism	88.5
Isaiah	7	Male	Autism	129.5
Carter	10	Male	IDD	96.5

Note: VB-MAPP = Verbal Behavior Milestones Assessment & Placement Program, Total possible score = 170

5.1.2 Secondary Participants

The secondary peer participants were neurotypical students that attended school with the primary participants in the study (see Table 2). Secondary peer participants were recruited with the

collaboration of the building principal that shared the opportunity to serve as a peer support in a research study with parents in the parent-teacher association. All secondary participants that demonstrated interest were in grades three through five. None of the secondary participants had any type of noted disability. The secondary participants served as peer support/ communicative partners for two peers each. All secondary participants went through the consent and assent procedures approved by the Institutional Review Board (IRB) (see Appendix A).

Table 2. Secondary Participants

<i>Student</i>	<i>Grade Level</i>	<i>Gender</i>	<i>Classification</i>
Zoe	3 rd	Female	None
Sam	5 th	Male	None
Adam	4 th	Male	None

5.1.3 Instructor Participants

Instructor participants were recruited through the support of the district special education administration (see Table 3). An introductory meeting explaining the study and the elements of instructor participation were presented to all para educators and teachers serving in two life skills special education classrooms. Instructor participants signed up for participation in the investigation through compliance with the IRB approved process (see Appendix A). All instructor participants received 6.5 hrs of formal competency-based training on instructional procedures and data collection following consent procedures and prior to beginning research sessions. As primary facilitators, the instructors managed instructional materials, implemented teaching procedures and prompts, and collected data on unprompted mands and unprompted

deliveries of reinforcers to peers. Prior to conducting baseline sessions, all participants demonstrated 100% mastery on all teaching procedures and prompts as needed to serve as an instructor.

Table 3. Instructor Participants

<i>Instructor Participants</i>	<i>Role</i>	<i>Years Receiving ABA Consultation</i>
Denise	Para Educator	.5 years
Karly	Teacher	4.5 years
Olivia	Teacher	4.5 years
Kelly	Para Educator	4.5 years
Zia	Para Educator	.5 years

Note: ABA= Applied Behavior Analysis

5.2 SETTING

All phases of the investigation were conducted in the primary participants' school and assigned classrooms. Sessions were conducted using classroom furniture that was already present in the classrooms. In most situations, the furniture used for mand sessions consisted of two traditional student desks (24" length and 18"width) with a 22" wide storage cart in the middle, and two student chairs. Early in the investigation, other table/ furniture configurations were attempted. However, there were not the same types of tables across classroom environments, and maintaining privacy during sessions was difficult with other furniture arrangements. Therefore the desk/ cart configuration was selected and maintained for the remainder of the investigation.

Other students and instructors were present in the classroom, but were outside of the instructional area designated for peer mand training. All other students in the classroom were engaged in assigned tasks in designated classroom areas, out of the direct view of the peer manding session area. The classrooms contained typical instructional materials and resources found in an elementary school classroom such as, desks, carpet, computers, chairs, and toys.

5.3 EXPERIMENTAL DESIGN

A multiple probe across dyads design (Horner & Baer, 1978; Kennedy, 2005) was used to assess the rate of unprompted mands across dyads and the rate of unprompted reinforcer deliveries across dyads. All tiers of the investigation had baseline, intervention, withdrawal, generalization phases, and maintenance sessions. The use of the multiple probe design allowed the investigator to assess participant responding without requiring sessions to be conducted on all participants every day. As a variant of the basic multiple baseline design across participants (Baer, Wolf, Risley, 1968), the multiple probe design allowed for the intermittent monitoring of responding while participants were in baseline waiting for their introduction to the intervention phase. While in baseline all participants' response rates were assessed a minimum of every five possible sessions and prior to the introduction to the intervention for any dyad. All participants were partnered with a peer for mand sessions. These partners were introduced to all changes in conditions at the same time and response results are presented together as a dyad. As in a basic multiple baseline design across participants, each dyad was introduced to each phase of the investigation after mastery criteria was met and responding had stabilized for the previous dyad. Dyads moved from the baseline to the intervention phase after the preceding dyad had met the

mastery criteria to move from the intervention phase to the withdrawal phase. The mastery criteria for progression from the intervention to the withdrawal phase was stabilized responding with approximately 1 unprompted mand and 1 unprompted reinforcer delivery/ minute across multiple sessions. Participants moved on from the withdrawal phase after a minimum of five sessions with continued stable responding generally above .5 unprompted mands and unprompted reinforcer deliveries/ min. To move from the generalization phase to the maintenance phase, participants needed to complete a minimum of five sessions with their general education peers with continued stable responding above .5 unprompted mands and unprompted reinforcer deliveries/ min. If participants demonstrated responding below desired levels and they did not respond to minor modifications to the procedures, the participants were reintroduced to the intervention.

5.4 MATERIALS

Toys and other reinforcing items identified through the preference assessments, outlined in the procedures section, were used in all sessions. Attempts were made by instructional teams to ensure that items used in sessions were not generally accessible to participants throughout the rest of the day. Consumable reinforcers/ edibles were also used as mand items and differential reinforcement. All consumable reinforcers were presented in manding sessions as outlined in the procedures section. Other consumable reinforcers used for differential reinforcement remained in the control of instructors and were not accessible to participants or peers, but through adult delivery. A video camera, tripod, timer, and recording materials were used for all sessions.

5.5 DEPENDENT MEASURES

The frequency of unprompted mands and unprompted reinforcer deliveries were collected during 12 min manding sessions and were converted to rates. The session duration of 12 min was intended to simulate a naturalized play period. The 12 min intervals minimized issues with participants repeatedly selecting the same item, and the 12 min sessions promoted peers serving as stimuli for manding behavior because of limited adult involvement. The dependent measures assessed were the rate of unprompted mands to peers and the rate of unprompted peer reinforcer deliveries.

5.5.1 Unprompted Mands

An unprompted mand was defined as when the participant oriented towards the peer with possession of the desired item or demonstrated neutral orientation and made the request for an item or action. Unprompted mands do not include reaching for the item, pointing, gesturing, or grabbing the item from peer. Unprompted mands do not include prompted mands or mands demonstrated with orientation towards an adult. Although multiple participants demonstrated mands for attention and information, these were not scored as unprompted mands for this study. Scoring mands for attention and information would have added a level of complexity and the team did not feel it was feasible to track these measures with accuracy for this initial investigation. Mands for escape from the instructional environment and mands for other participants to demonstrate problem behavior were also not scored as unprompted mands.

Unprompted mands accepted include the single word name of a desired item or action made in the absence of a prompt from an instructor. If a participant made some other

vocalization between the prompt and the response, or 10 s passed between the prompt and the participant's response, it was considered an unprompted mand. Multiple word mands were accepted as unprompted mands if the phrases contained a word specifically identifying an item or action. Mands demonstrated within a carrier phrase were accepted as unprompted mands as long as the phrase clearly identified a specific item or action desired (e.g. "I want ball"). Generalized mands were not counted as unprompted mands and were treated as errors unless the generalized mand directly followed a specific mand. Examples of generalized mands treated as errors include "more," "that one," "give me, " or other mands that could be used to make requests for a number of items. However, if a participant asked for a pretzel and then said can I have two more, this counted as an unprompted mand because a specific referent was already expressed. If a child specifically requested an item by name three separate times each of these was counted as a single unprompted mand, for a total of three unprompted mands. If a participant asked for "three pretzels" this counted as one unprompted mand. Mands were also scored as unprompted if another peer participant prompted the mand.

5.5.2 Unprompted Delivery of Reinforcers

An unprompted delivery of a reinforcer to a peer was scored when an item was delivered to the peer within reach without prompts provided by the instructor. A request by the peer was not needed to score an unprompted delivery of a reinforcer. An unprompted delivery of a reinforcer was also the delivery of a specified reinforcer within 3 s of a peer mand. If a mand was displayed and an incorrect item was delivered, this was not scored as an unprompted delivery. The item was returned to the other side and the error correction procedure was implemented. If however a

mand was made for something that was not available for delivery or was not present and a participant delivered and alternative item this was scored as an unprompted delivery.

5.6 OTHER MEASURES

Additional measures included, prompted mands, prompted deliveries of reinforcers to peers, and problem behaviors.

5.6.1 Prompted Mands

Prompted mands were recorded as mands directly following an echoic prompt (within 10 s) provided by the instructor to ensure successful demonstration of a vocal mand. Prompted mands could follow incorrect unprompted mands as a part of the error correction procedure. Prompted mands could also follow an approach, reach, or other motivation indicating behavior. Prompted mands were observed after a 30 s period with the absence of manding by either participant and when interfering or repetitive behaviors occurred.

5.6.2 Prompted Delivery of Reinforcers

A prompted delivery of a reinforcer to a peer was scored when the instructor provided any type of prompt to facilitate the delivery of a reinforcer to a peer. If the participant did not deliver the requested item within 3 s of the mand the instructor implemented a graduated guidance physical prompt and the response was recorded as a prompted reinforcer delivery. The instructors used

the least intrusive physical prompt necessary to ensure successful delivery of the preferred item to the peer. Unlike traditional least-to-most prompt hierarchies, the graduated guidance prompt procedure does not include the use of verbal or gestural prompts (Neitzel & Wolery, 2009). This was key to ensure proper stimulus control for participant responding. A prompted reinforcer delivery was also scored as part of the error correction procedure if an incorrect item was delivered after a mand. The item was returned, the mand was prompted, and the correct reinforcer delivery was prompted immediately with a graduated guidance physical prompt.

5.6.3 Problem Behavior

A frequency count of problem behavior was scored based on definitions for each student identified by the teacher in the student's positive behavior support plan (PBSP). If a participant did not have a PBSP, but was demonstrating property destruction, aggression, or self-injury these behaviors were also recorded. Shortly after beginning the study, Bella started to demonstrate problem behavior throughout the instructional day. These problem behaviors were also observable during peer play research sessions. It was determined that data would be collected for Bella on three problem behavior measures, disruptive behaviors, flailing limbs/ body parts, and aggression.

5.6.4 Disruptive Behaviors

Disruptive behaviors were defined as screaming or making vocalizations above a conversational level, statements include but are not limited to negative statements ("no no no"/ "good bye everyone") often seen in repetition, requests/ statements to go home / regarding home also often

seen in rapid repetition, requests for her peers to demonstrate problem behavior “Caleb’s crying”/ “cry Caleb,” questions to her peers or other adults about going home or saying goodbye, repeating phrases from movies/ TV shows about going home, saying goodbye, or not wanting to go to school.

5.6.5 Flailing Behaviors

Flailing behaviors were often seen in conjunction with disruptive problem behaviors. Flailing behaviors consisted of movement of limbs and head from a relatively calm and stable state to a wide range of movement including swinging or waving. Flailing behaviors occurred when others were in close proximity (within one foot of the participant). Flailing behaviors were often observed when instructors were prompting to fulfill a demand, when peers entered her instructional area, or when access to a preferred item was removed.

5.6.6 Aggressive Behaviors

Aggressive behaviors were defined as behaviors in which contact or attempted contact had the potential to cause harm. Behaviors in this category included, hitting, kicking, grabbing/ squeezing limbs of others with force, pushing others physically away, head butting, and biting. Biting and head butting were not observed in research sessions, but were observed at other times throughout the instructional day while the research was being conducted.

5.6.7 Frequency of Incident

The primary investigator collected problem behavior data via video recordings to promote accurate recording of high frequency behaviors. Behaviors were measured by the frequency of incidents. An incident was scored for each problem behavior that occurred. If a problem behavior extended longer than 30 s it was scored as new incident of problem behavior. If there was demonstration of a mand or other vocalization between disruptive behaviors it was measured as a new incident when the problem behavior started again.

5.7 DATA COLLECTION

Classroom instructor participants collected data using a paper and pencil on the frequency of unprompted mands within each session. Data was also collected using a paper and pencil on the frequency of unprompted deliveries of reinforcers to peers throughout each session. Instructors were given the option to use a tally counter/ clicker if they felt that it was more feasible for them to keep track of the frequency of unprompted responses. If using a tally counter/ clicker the responses were recorded with paper/ pencil every four min during the sessions. All additional measures outlined, (prompted mands, prompted deliveries of reinforcers, and problem behavior) were measured by the primary investigator through a review of the manding sessions via video recordings. All data collectors were trained in data collection and recording procedures.

The instructor training was a competency-based model that included content focused on instructional procedures and data collection. All instructors needed to demonstrate mastery of 11 competencies prior to baseline sessions. Training consisted of approximately 1.5 hrs of video-

based instruction and 5 hrs of hands on practice and skill demonstration. Video-based instruction consisted of clips modeling and explaining the procedures on 10 different categories. Categories included mand procedures, multiple stimulus preference assessments, MO checks, differential reinforcement, generalization, error correction, etc. Following the presentation of each topic, instructor participants would practice and demonstrate skills. The final competency focused on data collection. After reviewing scoring criteria and data collection forms, each instructor participant was asked to score one of six 4-min sample instructional sessions. All participants had to continue to practice scoring on various sample video sessions until they achieved 95% interobserver agreement on all four measures with the primary investigator (prompted and unprompted responses). Video footage of all sessions was collected to ensure data collection procedures were accurate throughout all phases of the investigation. Classroom instructor participants served as the primary data collectors following mastery of data collection training.

5.8 PROCEDURES

Peer-to-Peer mand training was evaluated using a multiple probe across dyads design (Horner & Baer, 1978; Kennedy, 2005). All sessions conducted were 12 min in length. The order of dyad participation in manding sessions was chosen through random selection to reduce the influence of order or timing on participant performance. The three dyads pseudonyms were placed in a container and were pulled randomly from the container to determine the order in which participants would be introduced to the intervention. In all sessions each participant was simultaneously serving in the role of the speaker and the listener. Participants sat at desks next to each other with a small cart in between, with the

participants' desired items in easy reach of the peer, but out of the reach of the participant. Each participant would have 12 toys/ items (identified from the preference assessments and motivation checks) and would have six food items of up to two types in easy access to the peer, but out his own of reach.

Items placed on desks were previously mastered mands when working with adults and were identified as individually preferred items through multiple stimulus preference assessment without replacement procedures (DeLeon & Iwata 1996), or through free operant selection. During all sessions, preferred items and edibles were reset to the original location on the desks out of the reach of the participant, but within the reach of the peer every 4 min. Adults were positioned behind the peers. The primary interventionists guiding the procedures were the classroom instructor participants. Classroom teachers and para educators who served in this role received ongoing regular consultation in behavior analytic principles and the application of behavioral principles to research validated instruction throughout the investigation. All adults supporting the intervention and data collection demonstrated mastery of the skills through the competency-based training.

5.8.1 Preference Assessments

Preferred items and toys were identified for each participant using a multiple stimulus preference assessment without replacement (DeLeon & Iwata, 1996) prior to the study. Items and toys gathered based on preference assessments were used throughout sessions. Free operant preference assessments (Roane, Volmer, Ringdahl, & Marcus, 1998) were also used prior to each

session to identify preferred items and edibles. Preferences were assessed at the very beginning of each session to ensure that the materials used were of relative motivational value. To the greatest extent possible, participants were restricted from accessing items and toys identified through preference assessments prior to the sessions and throughout the rest of the day unless requests for items are specifically made to a peer. All items identified for inclusion were mastered mands with an adult prior to inclusion in an intervention session.

5.8.2 Motivation Check

Prior to the beginning of each session the instructor(s) placed toys and desired items identified through the preference assessment process on the table in front of the participants to do an immediate check for motivation prior to the session. Items were presented in groups of 12. The instructor(s) attempted to group items of similar preference level based on preference assessments and classroom team reporting on reinforcer strength. If the participant showed motivation for items presented, by demonstrating approach behaviors, these items were used during the session. If the participant did not show motivation for the items presented, the instructor presented additional items identified through the preference assessment process and assessed immediate motivation prior to the session. This process continued until the participants demonstrated motivation for at least two items in the group of 12 within 1 min of presentation. Once more than one item was selected in a lot of toys, this grouping of toys was utilized for the mand session.

5.8.3 Shared Interest Items

Attempts were made throughout the reinforcer identification process to identify reinforcers for peer participants that were strong reinforcers for one participant, but were not as strong for the other peer partner. This proved easier for some dyads than for others. If during sessions instructors observed that a participant's engagement with his partner's intended mand item(s) was interfering with the communicative exchange, these items would remain available for the rest of the session, but would be removed from the lot of potential reinforcers for future sessions.

5.8.4 Consumable Reinforcement

Six edible reinforcers of up to two types were included in mand sessions at a given time. Edibles were very small pieces of food cut up from larger items. The use of small pieces was to help protect against the principle of satiation and to be mindful of participant health. Edible items were included as potential mand items in attempt to maintain motivation for items throughout the peer manding sessions. Including potential mand items across multiple motivational categories was intended to help promote and maintain motivation throughout sessions. Every 4 min any edibles consumed in the session were replaced. Attempts were made to select food items that were of interest to one peer and of little interest to the participant's peer partner.

Edible reinforcement was also used as differential reinforcement for unprompted responses. Instructors would provide a small amount of access to edible reinforcers prior to sessions daily to determine the relative rank of edible reinforcers. Instructors would

then select edible reinforcers to be used for mand items and to be used as instructor-facilitated differential reinforcement.

5.9 BASELINE

Baseline sessions began with the instructor(s) placing the desired items and edibles identified for each participant on the opposite side of the table, out of the reach of the participant and next to his/her peer. The instructor(s) did not provide any prompts to facilitate manding or the delivery of preferred items. All mands made to adults were placed on extinction. Any materials that were moved by either participant in the dyad were replaced to their initially assigned location every 4 min. Any food that was taken was also replaced every 4 min. The instructors positioned themselves out of the direct sight of the participants and remained behind participants to the greatest extent possible throughout sessions.

5.10 INDEPENDENT VARIABLE

The intervention phase introduced prompt procedures and the use of differential reinforcement for peer manding and the delivery of reinforcers to peers. Use of the fixed interval 3 s time delay for prompting mands and peer reinforcer delivery was introduced.

5.10.1 Manding Training

Echoic prompts were used to facilitate manding. If a participant indicated interest in an item or edible and the correct mand was not presented after 3 s, the instructor used an echoic prompt. For example if the desired item was a ball, the instructor would wait 3 s for the participant to correctly mand for ball, and would prompt the participant by saying, “ball.” To the greatest extent possible, instructors did not produce any other vocalizations.

Differential reinforcement was delivered for manding to the peer in the form of a consumable. If a participant made an unprompted mand, following the delivery of the requested mand item, the participant would receive an edible (different from those available in the mand session). The item requested was always to be delivered before the application of any differential reinforcement.

If at any point 30 s of time passed without a reach, mand, or the delivery of a reinforcer, the instructor prompted the participant who had not manded for the longest period of time to mand (based on participant attending and approach behaviors). Examples included eye gaze or leaning toward an item. If no approach or attending behaviors were observed, instructors would prompt a mand based on what the instructor observed was highly desired in recent sessions. If mand sessions were to repeatedly begin with no motivation observed, a re-evaluation of reinforcers would be conducted and items used for mand sessions would be changed. This did not occur in the investigation.

If participants were demonstrating low intensity interfering or repetitive behaviors, instructors would prompt a mand in an attempt to compete with the interfering behaviors. For example, if a participant demonstrated repeated deliveries to a peer without any peer requests, a mand would be prompted. If a participant demonstrated some type of self-stimulatory behavior, a

mand would be prompted. The specific mand item prompted would be based on the participant's history of most commonly identified highly motivating item(s) or item(s) that the participant had recently demonstrated interest in earlier in the session or on the motivation check.

5.10.2 Delivery of Reinforcers to Peers

The intervention treatment package also included procedures intended to increase the unprompted delivery of reinforcers to peers. The instructors used a 3 s time delay following the request of the speaking peer to prompt the delivery of that reinforcer by the listening peer, (keeping in mind that the role of the listening peer and the speaking peer are changing throughout the session). Instructors used the least intrusive physical prompt necessary to ensure successful delivery of the preferred item to the peer. Unlike traditional least-to-most prompt hierarchies, the graduated guidance prompt procedure did not include the use of verbal or gestural prompts (Neitzel & Wolery, 2009). In an attempt to keep the control of the response under the stimuli of the peer presence, all instructor prompt procedures were limited to physical prompts delivered from behind the participants. Following the unprompted delivery of the reinforcer to the peer, the instructor delivered differential reinforcement in the form of a consumable to the participant. Consumable reinforcement was delivered only for unprompted deliveries.

5.10.3 Error Correction Procedures

If participants demonstrated interest in an item and an incorrect mand was given or the participant attempted to physically gain access to the item, the instructor would wait 5 s

following the response and provide a prompt for the correct response. This was quite rare during sessions and for many participants was never observed. If a mand was produced and a peer partner failed to deliver the item after a 3 s time delay, the instructor provided a prompt for the delivery of the item using the prompt procedures outlined above. If following a peer mand the participant attempted to deliver an item that was not the item requested by the peer partner, the instructor would wait 5 s and prompt the peer partner to mand for the desired item again and provide an immediate prompt to the participant to deliver the requested reinforcer.

Error correction procedures were conducted for problem behavior. If the error correction procedure was conducted on ten consecutive opportunities for severe problem behavior (aggression, self-injury, property destruction), the session would be terminated. This was not observed during this investigation. The sessions were also terminated if the intensity or severity of problem behavior increased in aggression towards the peer partner, or if the instructors felt that a participant's increasing level of aggression might result in harm/ injury. When a session was ended early, the investigator/ team evaluated modifications to items and edibles included in the session. If a participant demonstrated repeated problem behavior resulting in the termination of a session on more than one occasion, the team would have to evaluate if the participant was well positioned to continue to successfully participate in peer manding sessions.

5.10.4 Differential Reinforcement Procedures

As mentioned above, instructor-facilitated edible reinforcement was delivered for unprompted mands and unprompted reinforcer deliveries. Instructors were required to be active observers of participant response levels in order to make efficient use of the differential reinforcement available. Instructors had at least three valuable types edible reinforcers for each session

identified for each participant and were knowledgeable of the relative ranking of the food items on preference assessments and based on participant histories. Initially the most highly preferred edible reinforcer was delivered for unprompted mands and unprompted reinforcer deliveries. As the investigation progressed, the instructors were required to monitor participant responding and differentially deliver edible reinforcement for the behaviors observed. If a participant was demonstrating a high level of unprompted mands, but very few unprompted reinforcer deliveries, instructors would deliver the most highly preferred edible for unprompted reinforcer delivery behaviors, and might give a lesser but still preferred edible for unprompted mand behaviors observed. If patterns continued, instructors were also trained to implement changes in the magnitude of the edible reinforcers delivered. For example a whole sour patch (most highly preferred) may have been delivered for a rare unprompted reinforcer delivery response, and in the same session a small piece of marshmallow (less preferred) would be delivered for a frequently observed unprompted mand.

5.11 MODIFICATIONS TO INTERVENTION PROCEDURES

5.11.1 Intervention Modification-1 (IV-1)

A slight modification to the basic procedures was determined appropriate in an attempt to increase the unprompted delivery of reinforcers for Caleb. Caleb participated in four sessions in the initial intervention phase and was demonstrating zero or close to zero unprompted deliveries of reinforcers to his peer partner. It was determined that the team would support a slight modification to the procedures in attempt to increase unprompted deliveries.

The modification consisted of the delivery of a consumable by the instructor for prompted deliveries. This modification was delivered differentially in comparison to the consumable reinforcement delivered for unprompted deliveries of reinforcers to peers. Caleb would get a small lesser preferred edible reinforcer for the prompted delivery of a reinforcer and would get a larger more highly preferred edible for the unprompted delivery of reinforcers to peers. Once this participant was showing increased deliveries, the dyad was moved into the IV-2 modification to procedures.

5.11.2 Intervention Modification-2 (IV-2)

Following the implementation of the IV-1 modifications, Caleb was delivering reinforcers to his peer partner at a rapid rate, but was not waiting for his peer partner to make requests. A second modification to the procedures was introduced to address this need. The intervention modification-2 (IV-2) consisted of a block procedure where free reinforcer deliveries were blocked by the instructor and after a 3 s delay the peer partner was prompted to mand for the item before the item could be delivered and the block of the delivery was removed.

5.11.3 Intervention Modification to Procedures Praise (IV-P)

An additional modification to the procedures was made for Isaiah, who demonstrated strong unprompted deliveries when introduced to the intervention, but did not demonstrate an increased level of unprompted mands after repeated exposure to the intervention (10 sessions). Although Isaiah would express interest in edible reinforcers to be used as differential reinforcement for unprompted responses at the beginning of the sessions, it was noted by the team that at times he

would not eat these when delivered during the sessions. Many attempts were made by the team to identify additional edibles that were of higher interest. Although some new food items were included in sessions, Isaiah continued to leave some edibles uneaten and his unprompted mand behaviors were still low.

The team noted this participant's strong history of positive responding to social reinforcement. It was determined that for this participant, in addition to the delivery of consumable reinforcement, social reinforcement (praise) would be delivered for any unprompted mands. Directly following an unprompted mand by Isaiah, the instructor supporting him would give social praise and the delivery of an edible. Social praise consisted of phrases like "way to go," "nice job asking," and "that was a great job asking." All modifications to procedures were removed for participants when they moved from the intervention to the withdrawal phase of the investigation.

5.12 WITHDRAWAL

Once participants were demonstrating increased unprompted mands and unprompted deliveries of reinforcers, as evidenced by a minimum of approximately one unprompted mand and reinforcer delivery per min, participants entered the withdrawal phase. Once in the withdrawal phase, participants continued peer manding sessions with their assigned communicative partner from intervention sessions, but no prompt procedures or differential reinforcement were provided. If participants continued to maintain responding at the defined withdrawal mastery criteria (stable responding above approximately .5 unprompted responses per min) for at least five days, they entered the generalization phase. If participants failed to maintain the mastery

criteria in the withdrawal phase and response rates were lower than the set criteria, the intervention treatment package would have been reinstated. Participants would have continued in the intervention phase until the intervention mastery criteria was reached for five consecutive sessions before moving back to the withdrawal phase. If this process repeated more than once, alternative procedures would need to have been evaluated.

5.13 GENERALIZATION

After students maintained mastery rates of responding for a minimum of five consecutive withdrawal sessions, participants entered the generalization phase. In the generalization phase, participants were introduced to manding sessions with a novel general education peer to see if the mastery of peer manding skills generalized across individuals. The general education peer participants were trained in the general peer manding process and demonstrated mastery criteria to participate in sessions. All procedures in the generalization phase of the investigation were the same as those implemented in the baseline and withdrawal conditions. The only difference in this phase was the introduction of the new peer partner. Although generalization was not a primary component of the investigation, it was hoped that at least some of the participants would demonstrate generalization of peer manding skills to a novel peer.

5.14 MAINTENANCE PROBES

Once participants demonstrated continued rates of peer mand and peer delivery of reinforcer behaviors in a minimum of five generalization sessions, participants began maintenance checks. Maintenance probe sessions were administered one time per week for up to three weeks after achieving mastery criteria in the withdrawal phase. Maintenance probe sessions included all of the same elements procedurally as the sessions in the withdrawal phase, however these sessions were conducted only one time out of every five possible sessions to assess if the participants' skills maintained over time. Each participant was partnered with his/ her original communicative partner from the earlier phases of the investigation. If participants failed to maintain the mastery criteria in the maintenance phase and response rates were lower than the set criteria, the intervention treatment package was reinstated. Participants continued in the intervention phase until the intervention mastery criteria was reached for five consecutive sessions before moving back to the withdrawal phase.

5.15 REINTRODUCTION OF THE INTERVENTION DYAD 2

During the maintenance probes, the team determined that a reintroduction of the intervention phase was needed for Dyad 2. Although the dyad demonstrated success through maintaining the response criteria in the withdrawal phases and the generalization phase, one of the participants in the Dyad 2, (Caleb) demonstrated a decrease in the unprompted delivery of reinforcers to his peer partner when maintenance sessions were administered once a week. While in the maintenance phase, Caleb's peer reinforcer delivery behavior fell well below the general

minimum criteria of .5 unprompted reinforcer deliveries per min. Caleb only demonstrated 1 delivery in the two total peer mand sessions in the phase. It was determined appropriate to reintroduce the intervention for his dyad. The initial reintroduction of the intervention resulted in responding very similar to Caleb's initial introduction to the intervention, with so after three sessions with low responding a modification to the intervention combining the two previous modifications was implemented.

5.15.1 Modification to Intervention-3 (IV-3)

When Caleb continued to show limited reinforcer delivery behavior following the reintroduction to intervention, the team considered previous modifications to the procedures. The first modification to the procedures in the reintroduction to the intervention phase consisted of combining the elements from the two previously introduced modification procedures for reinforcer deliveries. Additional reinforcement was provided for prompted peer reinforcer deliveries (IV-1) and a block on free deliveries absent of peer mands (IV-2) was implemented. Soon after the combined modification introduction, it was determined that the team would replicate the procedures implemented in the initial modifications to the intervention. The combined modification procedures were complicated to implement and did not demonstrate the intended effect. The team returned to only implementing the additional reinforcement for prompted peer reinforcer deliveries (IV-1) first and then after success with increased unprompted deliveries, the team reinstituted the block procedure on free reinforcer deliveries absent of a mand (IV-2).

5.16 INTEROBSERVER AGREEMENT

A second observer collected data on unprompted mands and unprompted reinforcer deliveries during 97.9% of sessions across all participants and conditions. Interobserver agreement was calculated using a total agreement formula (smaller total number divided by larger total number multiplied 100) (Kennedy, 2005, p. 115).

When agreement dropped below 90% on any observation for any of the two measures collected by facilitators, data collection training was conducted. Initial plans were for primary data collectors to collect on both unprompted and prompted participant responses, but shortly after introducing the first dyad into the intervention it was determined that it was logistically difficult to accurately implement the procedures and to collect data on four measures and problem behavior. It was determined that the primary data collectors would focus on collection of the unprompted variables listed above and the second data collector would collect data on the secondary prompted responses and problem behavior via video analysis.

Secondary data collection by video allowed for the secondary data collector/ principal investigator to be available to observe the teaching procedures and scoring procedures during live session time to provide assistance and answer questions as needed. Areas where additional scoring clarification were needed included, if the participants picked up multiple items in one hand swipe and delivered, if participants asked for multiple of the same item (“can I have 3 chocolates”), if participants used three separate movements to pick up things, but then delivered in one handful, if the participants asked appropriately with a specific mand for an item and then followed shortly after with a generalized mand for more of that item, mands for information and mands for attention were excluded from totals but were discussed for scoring consistency.

Other variables that may have had an influence on scoring include articulation and volume of responses by participants, and the problem behavior of one participant. The overall total interobserver agreement across participants and measures was 99.5% (see Table 4). The lowest average agreement level of 78% was for unprompted mands for Bella. A factor that may have contributed to the lower levels of agreement was that this participant was in the first dyad to enter the intervention. Some of the participant responses observed in the initial intervention sessions fell outside the criteria we had clearly defined in the measurement training. As a result the primary investigator had to clarify how to score particular situations after the sessions and train the team to score those responses in a consistent manner from that point forward. Instructor participants were also not yet fluent with the procedures and data collection. It appears it was more likely for the data collectors to miss response events that occurred early in the investigation. Many of the sessions with lower percentages of agreement occurred in the very early stages of the study. For example for Bella's unprompted mand measure, six of the first ten sessions had agreements rates of 75% or below. As additional training on scoring was conducted the agreement rates increased and stayed relatively steady over time. The demonstration of problem behavior, and the demonstration of mands for problem behavior to another participant also likely contributed to scoring complexity.

Table 4. Interobserver Agreement by Participant

<i>Participants</i>	<i>% Agreement Unprompted Mands</i>	<i>% Agreement Unprompted S^{r+} Deliveries</i>
Bella	78	92
Calvin	94	95
Mark	98	97
Caleb	98	92
Isaiah	99	96
Carter	93	99

5.17 PROCEDURAL INTEGRITY

Procedural integrity checklists containing the components of the procedures for the various phases of the investigation were developed (see Appendix B). Procedural integrity checklists were conducted on 55% of sessions throughout all phases of the investigation and across all dyads. The average procedural integrity for all sessions was 99.9%. If procedural integrity fell below 90% on any given observation, training on procedures was conducted until mastery criteria was achieved. This only occurred on one instance at the very beginning of the investigation. Reviewing of the procedures quickly resulted in accurate demonstration of teaching strategies throughout the remainder of the investigation.

5.18 SOCIAL VALIDITY

A social validity questionnaires containing 10 questions regarding various elements of the investigation, its purpose, and aims were administered to classroom instructors following completion of research sessions. Due to the limited language abilities of the primary participants, a social validity survey designed to address these questions with each of the participants was not feasible to administer. A social validity questionnaire consisting of five questions regarding various elements of the investigation, its purpose, and aims was administered to the general education communicative partners from the generalization phase. Peer participants were asked to answer questions indicating their perceived value of the sessions and enjoyment in participation by answering questions using a 3-point likert scale with 1 representing the response no, 2 representing maybe, and 3 indicating yes.

6.0 RESULTS

The results section contains data collected on all six primary participants throughout all phases of this investigation. The rate of unprompted peer mands and the rate of unprompted peer deliveries of reinforcers per minute are displayed. Additional data on problem behavior for one participant is also displayed. Social validity measures for instructor participants and peer support participants conclude this section.

6.1 UNPROMPTED MANDS

What effect(s) will the introduction of a peer-to-peer manding treatment package consisting of the use of differential reinforcement and time delay procedures have on the rate of unprompted peer mands in individuals with autism and IDD?

Figures 1 and 2 contain graphs of the frequency of unprompted mands during 12 min peer mand sessions across dyads for all phases of the investigation. In Figure 1, the x axis represents days and the y axis represents the rate of unprompted peer mands per min. The first participant in each dyad's results is represented with an x marker and the second participant in each dyad's responses is represented as a triangle, however both participants in each dyad were introduced to the changes in conditions simultaneously. Sessions occurring on consecutive days have connected lines unless the investigative team introduced a phase change. Solid dog-legged

lines represent phase changes and dotted vertical lines represent minor modifications to procedures. Primary phase changes indicated with a solid dog legged line include changes from baseline to intervention, intervention to withdrawal, withdrawal to generalization, generalization to maintenance, and maintenance to the reintroduction of the intervention. Tables 5 and 6 provide specific information on the means and ranges of responding across all phases for each participant.

Table 5. Mean Unprompted Peer Mand Results

<i>Participants</i>	<i>Baseline M</i>	<i>Intervention M</i>	<i>Withdrawal M</i>	<i>General. M</i>	<i>Maint. M</i>	<i>Reintro. IV M</i>
Bella	.08	.69	.73	.46	.39	
Calvin	.08	.97	1.72	1.61	2.22	
Mark	0	.57	1.55	1.25	1.34	.83
Caleb	.07	1.21	1.30	1.53	1.17	.96
Isaiah	.01	.65	1.72	.80	.59	
Carter	.01	2.17	2.35	1.80	3.38	

Table 6. Range of Unprompted Peer Mand Results

<i>Participants</i>	<i>Baseline Range</i>	<i>Intervention Range</i>	<i>Withdrawal Range</i>	<i>General. Range</i>	<i>Maint. Range</i>	<i>Reintro IV Range</i>
Bella	0 - .25	.08 - 1.75	.17 - 1.58	.25 - .83	.08 - .75	
Calvin	0 - .25	.08 - 1.92	.75 - 2.75	1.08 - 2.25	1.33 - 2.83	
Mark	0	.08 - 1.83	.83 - 2.17	.42 - 2.25	1.25 - 1.42	.17 - 1.5
Caleb	0 - .17	.08 - 5.0	.33 - 3.17	.42 - 2.33	1.0 - 1.33	.08 - 3.67
Isaiah	0 - .08	0 - 2.83	.42 - 2.75	.42 - 1.42	0.5 - 0.67	
Carter	0 - .08	.5 - 3.75	.33 - 5.0	1.58 - 2.0	2.25 - 4.5	

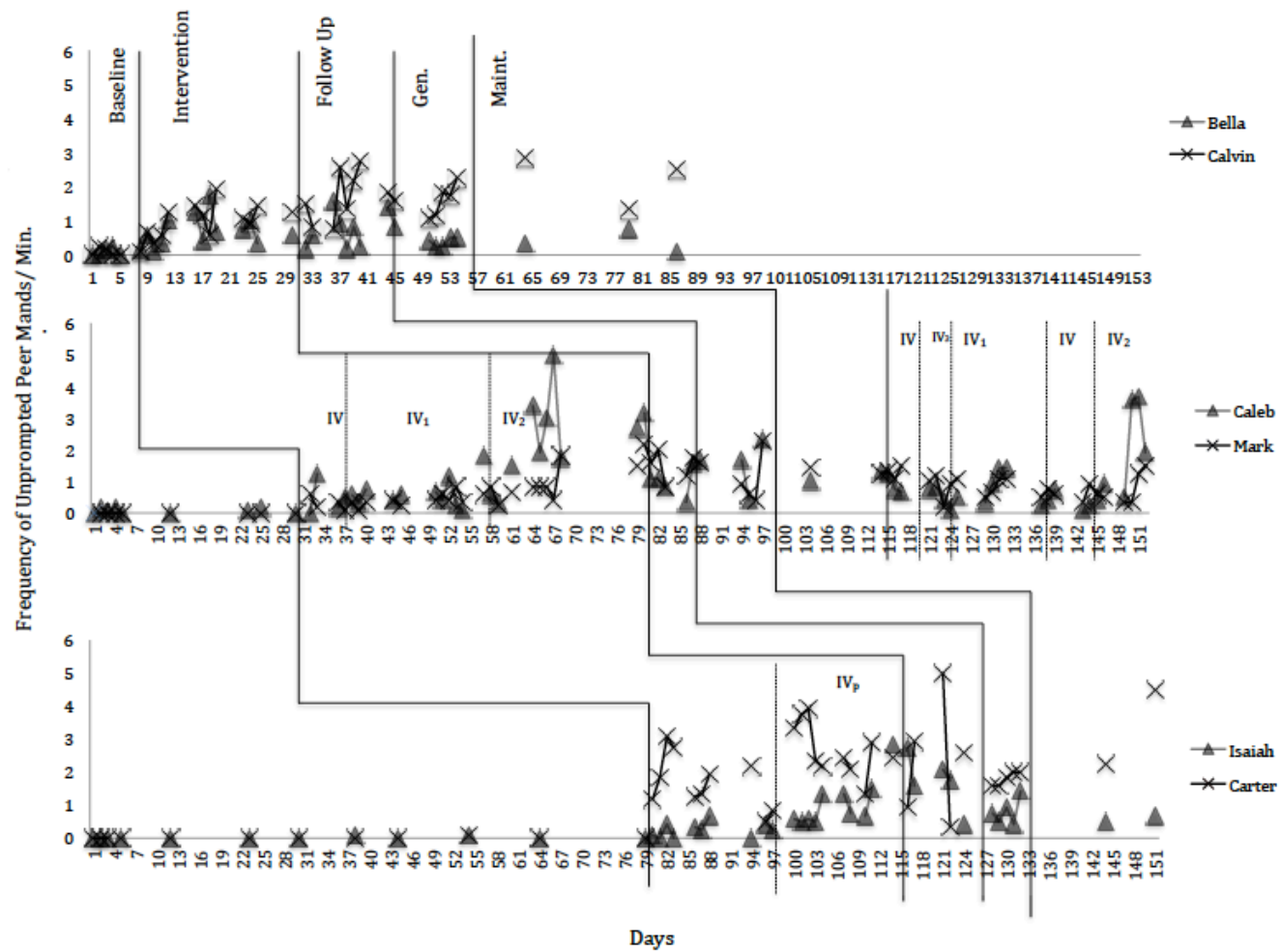


Figure 1. Frequency of Unprompted Mands/ Min by Dyad

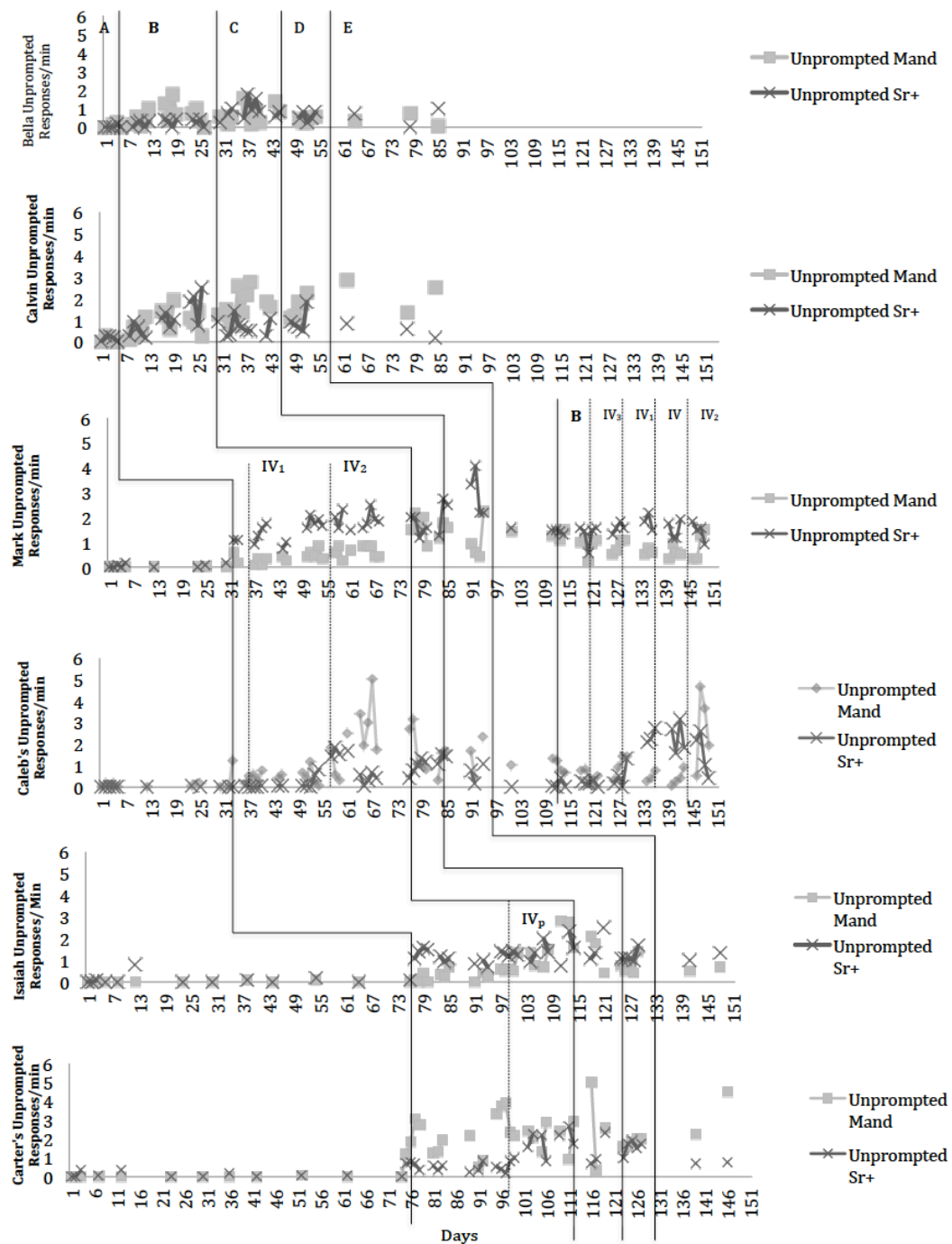


Figure 2. Frequency of Unprompted Responses by Participant

Note: A = Baseline, B = Intervention, C = Withdrawal, D = Generalization, E = Maintenance

6.2 BASELINE

During baseline all participants demonstrated very low levels of unprompted peer mands per min. In baseline although most participants demonstrated 0 mands during most mand sessions, a range of 0 to .25 mands per min was observed. The mean unprompted peer mand rate during baseline was .03 mands per minute. The level remained low for all participants throughout baseline with very little variability, and no increasing trend.

6.3 INTERVENTION

All participants showed improvement in unprompted peer mands with the introduction of basic the intervention treatment package with the exception of one participant (Isaiah). As is expected for an intervention with the intent of teaching skills over time, the results generally do not show immediate jumps or changes in level between conditions, but instead show increasing trends directly following the introduction of the intervention, which later flatten out, resulting in changes in level within conditions.

6.3.1 Bella

Bella spent a total of 13 sessions in intervention. When introduced to the intervention (IV) she demonstrated increases in level (baseline $M = .08$; IV $M = .69$) and an increase in trend (baseline range = 0 - .25; IV range = .08 - 1.75). Although she did not demonstrate consistent responding around 1.0 mands per min in intervention, she demonstrated a marked increase in responding.

Bella also was concurrently demonstrating increases in problem behavior. An analysis of problem behavior data for Bella is covered later in this section. When comparing the baseline to the intervention data for Bella 78% of all data points were non-overlapping.

6.3.2 Calvin

Calvin spent 13 sessions in the intervention phase and also demonstrated an increase in trend from the baseline to the intervention. An overall change in level between conditions was observed (baseline $M = .08$; IV $M = .97$). When introduced to the intervention, Calvin demonstrated an immediate increase in trend and after about four sessions in the intervention phase his responding stabilized, with seven of the nine remaining sessions in intervention with unprompted mand rate levels between 1.17 and 1.92 mands per min. Calvin demonstrated 83% non overlapping data points between baseline and intervention. He demonstrated overall strong responding without much variability after his initial climb in responding.

6.3.3 Mark

During Mark's initial intervention experience he had 24 total sessions. Of those sessions the first four sessions were the basic intervention, and the next 11 sessions were IV-1 sessions (Caleb was receiving differential reinforcement for unprompted deliveries). In IV-1 sessions there were no changes to any specific procedures being implemented with Mark, however, his partner was experiencing modified procedures during this period of time. The last nine sessions were IV-2 sessions. In IV-2 sessions, Caleb's free deliveries of reinforcers to Mark were blocked and Mark was prompted to mand for items after a 3 s time delay. Likewise Mark's free deliveries to Caleb

were blocked and Caleb was prompted to mand for the item after a 3 s time delay. The average unprompted mand rate increased from baseline ($M = 0$) to intervention ($M = .57$). With each modification to procedures, Mark showed increased unprompted mand behaviors (IV $M = .29$; IV-1 $M = .42$; IV-2 $M = .89$ mands/ min). Mark's range increased from responding only at 0 in baseline to .08 to 1.83 mands/ min in intervention. Mark demonstrated an increasing trend throughout the intervention phase and through each of the modifications to the intervention. Mark displayed 100% non-overlapping data points for unprompted peer mands from baseline to intervention. He demonstrated an overall change in level throughout the intervention phases, but no clear between phase change in level was observed from baseline to intervention. Responding was stable and above one mand per min for the last two data points in the intervention phase.

6.3.4 Caleb

Caleb participated in 24 total intervention sessions before entering the withdrawal phase. Of those sessions, the first four sessions were the basic intervention, the next 11 sessions were IV-1 sessions, and the last 9 were IV-2 sessions. There was an overall increase in level from baseline ($M = .07$) throughout the entire intervention phase ($M = 1.21$). This change in level was gradual and continuous over all of the intervention phase. Caleb demonstrated an increasing trend in unprompted mands shortly after entering the intervention phase. Although Caleb was making progress in demonstrating unprompted mands through the initial intervention procedures, he was not showing the same success in the unprompted delivery of reinforcers to peers. This led to the modifications of procedures intended to focus on the development of his unprompted deliveries of reinforcers to peers. As noted above, in IV-1 Caleb received differential reinforcement for prompted reinforcer deliveries and once unprompted reinforcer deliveries increased, the partners

were introduced to IV-2 procedures where free deliveries of reinforcers were blocked and participants were prompted to mand for items after a 3 s time delay. Trend and level continued to increase for unprompted mands across all modifications of the intervention (IV $M = .48$; IV-1 $M = .64$; IV-2 $M = 2.24$). When assessing unprompted mands in the baseline and initial intervention phase there were 64% non-overlapping data points.

6.3.5 Isaiah

Isaiah spent a total of 20 sessions in the intervention phase. As noted above he is the only one of the six primary participants to demonstrate limited responding on his rate of unprompted peer mands when receiving the basic intervention treatment package during mand sessions. Through the initial 10 sessions in the intervention, there was a visible gradual increase in trend, but the level of the rate of unprompted peer mands per minute was still low, with the highest rate of unprompted mands during IV at .67 unprompted peer mands/ min and in three of those ten sessions Isaiah demonstrated zero unprompted mands per min.

When the team analyzed Isaiah's responding during sessions it was observed that he did not appear to be consuming the edible reinforcers delivered with consistency even with new edible reinforcers daily and motivation checks conducted at the beginning of the sessions. It was noted that this participant had a history of responding well to social reinforcement so the team implemented the IV-P procedure where social praise was added with the delivery of a consumable reinforcer for any unprompted mands observed. There was an increase in the level of unprompted mands from the baseline ($M = .01$) to the overall intervention ($M = .65$). Although there was a gradual increase in level when introduced to the basic IV ($M = .12$), the level increased observably when praise was added to the treatment package with the IV-P

modification ($M = 1.10$). The increasing trend became more pronounced and maintained throughout the remainder of the condition with the IV-P modification. There were 50% of non-overlapping data points from the baseline through the overall intervention phase. This participant's slow responding to the initial intervention may have been a contributing factor to the higher percentage of overlap across conditions observed.

6.3.6 Carter

Carter participated in 20 sessions in the intervention phase. Although his peer partner Isaiah experienced modified procedures for a portion of these sessions, the procedures for Carter stayed the same throughout the entire intervention phase. When introduced to the intervention treatment package, Carter demonstrated a strong increase in trend and level throughout the entire intervention period. His rates of unprompted mands per minute increased from a mean of .01 mands per min in baseline to 2.17 mands per min in the intervention phase. Unlike all other participants, Carter did show a distinct change in level immediately between conditions ending baseline with 0 unprompted mands per minute, and starting out the first session in intervention with a quick 1.17 unprompted mands/ min. This change in level continued throughout the intervention phase (range = .5 – 3.75 unprompted peer mands/ min). When evaluating the percentage of overlap from baseline to intervention, Carter demonstrated 100% non-overlapping data points.

6.4 WITHDRAWAL

6.4.1 Bella

Bella was in the withdrawal phase for eight sessions following the intervention. While in the withdrawal phase, Bella continued to demonstrate unprompted mands. There was some increased variability in her responding in withdrawal, when comparing to her pattern of responding at the end of baseline, but when reviewing this data to problem behavior data (see Figure 3) there appears to be correlations between lower rates of problem behavior and higher unprompted peer mands. A decreasing trend in responding was observable through the second half of the withdrawal phase. This trend stabilized towards the end of the condition with a lower level. There is slight overall increase in level in the withdrawal phase ($M = .73$ unprompted mands/min) compared to the intervention phase ($M = .67$ unprompted mands/min), and to the initial baseline levels ($M = .08$ unprompted mands/min). The percent of non-overlapping data points from the intervention to the withdrawal phase was 4.76%, indicating that the level generally stayed the same from the intervention to the withdrawal phase.

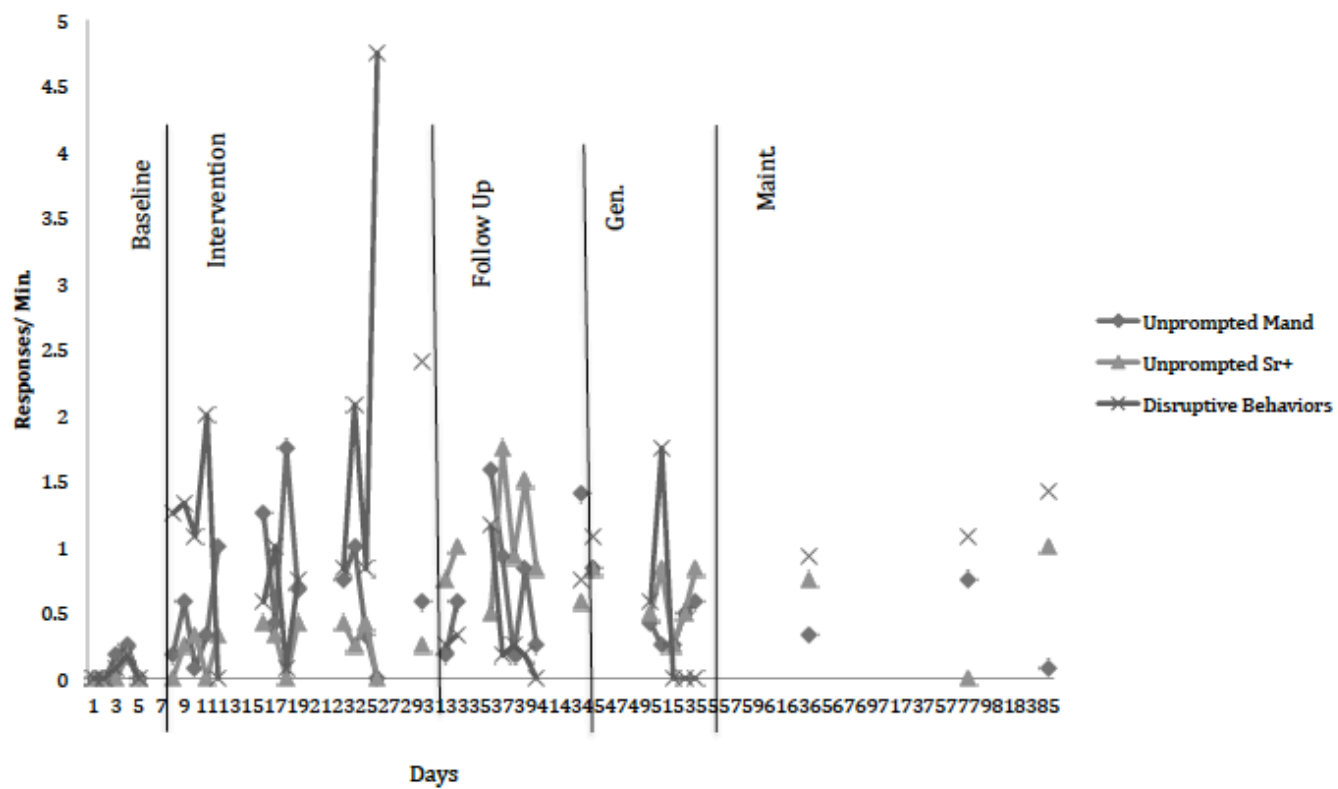


Figure 3. Bella's Response Frequency and Disruptive Behaviors in Mand Sessions

6.4.2 Calvin

Calvin was also in the withdrawal phase for eight sessions prior to moving into the generalization phase. Calvin demonstrated a strong increase in trend throughout the withdrawal phase. The general level of responding continued to rise in the withdrawal phase ($M = 1.72$ unprompted mands/ min), compared to baseline ($M = .08$ unprompted peer mands/ min) and intervention levels ($M = .97$ unprompted peer mands/ min). The percent of non-overlapping data points when assessing the intervention to the withdrawal phase was 38.10%.

6.4.3 Mark

Mark participated in five sessions in the withdrawal phase before moving on the generalization phase. Similar to Calvin's responding, Mark's rate of unprompted peer mand continued increasing in trend and gradually increasing in level as he moved through the withdrawal phase. His overall level in the withdrawal phase ($M = 1.55$ unprompted peer mands/ min) was higher than his level in the intervention phase ($M = .57$ unprompted peer mands/ min), which was also higher than the level in baseline ($M = .0$ unprompted peer mands/ min). Mark's percentage of non-overlapping data points from the intervention phase to the withdrawal phase was 65.52%.

6.4.4 Caleb

Caleb participated in five withdrawal sessions prior to entering the generalization condition. There was an initial drop in level from the end of the intervention phase to the beginning of the withdrawal phase, however the moderate level maintained throughout the withdrawal phase (M

= 1.30 unprompted peer mands/ min) and was still observably higher than the baseline levels ($M = .07$ unprompted peer mands/ min). A decreasing trend was present throughout the withdrawal phase, ending the last session in the phase with .83 unprompted peer mands/ min. There were 0% of non-overlapping data points from the intervention to the withdrawal phase. All responding stayed within the range observed during the intervention phase.

6.4.5 Isaiah

Isaiah participated in five sessions in the withdrawal phase before moving into the generalization phase. Overall Isaiah maintained, and even increased the overall level of responding seen from the IV-P condition ($M = 1.10$ unprompted peer mands/ min) to the withdrawal condition ($M = 1.72$ unprompted peer mands/ min). As observed with several participants, there was not a clear drop in level between conditions, but there was a steady decreasing trend throughout the withdrawal phase. The responding observed at the end of the withdrawal phase (.42 and .75 unprompted peer mands per min) still indicated an increased level from baseline. Twenty-eight percent of the data points from the intervention and withdrawal phases were non-overlapping. The non-overlapping data points observed were early data points in the intervention phase, before responding had strengthened. Once responding was strong, the rates maintained in the same range throughout the remainder of intervention and withdrawal.

6.4.6 Carter

Carter participated in five withdrawal sessions after the intervention condition. In the withdrawal condition, Carter's responding displayed considerable variability (range = .33 - 5.0 unprompted

peer mands/ min). The overall level of responding in the withdrawal condition ($M = 2.35$ unprompted peer mands/ min) was slightly higher than that observed in the intervention condition ($M = 2.17$ unprompted peer mand/ min), but was lower than the level seen at the beginning of the IV-P modification phase. His level of responding in withdrawal was still greater than the baseline condition ($M = .01$ unprompted peer mands/ min), indicating that the procedures maintained the peer manding skills over time even with the removal of additional reinforcement for unprompted mands. There were 0% non-overlapping data points from the intervention to the withdrawal phase.

6.5 GENERALIZATION

6.5.1 Bella

Bella participated in six generalization sessions with her typical peer partner Zoe. As noted in previous sections, Bella's problem behavior was likely to have had an affect on responding. Bella showed a decrease in her level of responding from the withdrawal phase to the mand sessions with her peer partner from the general education classroom. Although levels were low in the generalization phase ($M = .46$ unprompted peer mands/ min), they were still higher than initial baseline levels ($M = .08$ unprompted peer mands/ min) and generalization of the skill was observed. Other behaviors were observed and could be of relevance when evaluating this phase of the investigation. Some quotes made by Bella observed included "would you like to be my friend Zoe," and "Hi Zoe, ready for a sleep over," "can I have a hug." Although mand rates were slightly low in level and demonstrated a decreasing trend at the beginning of the generalization

phase, Bella appeared to demonstrate interest in socialization with the peer partner, which had not been observed in other phases of the investigation. There were 35.71% non-overlapping data points from the withdrawal to the generalization phase, but all non-overlapping data points appear the result of the large range of responding observed in the withdrawal phase (.17- 1.58 unprompted peer mands/ min).

6.5.2 Calvin

Calvin participated in six generalization sessions with his typical peer partner Zoe. Upon entering the generalization phase, Calvin initially demonstrated a decreasing trend and a decreased level of responding, but as he continued throughout the generalization sessions he demonstrated an increase in trend and level. Calvin's overall level of unprompted peer mands in the generalization phase ($M = 1.61$ unprompted peer mands/ min) was slightly lower than his level of unprompted peer mands in the withdrawal phase ($M = 1.72$ unprompted peer mands/ min), but qualitatively his interactions were much more social in nature. When partnered with his general education peer partner Zoe he asked questions/ mands for information, demonstrated mands for actions/ attention, and he wanted to play games like "Go Fish" that required turn taking and communicative exchange. Despite the decreased rate of unprompted mands from the withdrawal to the generalization phase, the rate of responding in the generalization phase was still higher than the unprompted mand rates during baseline ($M = .08$ unprompted peer mands/ min). The percentage of non-overlapping data points from the withdrawal to the generalization phases was 21.43%. All of these non-overlapping data points were in the withdrawal condition where there was a larger range (.75- 2.75) than in the generalization phase.

6.5.3 Mark

Mark participated in six generalization sessions with his typical peer partner Sam. While in the generalization phase, Mark demonstrated a decreasing trend and a decreased level from the previous condition. Despite the decreasing trend, Mark demonstrated an elevated level of responding on the last data point in the generalization phase (2.25 unprompted peer mands/ min). His overall level of responding in the generalization phase ($M = 1.25$ unprompted peer mands/ min) was still increased from his baseline level ($M = 0$ unprompted peer mands/ min) despite being lower than the level of responding in the withdrawal phase ($M = 1.55$ unprompted peer mands/ min). The percentage of non-overlapping data points from the withdrawal to the generalization phase was 27.27 %, with all of the non-overlapping data points in the generalization phase due to the increased range/ variability in responding (range = .42 - 2.25 unprompted peer mands/ min).

6.5.4 Caleb

Caleb participated in five generalization sessions with his general education peer play partner Sam. The level and trend of Caleb's responding continued to increase throughout the generalization phase ($M = 1.53$ unprompted peer mands/ min) with only one data point of variability dropping considerably below the rest (.42 unprompted mands per minute). This lower level of responding was observed towards the end of the generalization mand sessions, and happened to be the last session before Caleb was absent the following day. Although Caleb's responding in the generalization phase (maximum mand/ min = 2.33) was not as high as early responding in the withdrawal phase (3.17 unprompted mands/ min), it was strong overall and

stable in the generalization phase. Only 20% of the data between the withdrawal phase and the generalization phase were non-overlapping data points. This is likely because both of the phases had very similar and somewhat large ranges (see Table 6). An additional observation from this phase that was not targeted was that Caleb demonstrated an attempt to play with a toy in the same manner as his peer play partner. Although Caleb had been exposed to this item before, he never attempted to use the toy as intended. After watching Sam for repeated sessions, Caleb demonstrated delayed generalized motor imitation and attempted to put a ball on a slingshot. When struggling to do this he looked towards his peer partner and requested, “help.”

6.5.5 Isaiah

Isaiah participated in five generalization sessions with his general education play partner Adam. Although Isaiah’s overall level dropped from the withdrawal phase ($M = 1.72$ unprompted peer mands/ min) to the generalization phase ($M = .80$ unprompted peer mands/ min), when comparing between condition changes, Isaiah’s level of responding in the generalization phase started at a level similar to where responding was occurring at the end of withdrawal phase. As Isaiah progressed through the generalization phase, he demonstrated a stable gradual increasing trend in responding. Isaiah did show generalization of his unprompted mand skills, at a level much higher than baseline, but it was at a level lower than when partnered with his play partner for all of the previous sessions. Isaiah demonstrated some behaviors of interest that also fell outside of the quantitative recording systems. When partnered with Adam, Isaiah demonstrated increased turn taking play behavior like shooting at a target. He also demonstrated noticeable social commenting and generalized imitation play behaviors. When Adam went to play with a handheld game, Isaiah also picked up a handheld game at the same time and attempted to play.

There were 40% of non-overlapping data points from the withdrawal to the generalization phase. The more stable responding and narrower response range in the generalization phase likely contributed to this result.

6.5.6 Carter

Carter participated in five generalization sessions with his general education peer play partner Adam. In the generalization phase, Carter demonstrated less variability in responding and a slow increasing trend throughout mand sessions with Adam. The overall level of Carter's responding in the generalization phase ($M = 1.80$ unprompted peer mands/ min) was lower than the level of responding observed in the withdrawal phase ($M = 2.35$ unprompted peer mands/ min), but was still fairly strong with a steady stream of interaction occurring throughout the mand session. Sixty percent of all unprompted peer mand data points were non-overlapping in the withdrawal and generalization phases. The large range of responding and variability demonstrated in the withdrawal phase, and the more narrow/stable responding evidenced in the generalization phase led to this result.

6.6 MAINTENANCE

All participants took part in at least two maintenance checks. Maintenance checks were intended to see if the skill mastered in the intervention phase and demonstrated in the withdrawal and generalization phases would maintain over time with sessions conducted once a week. Participants demonstrated variable responding when introduced to maintenance sessions.

6.6.1 Bella

Bella's participated in three maintenance check sessions before it was determined that it was not in the best interest of her or her partner for her to continue in the study any longer due to her high rates of disruptive behavior and increasing level of aggressive behaviors throughout the instructional day. She made it through the all of the phases of the investigation and continuing sessions in the maintenance phase was not anticipated to improve the participants' skills or bring further helpful data and results. Bella demonstrated lower rates of responding in the maintenance phase ($M = .39$ unprompted mands/ min) than in the generalization phase, but her level of unprompted mands in the maintenance phase was still higher than that during baseline ($M = .08$ unprompted mands/ min). Of the eight sessions in the generalization and maintenance phases 25% of the data points were non-overlapping. This higher percentage of overlap is an indication that responding did maintain at levels close to those observed during the preceding phase.

6.6.2 Calvin

Calvin also participated in three maintenance check sessions. Calvin's peer partner Bella was demonstrating increased rates of problem behavior with increased intensity during the maintenance sessions and it was determined by the team that it was in the best interest of both participants to discontinue sessions. Calvin demonstrated an immediate increase in unprompted mands when assessing the level between conditions from the last data point in the generalization phase (2.25 unprompted peer mands/ min) to the first data point collected in the maintenance phase (2.83 unprompted peer mands/ min). His overall level throughout the phase maintained high ($M = 2.22$ unprompted peer mands/ min) and there was only a slight decreasing trend across

sessions throughout the maintenance phase. His responding maintained fairly stable through the generalization phase (range = 1.08 - 2.25) and maintenance phases (range = 1.33 - 2.83). The level of unprompted peer mands in the maintenance phase ($M = 2.22$) shows a considerable change in responding from the baseline levels of unprompted peer mands/ min ($M = .08$). Mand response levels maintained strength even when mand sessions were only implemented once out of every five possible sessions and no prompt or instructor facilitated reinforcement procedures were in place. Calvin demonstrated 44.44% non-overlapping data points through the generalization and maintenance phases, with response rates from two of three the maintenance sessions above rates observed in the generalization phase.

6.6.3 Mark

Mark participated in two maintenance check sessions before being reintroduced to the conditions of the intervention phase. His participation in maintenance checks was ended because his peer partner was not demonstrating the delivery of reinforcers to Mark despite Mark's repeated manding. The research team felt that continuing to leave Mark and Caleb in the maintenance condition without implementing a modification could be problematic and it was unlikely for Caleb to begin delivering without some types of assistance. The team was also concerned that if Mark and Caleb were to continue in the maintenance phase without a change in procedures that the lack of responding by Mark's play partner might actually result in reduced unprompted peer mands by Mark. When reviewing Mark's responding, there is an increase in the level of unprompted peer mands from the generalization phase ($M = 1.25$) to the maintenance phase ($M = 1.34$). Mark's increased rates of peer mands in the maintenance phase could be because his

peer partner in the maintenance phase was not immediately or effectively fulfilling his requests as was observed for Mark when partnered with Sam for the generalization phase.

Although there was an immediate drop in level when analyzing Mark's rate of unprompted peer mands across conditions (last data in generalization = 2.25; first point in maintenance 1.42), overall the responding maintained strong with little variability in the maintenance phase. Mark's level of unprompted mands in the maintenance phase ($M = 1.34$) demonstrates a considerable change from his response levels in baseline ($M = 0$). Despite the reduced session schedule to every five session days, and the removal of prompt procedures and instructor controlled reinforcement, Mark continued to show strong and stable responding in the maintenance phase. Mark demonstrated 50% non-overlapping data points from the generalization to the maintenance phase, but all non-overlapping data point were observed in the generalization phase because of the large range of responding observed (.42 - 2.25 unprompted peer mands/ min).

6.6.4 Caleb

Caleb also participated in two sessions in the maintenance phase of the investigation. As noted above, despite his demonstration of peer mand behaviors in the maintenance phase, Caleb had difficulty delivering reinforcers to his peer play partner in the maintenance phase when sessions were reduced to every five session days. This limitation called for the investigative team to consider modifications to the procedures and to discontinue the maintenance phase and reintroduce intervention procedures for Caleb and Mark. Caleb demonstrated an immediate drop in the level of unprompted peer mands/ min between conditions (last data point generalization = 2.33; first data point in maintenance 1.33) and his overall level of responding was lower in the

maintenance phase ($M = 1.17$ unprompted peer mands/ min) than in the generalization phase ($M = 1.53$ unprompted peer mands/ min). Despite the drop in level, Caleb's responding in the maintenance phase was very stable with only a small range (1.0 - 1.33) and a slight increasing trend throughout the condition. With the reduction in session frequency, Caleb maintained strong and stable unprompted peer mand responses throughout the maintenance phase and there was an observable increase in responding compared to unprompted peer mands/ min in the baseline condition ($M = .07$). Caleb demonstrated 62.5% non-overlapping data points from the generalization to the maintenance phase, but all non-overlapping responses were observed in the generalization phase because of the large range of responding observed (.42 - 2.33 unprompted peer mands/ min).

6.6.5 Isaiah

Isaiah participated in two maintenance sessions before the end of the investigation. When comparing responding between conditions, Isaiah demonstrated a decrease in his level of responding from the generalization to the maintenance phase (last point of generalization = 1.42; first point in maintenance = .5). The reduction in level of unprompted peer mands/ min stayed overall lower throughout the entire maintenance phase (generalization $M = 1.53$; maintenance $M = .59$). Once in the maintenance phase (range = 0.5 - 0.67), there was a reduction in variability compared to the generalization phase and there was a slight increasing trend throughout the phase. Isaiah's rate of unprompted peer mands/ min reduced in the maintenance phase, but his responding demonstrated that he could maintain the skill when the sessions were run less frequently. The level of unprompted peer mands observed in the maintenance phase ($M = .59$) was observably higher than the initial baseline level of responding ($M = .01$). Isaiah

demonstrated 42.86% non-overlapping data points from the generalization to the maintenance phase. All non-overlapping responses were observed in the generalization phase due to the large range of responding observed in the generalization phase (.42 - 1.42 unprompted peer mands/ min) and the narrow range responding in the maintenance phase (0.5 - 0.67 unprompted peer mands/ min).

6.6.6 Carter

Carter participated in two maintenance check sessions prior to the end of the investigation. Similar to the response of Calvin, Carter showed an immediate increase in responding when introduced to the maintenance phase. An increase in responding was observed from the end of the generalization phase (2.0 unprompted peer mands/ min) to the beginning of the maintenance phase (2.25 unprompted peer mands/ min). Carter had a steep increasing trend throughout the maintenance phase ($M = 3.38$) and showed an increased overall level of responding when compared to the generalization phase ($M = 1.80$). It is unclear if this trend would have continued or if responding would have decreased with more time in the maintenance phase, but it is clear that unprompted peer mands maintained even when sessions were reduced to one time a week. When comparing his levels of unprompted to peer mands from baseline to the maintenance phase there was a clear difference in response frequency (baseline $M = .01$; maintenance $M = 3.38$). Carter demonstrated 100% non-overlapping data points from the generalization to the maintenance phase because his rate of responding in the maintenance phase exceeded any response levels observed in the generalization phase.

6.7 REINTRODUCTION OF INTERVENTION

Despite Caleb's strength in maintaining manding behaviors to peers throughout all phases of the investigation, it was determined that Dyad 2 should be reintroduced to intervention procedures in attempt to increase Caleb's unprompted delivery of reinforcers to his play partner Mark. The reintroduction of the intervention and modifications to procedures are outlined in the procedures section. The reintroduction of time delay procedures, reinforcement for prompted/ unprompted responding, and the use of block procedures for free deliveries likely influenced mand rates as well as peer reinforcer delivery rates.

6.7.1 Mark

Mark participated in a total of 23 sessions when the intervention and modified intervention procedures were reintroduced following participation in maintenance sessions. When reintroduced to the basic intervention (IV), (first data point = 1.33 mands/ min) Mark showed responding consistent with his rates of unprompted peer mands/ min observed the end of the maintenance phase (last data point = 1.25). His mand rates maintained fairly stable and above baseline levels throughout the entire reintroduction to the intervention phase ($M = .83$). This was somewhat of a drop from the maintenance phase ($M = 1.34$), but considering that the rate of prompted mands rose during these phases this could be anticipated. Responding at the end of IV-2 demonstrated increased variability and an increasing trend. By the end of the IV-2 phase, Mark's unprompted peer mands rates were 1.25 and 1.5 responses per min. The percent of non-overlapping data points was 84% due to the narrow range observed in maintenance sessions

(1.25 - 1.42 unprompted peer mands/ min) and the large range in responding in the reintroduction to the intervention phase (.17-1.5 unprompted peer mands/ min).

6.7.2 Caleb

Caleb also showed responding similar to Mark's unprompted mands throughout the reintroduction to the intervention and modification to intervention phases. Caleb spent a total of 23 sessions in the reintroduction to the intervention phase. Like Mark, Caleb maintained a moderate, yet stable level of unprompted peer mand responding throughout the reintroduction of the intervention phase ($M = .96$ unprompted peer mands/ min). This is a decrease in level from the maintenance phase ($M = 1.53$), but responding stayed stable and consistent in manding across modifications of procedures. Caleb did start to show an increase in level and trend at the end the IV-2 modification period with mand rates as high as 3.58 and 2.37 unprompted peer mands/ minute. It is hoped that this trend would continue for both participants if the instructional team maintained the procedures. The percent of non-overlapping data points was 88% due to the extremely narrow range of responding observed in the maintenance phase (1.0-1.33 unprompted peer mands/ min) and large range of responding observed in the reintroduction to the intervention phase (.08 - 3.67 unprompted peer mands/ min).

6.8 UNPROMPTED REINFORCER DELIVERIES TO PEERS

What effect(s) will the use of time delay procedures and differential reinforcement have on the rate of deliveries of preferred items to peers in individuals with autism and IDD?

Figures 2 and 4 contain graphs of the frequency of unprompted peer reinforcer (S^{r+}) deliveries during 12 min peer mand sessions across dyads for all phases of the investigation. In Figure 4, the x-axis represents days and the y-axis represents the rate of unprompted peer reinforcer deliveries per min. The first participant in each dyad is represented with an x marker and the second participant in each dyad is represented as a triangle, however both participants in the dyad were introduced to phase changes at the same time. Sessions occurring on consecutive days have connected lines unless the investigative team introduced a phase change. Solid dog-legged lines represent phase changes and dotted vertical lines represent minor modifications to procedures. Primary phase changes are indicated with a solid dog-legged line include changes from baseline to intervention, intervention to withdrawal, withdrawal to generalization, generalization to maintenance, and maintenance to the reintroduction of the intervention. Tables 7 and 8 provide specific information on the means and ranges of responding across all phases for each participant.

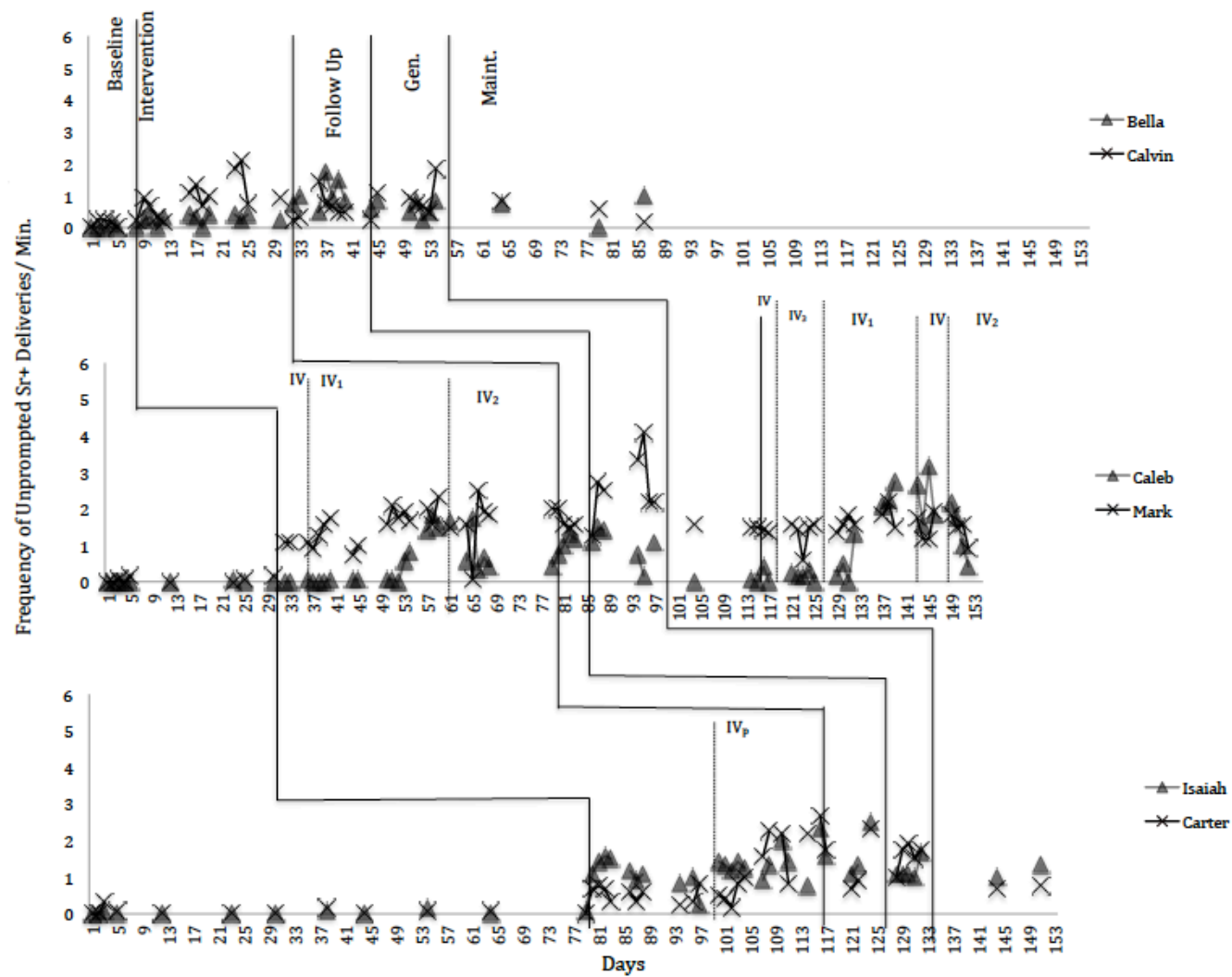


Figure 4. Frequency of Unprompted Reinforcer Deliveries by Dyad

Table 7. Mean Unprompted Reinforcer Deliveries

<i>Participants</i>	<i>Baseline M</i>	<i>Intervention M</i>	<i>Withdrawal M</i>	<i>General. M</i>	<i>Maint. M</i>	<i>Reintro. IV M</i>
Bella	.03	.26	.98	.62	.58	
Calvin	.13	1.04	.58	.96	.53	
Mark	.06	1.5	1.58	2.83	1.54	1.50
Caleb	.01	.52	1.07	.98	.04	1.09
Isaiah	.03	1.19	1.76	1.18	1.17	
Carter	.06	.86	1.69	1.58	.71	

Table 8. Range of Unprompted Reinforcer Deliveries

<i>Participants</i>	<i>Baseline Range</i>	<i>Intervention Range</i>	<i>Withdrawal Range</i>	<i>General. Range</i>	<i>Maint. Range</i>	<i>Reintro IV Range</i>
Bella	0.0 - .17	0.0 - .42	.50 - 1.75	.25 - .83	0.0 - 1.0	
Calvin	0.0 - .25	.25 - 2.08	.25 - 1.42	0.5 - 1.83	.17 - .83	
Mark	0.0 - .17	.08 - 2.33	1.25 - 2.0	2.17 - 4.08	1.5 - 1.58	.58 - 2.17
Caleb	0.0 - .08	0.0 - 1.83	.75 - 1.33	.17 - 1.42	0 - .08	0.0 - 3.17
Isaiah	0.0 - .17	.25 - 2.0	1.08 - 2.50	1.0 - 1.67	1.0 - 1.33	
Carter	0.0 - .33	.17 - 2.25	.67 - 2.67	1.0 - 1.92	.67 - .75	

6.9 BASELINE

During all 26 partnered baseline sessions, participants demonstrated very low levels of unprompted peer reinforcer deliveries per minute. In baseline although most participants demonstrated 0 reinforcer deliveries during most mand sessions, a range of 0 to .33 peer reinforcer deliveries per minute were observed during sessions. The mean unprompted peer reinforcer delivery rate during baseline was .05 reinforcer deliveries per minute. The level

remained low for all participants throughout baseline with very little variability, and no increasing trend.

6.10 INTERVENTION

All participants showed improvement in unprompted deliveries of reinforcers to peers with the introduction of basic the intervention treatment package with the exception of one participant (Caleb). As is expected for an intervention with the intent of teaching skills over time, the results generally do not show immediate jumps or changes in level between conditions, but instead show increasing trends directly following the introduction of the intervention, which later flatten out, resulting in changes in level within conditions.

6.10.1 Bella

Bella participated in a total of 13 intervention sessions after five sessions in baseline. Bella was demonstrating high frequency problem behaviors of increasing intensity throughout the period of time involved in the research study. Her delivery of reinforcer rates in the intervention phase ($M = .26$ unprompted deliveries/ min) were below ideal rates for moving into the withdrawal phase, but were higher than baseline rates ($M = .03$ unprompted deliveries/ min). Prompted reinforcer deliveries appeared to be potentially serving as an antecedent to some problem behavior so it was determined that moving her from the intervention to the withdrawal phase was appropriate despite the small increase in the unprompted delivery of reinforcer behaviors to her peer. Switching to the withdrawal phase removed reinforcer delivery demands, which the team

anticipated, would result in less problem behavior and in increased unprompted peer mands and unprompted peer delivery behaviors. In the intervention phase, Bella demonstrated a gradual stable increasing trend in the delivery of reinforcers to peers, but the change in level from the baseline to the intervention was less of a change than desired. The percentage of non-overlapping data points from baseline to intervention was 56%, demonstrating that there was an observable change in level when comparing level across conditions.

6.10.2 Calvin

Calvin also participated in 13 teaching sessions in the intervention phase. Unlike some of the other participants, Calvin did show some lower rates of unprompted deliveries of reinforcers to peers in the baseline phase ($M = .13$ unprompted reinforcer deliveries/ min), but his responding in baseline was low, stable and there was not an increasing trend in responding. When he moved into the intervention phase he demonstrated a fast change in responding resulting in a steep increasing trend throughout the intervention phase with some moderate levels of variability. The overall level increased measurably throughout intervention ($M = 1.04$ unprompted deliveries of reinforcers to peers/ min). This rate increase was strong, but it should be recognized that the rate of peer mands were likely influenced by the peer partner's reinforcer delivery rates. Calvin demonstrated 83% non-overlapping data points on the deliveries of reinforcers to peers from the baseline to the intervention phase, demonstrating an observable change in level when assessing each condition.

6.10.3 Mark

Mark spent 24 total sessions in the initial intervention phase. When introduced to the intervention he showed an immediate increase in unprompted peer reinforcer deliveries with a considerable jump in response level between conditions (last data point in baseline = .17; the first data point in the intervention = 1.08). Mark continued to show an increase in trend and level throughout the intervention phase, with responses at the end of the intervention phase at 2.0 unprompted peer reinforcer deliveries/ min. There was an observable change in level from the baseline phase ($M = .06$ unprompted peer reinforcer deliveries/ min) to intervention phase ($M = 1.5$ unprompted peer reinforcer deliveries/ min). Mark demonstrated 69.70% non-overlapping data points from the baseline to the intervention phase. As mentioned in the manding section, modifications to procedures were implemented throughout this initial intervention phase in an attempt to improve the reinforcer delivery rate of Mark's peer partner. Despite the introduction of various modifications to the procedures (IV-1 and IV-2), Mark continued to demonstrate increasing trends in his unprompted reinforcer delivery rate. With the exception of one data point (Day 65) towards the end of the IV-2, the rest of his responding was stable and consistent throughout the intervention phase despite minor changes to the intervention procedures.

6.10.4 Caleb

Caleb participated in 24 sessions in his initial exposure to the intervention condition. After four sessions in the intervention, Caleb was making minimal progress on unprompted peer reinforcer deliveries. He only made one unprompted delivery in the first four sessions ($M = .02$ unprompted reinforcer deliveries/ min). This lack of progress on this measure prompted the team

to re-evaluate the intervention procedures and deliver small amounts of edible reinforcement for prompted deliveries of reinforcers to his peer partner (IV-1). After switching to the IV-1 procedures, initially Caleb did not show changes in level or trend and his responding stayed low and stable. As he continued with the modified procedures for prompted deliveries, increases in unprompted peer reinforcers were observed. Towards the end of the IV-1 phase, Caleb began to show an increase in trend and level of responding. At this point few deliveries were prompted, however Caleb was now giving materials at a fast rate and without attention to any peer manding behavior. The team removed reinforcement for prompted deliveries and switched to a different modification to the procedures (IV-2), which embedded a block on the free delivery of reinforcers to peers and included providing a mand prompt to the peer partner after a 3 s time delay. After the initial switch to the IV-2 procedures, Caleb showed strong and gradually increasing responding, but as time continued in the phase he demonstrated a drop in level. Although there was a drop in responding, his level of unprompted peer reinforcer deliveries was still higher than that observed in baseline or responding seen earliest in the basic intervention phase. Although responding was variable throughout the intervention phase with modifications, there was still an observable increase in responding from the baseline level of unprompted peer reinforcer delivery behaviors ($M = .01$) to the intervention ($M = .52$). Caleb ended the IV-2 phases with reinforcer delivery rates observably above that seen when starting the intervention phase (1.83 and 1.5 unprompted peer reinforcer deliveries/ min). The change in responding is also observable through review of the ranges of unprompted peer reinforcer deliveries/ min in each condition (baseline range = 0 - .08; intervention range = 0 - 1.83). The percentage of non-overlapping data points from the baseline to the intervention for unprompted peer reinforcer deliveries for Caleb was 36.36%. Thirty-six percent non-overlapping data points is somewhat

low, but this could be anticipated because many of the initial data points in the intervention phase were very low.

6.10.5 Isaiah

Isaiah participated in 20 intervention sessions with the first 10 free of any social reinforcement, and the last 10 sessions in intervention with social praise added (IV-P) for unprompted mands demonstrated. This slight modification was intended to increase responding on that measure, but there was no observable need for a modification to the procedures on the reinforcer delivery measure. When reviewing the responding on reinforcer delivery measure, there was a change in level between baseline and intervention phases (last data point in baseline = .08; first data point in intervention = 1.08). This initial increase may be in part due to the increase in mands to respond to from his peer partner. Throughout the intervention phase, rates of reinforcer delivery stayed at an increased level ($M = 1.19$ unprompted peer reinforcer deliveries/ min). Initially there was a considerable jump in level and a strong increasing trend. This pattern of responding changed over the course of the phase and following the initial rise in trend there was a decreasing trend. Even with the decreasing trend, responding was still observably higher than rates of reinforcer delivery observed in the baseline phase ($M = .03$). Responding was stable along trend lines, but there was a fairly large range in responding throughout the phase (range = .25 - 2.0 unprompted peer reinforcer deliveries/ min). This could be affected by peer mand rates. There were 100% non-overlapping data points from the baseline to the intervention phase. This is likely because baseline rates were so low and Isaiah showed an immediate increase in reinforcer delivery responding as soon as introduced to the intervention.

6.10.6 Carter

Carter participated in 20 intervention sessions following his 12 sessions in the baseline condition. Carter showed an immediate increase in responding with an observable change in level when introduced to the intervention phase (first session in intervention session = .67 unprompted peer S^{r+} deliveries/ min; last session in baseline = 0 unprompted peer S^{r+} deliveries/ min). Throughout the basic intervention (IV) condition Carter demonstrated moderate levels of responding that were above baseline, but with a slightly decreasing trend. Isaiah's limited manding in intervention sessions may have contributed to Carter's reduced reinforcer delivery. Carter's delivery of reinforcer behavior followed the same patterns in responding as his play partner's mand response data. When Isaiah began to mand at higher rates in the intervention (IV-P) sessions, Carter's unprompted reinforcer delivery behavior also demonstrated an increasing trend. Carter's overall reinforcer delivery level increased from baseline ($M = .06$) to intervention ($M = .86$). There were 78.13% non-overlapping data points when assessing responding in the baseline and intervention conditions. This represents a change in level despite the fact that initial responding was not drastically higher than baseline levels.

6.11 WITHDRAWAL

In the withdrawal condition, reinforcement and instructor prompt procedures were removed for a minimum of five sessions to see if the skills taught in the intervention sessions would maintain without the intensive procedures previously needed to facilitate the mand sessions. All six participants maintained peer reinforcer delivery skills during the withdrawal phase.

6.11.1 Bella

Bella participated in eight sessions in the withdrawal condition. While in the withdrawal condition she demonstrated strong responding. Although her responding was somewhat variable there was an observable change in level from the intervention ($M = .26$ unprompted S^{r+} deliveries/ min) to the withdrawal condition ($M = .98$ unprompted S^{r+} deliveries/ min). This change in level was also visible when reviewing the range of unprompted S^{r+} deliveries/ min in both conditions (intervention range = 0.0 - .42; withdrawal range = .50 - 1.75). There were 100% non-overlapping data points across conditions indicating a distinct change in level. It was also hypothesized by the intervention team that instructor facilitated demands to fulfill peer requests were potential antecedents for problem behavior and the removal of the adult demands may have contributed to the increased appropriate play behaviors observed.

6.11.2 Calvin

Calvin maintained his delivery of reinforcers to his peer partner during his eight peer mand sessions in the withdrawal condition. As could be anticipated, Calvin's unprompted delivery of reinforcer behavior followed the response patterns of his peer partner's mand responding. He demonstrated a drop in unprompted S^{r+} delivery behaviors from the intervention ($M = 1.04$) to withdrawal condition ($M = .58$), but he still consistently demonstrated responding to peer requests by delivering the requested item(s). Although Calvin demonstrated peak responding in the middle of the withdrawal phase (initial increasing trend in the phase followed by a decreasing trend), the decline of the trend reduced towards the end of the phase. Calvin's reinforcer delivery response level in the withdrawal phase was clearly above the responding observed during

baseline, but was lower than the responding observed in the intervention phase. Calvin demonstrated 10% of non-overlapping reinforcer delivery data points from the intervention to the withdrawal phase. His variable responding and large range in rate of responding in the intervention phase (range = .25 - 2.08) decreased the likelihood for responding outside of this area. Responding in the withdrawal phase was a little bit more narrow and stable, and Calvin maintained reinforcer delivery to his peer partner during mand sessions.

6.11.3 Mark

Mark spent five sessions in the withdrawal condition after his time in the intervention phase. Mark's delivery of reinforcers to his peer partner rate maintained from the intervention ($M = 1.5$) to the withdrawal phase ($M = 1.58$). His level of responding was strong and stable with a slight decreasing trend throughout the withdrawal phase. The range in intervention was wider for Mark, as was observed with Bella, and the percent of non-overlapping data points was 34.48%. His responding stayed strong and was did not appear effected by the removal of instructor-controlled reinforcement, the removal of free delivery block procedure (IV-2), or the removal other instructional prompt procedures.

6.11.4 Caleb

Caleb participated in five withdrawal sessions after participation in the intervention phase. Caleb's level of responding from the intervention phase continued as he entered the withdrawal phase with a stable moderate rate. As he continued in the withdrawal phase, Caleb started to demonstrate increased trend in responding. Caleb's overall level in the withdrawal phase (M

=1.07 unprompted peer S^{r+} deliveries/ min) was much higher than his level of responding in the intervention phase ($M = .52$ unprompted S^{r+} deliveries/ min). There were 79.31% non-overlapping data points from the intervention to the withdrawal phase. Many of the response rates in the intervention phase were above or below the rates of responding in the withdrawal phase. Caleb not only demonstrated the reinforcer deliveries in response to peer requests at rates comparable to the response rates seen in the intervention phase, but he continued to improve in his rates in the withdrawal phase.

6.11.5 Isaiah

Isaiah participated in five sessions in the withdrawal phase following participation in the intervention phase. Isaiah demonstrated an immediate increase in the unprompted deliveries of reinforcers/ min when switching from the intervention to the withdrawal phase (last session in intervention = .75; the first session in withdrawal = 2.33). Throughout the withdrawal phase, Isaiah continued to show an increasing trend in responding. Isaiah also demonstrated an overall increased level of unprompted S^{r+} delivery from the intervention phase ($M = 1.19$) to the withdrawal phase ($M = 1.76$). When comparing unprompted peer S^{r+} deliveries in the intervention and withdrawal phases, Isaiah demonstrated 32% non-overlapping data points. The range of responding in the withdrawal phase was higher and narrower (range = 1.08 - 2.50) compared to responding observed in the intervention phase (range = .25 - 2.0). Isaiah maintained reinforcer delivery to his peer when instructor facilitated reinforcement and prompt procedures were removed.

6.11.6 Carter

Carter participated in five sessions in the withdrawal phase. Carter maintained, and even increased his level of unprompted peer S^{r+} deliveries from the intervention ($M = .86$) to the withdrawal phase ($M = 1.69$). Isaiah's increased mand rate likely contributed to Carter's strong and increased responding in the withdrawal phase. The increasing trend in responding continued to grow as he progressed through the withdrawal condition. There were 44% non-overlapping data points from the intervention to the withdrawal condition. Carter showed a general increase in the delivery of reinforcers to his peer partner during the withdrawal phase even though instructor-facilitated reinforcement was removed and no prompt procedures were active during this phase.

6.12 GENERALIZATION PHASE

As a whole, the six primary participants all demonstrated continued responding in the delivery of reinforcers to peers during the generalization phase. All participants responded to the requests of peers when partnered with a neurotypical general education peer partner for mand sessions. The rates of requesting by the typical peers may have been slower or less frequent than the request rates of the primary participant's initial peer play partners who also demonstrated some type of communication deficit.

6.12.1 Bella

Bella spent six sessions in the generalization phase of the investigation. Despite Bella's problem behavior throughout the investigation, she still fulfilled the requests of a peer partner when the peer partner was switched to a novel general education peer. Her level of responding in the generalization phase ($M = .62$ unprompted S^{r+} deliveries/ min) was a slightly lower level than that observed in the withdrawal phase ($M = .98$ unprompted S^{r+} deliveries/ min), but she still responded to novel peer requests during mand sessions. Bella demonstrated a stable moderate level of peer reinforcer deliveries, but no strong trends were observed. Bella fulfilled the requests of her general education peer partner when she asked for things, and at times she delivered reinforcers when no request was made. In the generalization phase, the typical peer partner, Zoe did not make nearly as many requests as Bella's partner from the other conditions. This could have had an affect on her rate of delivery. Although Bella's level of responding in the generalization phase was lower ($M = .62$) it was still observably above the level of unprompted reinforcer delivery observed during baseline ($M = .03$). Bella demonstrated 35.17% non-overlapping data points from the withdrawal to the generalization phase.

6.12.2 Calvin

Calvin played with his typical peer partner, Zoe for six generalization sessions. His overall responding in the generalization phase was similar to his responding in the withdrawal phase. His level of responding was moderate with some level of variability. There was an overall increase in level when comparing the unprompted reinforcer deliveries in the withdrawal phase ($M = .58$) to response rates in the generalization phase ($M = .96$). The types of interactions

observed were qualitatively different in the generalization phase. The reinforcer deliveries in the generalization phase included frequent fulfillment of requested actions and were part of a back and forth dialog of communication that was occurring throughout the session. Calvin started out the generalization phase with a decreasing trend, but his reinforcer delivery behavior picked back up at the end of the phase. This is likely due to the number of requests from his typical peer partner. Overall Calvin fulfilled the requests of his peer partner without assistance when partnered with a neurotypical general education peer. Calvin demonstrated 28.57% non-overlapping data points across the withdrawal and generalization phases. This shows that the skills overall maintained with the switch to the general education peer.

6.12.3 Mark

Mark spent six generalization mand sessions with his typical peer partner Sam. Mark demonstrated a drastic increase in the unprompted delivery of reinforcers to his partner during mand sessions. He showed an immediate increase from the last data point in the withdrawal condition (1.25 unprompted S^{r+} deliveries/ min) to the first data point in the generalization condition (2.75 unprompted S^{r+} deliveries/ min). Mark's responding continued on an increasing trend throughout the generalization phase with the highest levels of responding observed in any condition. The overall level of responding was considerably higher in the generalization phase ($M = 2.83$ unprompted S^{r+} deliveries/ min) than responding observed in the withdrawal phase ($M = 1.58$ unprompted peer S^{r+} deliveries/ min). There were 100% non-overlapping data points from the withdrawal to the generalization phase. His increased responding in the generalization phase could be influenced by his previous peer partner's lack of engagement and limited responding to Mark's mands in early sessions. Sam was proficient at fulfilling Mark's requests

immediately and was attentive to his desires and needs. During the generalization phase, Mark showed physical signs of excitement when his general education peer partner Sam entered the room. It is possible that his peer's proficient responding during this phase increased motivation for fulfilling his partner's requests.

6.12.4 Caleb

Caleb participated in five generalization mand sessions with his typical peer partner Sam. While in generalization, Caleb transferred the unprompted delivery of reinforcer skills mastered in the intervention phase to a neurotypical general education peer partner. Caleb's reinforcer delivery behavior in the generalization phase started at a level very similar to the level of responding where he finished in the withdrawal phase, but later in the generalization phase there was a drop in responding to lower levels. Overall there was a decreasing trend throughout this phase, with the lowest point (.17 unprompted deliveries/ min) occurring the day prior to an absence reportedly due to illness. Even with the decreasing trend, overall levels of responding in the generalization phase ($M = .98$ unprompted S^{r+} deliveries/ min) were only slightly lower than the level of responding observed in the withdrawal phase ($M = 1.07$ unprompted S^{r+} deliveries/ min) and response levels were still observably higher than in baseline ($M = .01$ unprompted S^{r+} deliveries/ min). Caleb demonstrated 30% non-overlapping data points across the withdrawal and generalization phases of the investigation. His responses were overall similar despite the change in communicative partner.

6.12.5 Isaiah

Isaiah participated in five generalization session with his general education peer partner Adam. When introduced to the generalization phase, Isaiah demonstrated an initial drop in his level of responding compared to his responding in the withdrawal phase (last session in withdrawal = 2.5; first session in generalization = 1.08). His responding was still observably higher in the generalization phase ($M = 1.18$ unprompted S^{r+} deliveries/ min) than the response rates observed during the baseline condition ($M = .03$ unprompted S^{r+} deliveries/ min). Overall his responding throughout the generalization phase was stable and did not show much variability or change in trend. Isaiah demonstrated 30% non-overlapping data points when assessing responding across withdrawal and generalization conditions. The higher percentage of overlapping data points was an indication of skill generalization despite the change in conditions.

6.12.6 Carter

Carter participated in five generalization sessions with his general education play partner Adam. Carter demonstrated strong and stable responding when he transitioned to responding in the generalization phase. Although he was reluctant at times to give over an Oreo or two, overall he showed strong and stable responding with regard to the delivery of reinforcers to his peer partner. He showed a slightly lower overall level of responding in the generalization phase ($M = 1.58$ unprompted S^{r+} deliveries/ min) as compared to his overall level or responding in the withdrawal phase ($M = 1.69$ unprompted S^{r+} deliveries/ min). There was no observable variability in responding and no clear trend throughout the generalization phase. The level of unprompted peer reinforcer delivery behavior maintained in the generalization phase was

observably higher ($M = 1.58$ unprompted peer deliveries of reinforcers/ min) than the delivery rates observed in baseline ($M = .06$ unprompted peer deliveries of reinforcers/ min). There were 40% non-overlapping data points in the withdrawal and generalization phases. All responding in the generalization phase fell within the wider range of responding observed in the withdrawal phase. This is an indication that the reinforcer delivery behavior maintained in the generalization phase even with the change in the play partner.

6.13 MAINTENANCE

In the maintenance phase participants returned to sessions with their original mand session partners from early phases in the investigation. During these sessions there was no instructor-facilitated delivery of reinforcement or prompt procedures. These sessions were held one out of every five possible session days. All of the participants maintained responding to peer requests through the delivery of reinforcers to peers, with exception of one participant, Caleb. Although some of the other participants demonstrated reduced rates of unprompted S^{r+} deliveries/ min, all of the participants except Caleb still demonstrated the skill throughout maintenance mand sessions.

6.13.1 Bella

Bella participated in three maintenance sessions prior to discontinuing her participation in the investigation. Bella was demonstrating high rates of problem behavior throughout the sessions and it was determined in her best interest to discontinue participation. In maintenance sessions,

Bella demonstrated low and relatively stable responding. On one of the maintenance probes she did not deliver any reinforcers to her peer during the session, however she did deliver reinforcers during the other two maintenance sessions (.75 & 1.0 unprompted reinforcer deliveries/ min). Her overall level of responding during the maintenance phase ($M = .58$ unprompted reinforcer deliveries/ min) was slightly lower than her rate of responding during the generalization phase ($M = .62$ unprompted reinforcer deliveries/ min), but it was still considerably higher than her rate of responding during the baseline sessions ($M = .03$ unprompted reinforcer deliveries/ min). Bella demonstrated 25% non-overlapping data points in the maintenance and generalization phases. The maintenance range of responding (0 - 1.0 unprompted reinforcer deliveries/ min) was similar and only slightly larger than the range of responding in the generalization phase (.25 - .83). The responding was similar in the maintenance and generalization phases. Overall Bella maintained the skill of delivering reinforcers to peers during mand sessions throughout the phases of the investigation following the intervention.

6.13.2 Calvin

Calvin also participated in three maintenance check sessions following the generalization phase. His reinforcer delivery rates were measurably lower in the maintenance phase ($M = .53$ unprompted reinforcer deliveries/ min) than the response rates observed in the generalization phase ($M = .96$ unprompted reinforcer deliveries/ min). His response rates in maintenance ($M = .53$ unprompted reinforcer deliveries/ min) were quite similar to the response rates observed in the withdrawal phase ($M = .58$ unprompted reinforcer deliveries/ min). This could be because his peer partner's mand rates were low. There were not a lot of defined opportunities to fulfill mand requests from his partner unless he choose to freely deliver reinforcing items absent of a peer

request. This is possible and was observed by this participant and other participants at times throughout the study. His continued responding to his partner despite her demonstration of problem behavior is a fairly strong indicator that the behavior repertoire is fairly robust and likely to maintain across circumstances and conditions. There was a slight decreasing trend in the unprompted delivery of reinforcers to his peer partner across the maintenance phase, but he was still delivering even more reinforcers than were requested by his peer during all of the maintenance sessions. There were 37.5% non-overlapping data points in the generalization and maintenance phases. All non-overlapping data points were during the generalization phase, where a larger range of responding was observed (.05 - 1.83 unprompted reinforcer deliveries/min).

6.13.3 Mark

Mark participated in two maintenance check sessions before it was determined that the instructors needed to reintroduce the intervention procedures for his peer partner Caleb. When Mark entered the maintenance phase, after a week absent of mand sessions, his unprompted reinforcer delivery level was still strong ($M = 1.54/\text{min}$), but did drop somewhat from the responding observed in the generalization phase ($M = 2.83/\text{min}$). His responding throughout the two sessions in the maintenance phase was stable and consistent. Since there were only two data points collected during this period there was really not enough information to identify a trend. As noted with the other participants, delivery behavior was not solely controlled by the mand rate of the communicative partner, but it did likely have an influence on rate of responding. Mark demonstrated 100% non-overlapping data points in the generalization and maintenance phases. His responding was so strong in the generalization phase that the drop in maintenance

skills fell outside of the level of responding observed in the previous phase. Despite the jump in level across conditions, Mark's unprompted deliveries of reinforcers to peers stayed relatively strong in the maintenance phase.

6.13.4 Caleb

Caleb participated in two maintenance check sessions before it was determined that his unprompted reinforcer delivery behavior was so low that the instructional team needed to implement a change in conditions. Caleb went from demonstrating 1.08 unprompted reinforcer deliveries/ min during the last session in the generalization phase, to 0 unprompted reinforcer deliveries/ min in the first session of the maintenance phase. His performance remained low in the next session. Although he demonstrated one delivery in the 12 min mand session (.08 unprompted reinforcer deliveries/ min), the team noted this was still clearly below minimal response criteria and determined it important to reintroduce the intervention rather than continue to allow the participants to respond in the maintenance phase. Continuing in maintenance did not appear likely to be beneficial for Caleb and could negatively influence Mark's mand behavior. In the maintenance phase, Caleb demonstrated low level to no responding ($M = .04$ unprompted peer S^{r+} deliveries/ min), which was a change in level from the previous phase ($M = .98$ unprompted peer S^{r+} deliveries/ min). His response level in the maintenance phase was comparable to his observed level of responding during baseline ($M = .01$ unprompted peer S^{r+} deliveries/ min). No trends were observed during the maintenance phase, as the responding was consistently low with little variability. There were 100% non-overlapping data points across the generalization and maintenance phases for this measure because of the considerable drop in responding observed in the maintenance phase.

6.13.5 Isaiah

Isaiah participated in two maintenance sessions prior to the end of the investigation. His initial responding in the maintenance phase (1.0 unprompted peer S^{r+} deliveries/ min) was an observable drop in level from his responding during the last session of the generalization phase (1.67 unprompted peer S^{r+} deliveries/ min). His responding did stabilize in the maintenance phase and overall levels of responding in the generalization and maintenance phases were very similar (generalization $M = 1.18$ unprompted peer S^{r+} deliveries/ min; maintenance $M = 1.17$ unprompted peer S^{r+} deliveries/ min). Responding was stable in the maintenance phase with a fairly small range (1.0 - 1.33 unprompted peer S^{r+} deliveries/ min). The two data points in the phase were limiting in identifying a trend, but based on the information available it appears there may have been a slight increasing trend during the maintenance phase. The percent of non-overlapping data points was 14.29%. The only non-overlapping data point was from the slightly larger range of responding seen in the generalization phase. Overall responding stayed strong indicating that Isaiah maintained the skill of delivering reinforcers to his peer partner during mand sessions when he did not have sessions daily and when instructor prompts and facilitated reinforcement were removed.

6.13.6 Carter

Carter also participated in two maintenance sessions following his mand sessions with his general education peer partner. Carter, like Isaiah, demonstrated an observable drop in responding from the end of the generalization phase to the beginning of the maintenance phase. Carter demonstrated 1.75 unprompted peer S^{r+} deliveries/ min during the last session in the

generalization phase and dropped to .67 unprompted deliveries of S^{r+} / min in the first session of the maintenance phase. This drop in level maintained stable throughout the maintenance phase where no relevant changes in trend or level were observed throughout the phase (range = .67 - .75 unprompted peer S^{r+} deliveries/ min). Having only two sessions within this phase limits analysis, but demonstrates that responding maintained during this phase ($M = .72$ unprompted peer deliveries of reinforcers/ min), but the level of responding was lower than that observed in the generalization phase ($M = 1.58$ unprompted peer S^{r+} deliveries/ min). The reduced peer mand behaviors observed by Carter's partner in the maintenance phase may have been a variable which contributed to Carter's reduced level of deliveries observed in this phase. There were 100% non-overlapping data points observed across the generalization and maintenance phases on this measure. The large drop in level of responding from the generalization to the maintenance phase caused for no overlap across conditions. The reduced delivery behaviors observed in the maintenance phase ($M = .71$) were still observably greater than the peer reinforcer delivery behaviors observed during the baseline phase of the investigation ($M = .06$). Despite the drop in level of responding, there was still evidence that peer reinforcer delivery behavior maintained when sessions were reduced to once a week.

6.14 REINTRODUCTION OF INTERVENTION

Based on Caleb's failure to maintain the unprompted delivery of reinforcer behavior in the maintenance phase of the investigation it was determined necessary to reintroduce the intervention. Modifications were made to the procedures throughout this reintroduction of the intervention phase based on participant responding. These modifications to procedures are

represented by dotted lines within the intervention phase (see Figure 4). All of the modifications to the procedures were modifications that were introduced when the participants went through the intervention phase the first time, with the exception of IV-3, which was a combination of two previous intervention modifications. The initial thought was that combining these two interventions previously introduced separately would provide efficient procedures likely to result in a fast rate increase, however the complexity of dual modifications to the procedures proved more difficult to implement with fidelity and increases in the rate of responding were not observed. Following these observations, the instructors moved to the IV-1 procedures alone and removed the IV-2 procedures. After the participants were demonstrating strong responding to IV-1 modifications in the reintroduction of the IV-1 phase, the IV-1 modifications were discontinued. The IV-1 modifications were followed by a short return to the basic IV procedures, before the IV-2 modifications were implemented.

6.14.1 Mark

Mark spent 23 sessions in the reintroduction to the intervention phase. His reintroduction to the intervention was based on the need for his communicative partner Caleb to increase his unprompted reinforcer deliveries after participation in the maintenance phase. Throughout the reintroduction of the intervention, Mark showed stable responding. His unprompted S^{r+} delivery behavior in the reintroduction of the intervention phase ($M = 1.50$) was very close to the same level of responding observed in the maintenance phase ($M = 1.54$). Overall there was no strong trend observed in the delivery of reinforcers to peer measure. There was evidence of a slight decreasing trend at the end of the IV-2 phase, but the level of responding was still observably higher than the responding observed in baseline (range = 0.0 - 0.17). Mark had 52% non-

overlapping data points in the maintenance and reintroduction of the intervention phases. All non-overlapping data points were in the reintroduction of the intervention phase because there were many more sessions and more variability observed. Overall Mark continued to maintain strong responding in unprompted S^{r+} delivery to peers throughout all phases of the investigation following initial intervention, including the reintroduction of the intervention phase.

6.14.2 Caleb

Caleb also spent 23 sessions in the reintroduction of the intervention phase. Caleb's minimal responding on the unprompted deliveries of reinforcers to peers in the maintenance phase was the reason for Dyad 2's reentry to the intervention phase. Caleb's overall level in the reintroduction of the intervention phase ($M = 1.09$ unprompted peer S^{r+} deliveries/ min) was observably higher than responding observed in the maintenance phase ($m = .04$ unprompted peer S^{r+} deliveries/ min). The return to the basic intervention procedures (IV) did not result in an observable change in level ($M = .14$ unprompted peer S^{r+} deliveries/ min) or trend and after three sessions it was determined in the best interest of the participants to introduce modified procedures as was conducted during the initial intervention phase. At this point the investigators attempted to introduce the IV-3 procedures, which combined IV-1 procedures (differential reinforcement for prompted deliveries of reinforcer) and IV-2 (a block on the free delivery of reinforcers and a prompt of peer mand after 3 s time delay). After three sessions in implementing the IV-3 modification, there was still very minimal change in Caleb's responding, with an average rate of unprompted peer reinforcer deliveries of .20 responses per minute. Instructor participants were also reporting difficulty implementing both modifications at the same time. Due to limited responding by Caleb and the input of the instructor participants, it was

determined that the team would move to the IV-1 procedures alone and focus on building up unprompted deliveries first before putting the block procedure in place for mands (IV-2). Caleb participated in nine sessions in the IV-1 phase. Once receiving differential reinforcement for prompted peer reinforcer deliveries and better reinforcement for unprompted peer reinforcer deliveries in IV-1, Caleb started to show an increasing trend in unprompted peer S^{+} deliveries/min and an overall increased level in responding (IV-1 $M = 1.05$). For three sessions the IV-1 procedures were removed and there was a return to the basic intervention procedures (IV). Although there was a strong level of responding in the basic IV condition with levels of reinforcer delivery generally higher than observed throughout the study (2.67, 2.58, and 3.17 rates of unprompted S^{+} deliveries/min), Caleb was primarily delivering the reinforcers absent of peer mands and was not demonstrating consistent responding to requests being made by his peer play partner Mark. At this point the IV-2 modifications to procedures was reintroduced and free deliveries were blocked and instructors used a 3 s time delay before prompting the peer partner to the request the item. When switching to this procedure Caleb fulfilled more specific mands and his general rate of unprompted deliveries of reinforcers maintained strong (reintro IV-2 $M = 1.43$). Overall throughout the maintenance phase and reintroduction of the intervention phase with modification there were 76% non-overlapping data points. This responding represented the change in level desired with the reintroduction of the intervention.

6.15 PROMPTED MEASURES

The primary investigator collected data on all prompted mands and reinforcer deliveries for all participants in all phases of the investigation. This data was used to assess participant responding

and to help identify if changes to the conditions or potential modifications to the procedures. All data collection on these secondary variables was collected via recording from videos. Prompted response data is available upon request, but is not included.

6.16 PROBLEM BEHAVIOR

For inclusion in the study participants were supposed to be generally free of problem behavior that interfered with instruction based on teacher report. Recording procedures for problem behavior measures were to be based on the participants' functional behavior assessment and positive behavior support plan. When the study began no participants were demonstrating problem behavior that warranted data collection and all were reported to not have problem behavior that significantly interfered with instruction in any way.

One participant, Bella, began to demonstrate significant problem behavior shortly after the beginning of the investigation. As noted in the methods section, once problem behaviors were observed, operational definitions for her problem behavior were developed and measurement systems were outlined. The primary investigator measured problem behaviors via video recording for all sessions.

When problem behavior was observed during intervention sessions, the instructor prompted a mand. Unfortunately, problem behavior was often occurring almost continuously throughout research sessions and the entire instructional day. Attempts were made to find new reinforcers for sessions and novel edible reinforcers to compete with the motivation for problem behavior. Although the team identified new reinforcers and edibles of value, these strategies did not result in the intended reduction of problem behavior.

Throughout the investigation only one session was terminated early due to increased intensity in problem behavior. Repeated sessions with intense problem behavior resulted in a team decision to discontinue participation for Dyad 1 in the maintenance phase of the investigation. The participant was demonstrating these behaviors throughout the instructional day, and it was determined not in the participants' best interests to continue sessions. Having made it to through three maintenance sessions and all other phases of the investigation the premature ending of the study for these two participants did not have a critical effect on the overall results.

Figure 5 represents the rate of problem behavior incidents in peer manding sessions. In the baseline phase, Bella demonstrated very low rates of problem behavior ($M = .05$ disruptive behaviors/ min) and on many sessions she did not demonstrate any problem behavior. An increase in the level of disruptive problem behavior was seen immediately after entering the intervention ($M = 1.46$ disruptive behaviors/ min). Disruptive behavior rates were variable during the intervention phase and demonstrated a general increasing trend. One session during the intervention phase (Day 27) was ended after only four min because of the high intensity behaviors observed in all three behavior categories (disruptive behaviors = 4.75 responses/ min, aggressive behaviors = .5 responses/ min, and flailing behaviors = .5 responses/ min). The team hypothesized that the prompt procedures and demand to deliver items may have resulted in the increased problem behavior. The team hoped that moving to the withdrawal phase where these procedures were removed might decrease her problem behavior. When moving to the withdrawal procedures, there was an immediate drop in the level of disruptive behaviors to levels close to zero again ($M = .39$ disruptive behaviors/ min). Disruptive behaviors maintained low throughout the remainder of the withdrawal phase with the exception of increases in responding in two

isolated sessions. When comparing disruptive behaviors between the withdrawal and the generalization phases there was not a meaningful change in level. The last data point in the withdrawal phase was .25 disruptive behaviors/ min and the first data point in the generalization phase is .33 disruptive behaviors/ min. Bella maintained moderate levels of disruptive behaviors throughout the first three sessions in the generalization phase, but demonstrated very low levels of problem behavior the last three sessions of the generalization phase. The overall level of disruptive behaviors during the generalization phase ($M = .57$ disruptive behaviors/ min) was slightly higher than in the withdrawal phase ($M = .39$ disruptive behaviors/ min). In the maintenance phase, Bella demonstrated an increased level and an increasing trend in disruptive behaviors/ min. There was an immediate increase in Bella's disruptive behaviors from the generalization to the maintenance phase, and this increased level continued throughout the remaining sessions in the maintenance phase ($M = 1.14$ disruptive behaviors/ min). Table 9 displays Bella's mean problem behavior rates across phases for all three operationally defined behavior categories.

Table 9. Bella's Mean Problem Behavior Incidents per Min by Phase

<i>Behavior</i>	<i>Baseline</i>	<i>Intervention</i>	<i>Withdrawal</i>	<i>General.</i>	<i>Maint.</i>
Disruptive	0.05	1.46	.39	.57	1.14
Flailing	0	0.06	0.06	0.07	0.08
Aggression	0	.06	0.07	0.03	.14

Figure 3 highlights Bella's unprompted response data on mands, peer reinforcer deliveries, and her rate of problem behavior. It was observable throughout the investigation that Bella often

demonstrated low peer reinforcer delivery rates when her disruptive behavior rates were high. Despite problem behavior, progress was observed and peer mands were noted outside of research sessions.

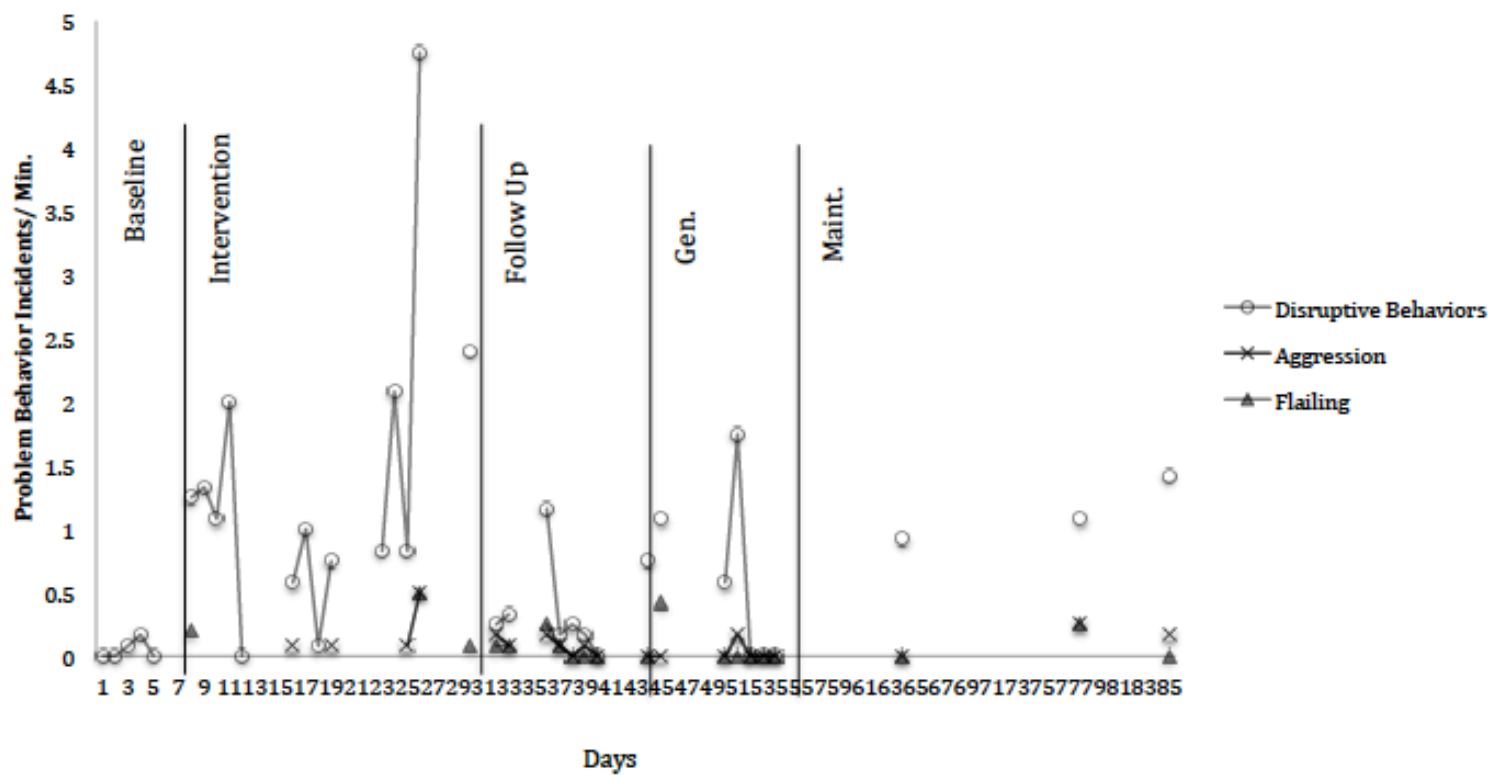


Figure 5. Bella's Rate of Problem Behaviors during Mand Sessions

6.17 SOCIAL VALIDITY

A social validity questionnaire containing 10 questions regarding various elements of the investigation was conducted following each instructor participant's last session. One of the five instructor participants' responses was not included in the analysis of results because she was unable to participate in the study past the initial baseline phase. Overall the instructors indicated that they found this investigation of social value selecting that they either "strongly agreed" or "agreed" on all questions asked (see Table 10). These responses indicated that the instructors found the "goal(s) of teaching" requesting and giving items to peers "important". The responses also indicated that the instructors found the procedures "acceptable" and "logistically manageable".

Due to the limited language abilities of the participants, a social validity survey designed to address these questions with each of the participants was not feasible to administer. A social validity questionnaire consisting of five questions regarding various elements of the investigation was also administered to the general education communicative partners from the generalization phase (see Table 11). Overall peer participants indicated that they found the sessions enjoyable and of value. Peer partners indicated that they "helped their friends learn to ask for toys and give them toys", and they would "help their friends ask for toys again."

Table 10. Instructor Social Validity Assessment

<i>Question</i>	<i>Instructor 1</i>	<i>Instructor 2</i>	<i>Instructor 3</i>	<i>Instructor 4</i>	<i>Average</i>
1. I thought the goal of teaching my students to give preferred items to their peers was an important goal.	5	5	5	5	5
2. I thought the goal of teaching peers to make requests was an important goal.	5	5	5	5	5
3. I found the teaching procedures acceptable.	4	5	5	4	4.5
4. I found the teaching procedures logistically manageable.	4	4	4	4	4
5. I would be likely to implement these teaching procedures with other students who have similar language and social needs.	4	5	5	4	4.5
6. I would suggest use of these teaching procedures to other instructors seeking to increase social communication among peers with autism and IDD.	4	5	5	5	4.75
7. I have observed increased rates of unprompted peer manding and delivery of reinforcers to peers following implementation of the procedures in teaching sessions.	4	5	5	4	4.5
8. I have observed increased rates of unprompted peer manding and delivery of reinforcers to peers following implementation of the procedures throughout the natural school day.	4	5	5	4	4.5
9. I think peer-to-peer manding has increased social skills in my students.	4	5	5	4	4.5
10. I think peer manding is a vital communication skill that without addressing could significantly affect quality of life.	5	4	5	5	4.75

Table 11. Peer Social Validity Assessment

	<i>Zoe</i>	<i>Sam</i>	<i>Adam</i>	<i>Average</i>
1. I liked playing with my friend.	3	3	3	3
2. I will play with my friend again.	2	3	3	2.67
3. I liked when my friend gave me toys.	3	3	3	3
4. I helped my friend learn to ask for toys and give me toys.	3	3	3	3
5. I will help my friend ask for toys again.	3	3	3	3

6.18 SUMMARY OF RESULTS

The overall results of the investigation indicate the application of a treatment package including time delay prompt procedures, differential reinforcement, and controls for motivation were effective in increasing unprompted peer mand and unprompted peer reinforcer delivery behavior in children with Autism and IDD. Although slight modifications were needed for two participants, all six participants demonstrated increased responding, demonstrating a functional relation between the treatment package and primary measures. All six participants demonstrated continued responding on unprompted mands and unprompted reinforcer deliveries in the conditions following the intervention, but many participants demonstrated reduced responding on at least one of the measures when sessions were reduced in frequency. Only one participant, Caleb demonstrated an observable decrease in reinforcer delivery in the maintenance phase,

requiring the reintroduction to the intervention procedures. Although some participants demonstrated decreased response levels, all of the participants demonstrated generalized unprompted mands and unprompted reinforcer deliveries when partnered with a neurotypical peer. Only one participant demonstrated problem behavior during peer mand sessions, and despite problem behavior, she still demonstrated improved responding on both measures following her introduction to the intervention. Instructor participants and neurotypical peer partners all noted that the investigation was of social value. Further analysis of the results will be explored in the discussion section.

7.0 DISCUSSION

As population statistics continue to rise for children with Autism (Center for Disease Control, 2014), the need for well established interventions to address the social and communication deficits of the diagnosis are needed (American Psychiatric Association, 2013; National Autism Project, 2009). ABA language interventions have consistently been proven successful in improving language and communication skills for this population (National Autism Project, 2009; Sundberg & Michael, 2001; Prelock, Paul, & Allen, 2011). Specifically, mand training has been highlighted as an important research-validated intervention for children with autism and IDD (Michael, 1988; Sundberg, 1993; Sigafoos, Kerr, Roberts, & Couzens, 1994; National Autism Project, 2009; Kane, Connell, & Pellecchia, 2010). Since mands are such a significant component of adult communication (Michael, 1988), much attention is needed to continue to expand the procedures and interventions available in this realm for families and practitioners.

Over the past decade, a handful of research teams have developed procedures in attempt to address the need to expand mand training to peers (Kodak et al., 2012; Lorah, et al., 2014; Paden et al., 2012; Taylor et al., 2005). Each peer manding investigation thus far has brought added valuable information to the research community, however, there are still many aspects of this intervention that need further investigation and clarification.

This current investigation aimed to combine elements of previous research into a treatment package replicable for practitioners. Only vocal responders were included in the study,

consistent with Pellecchia and Hinline (2007), in attempt to simplify the procedures and variables related to the use of multiple response forms. When developing the current design, attention was given to the importance of responding as a listener, as was noted in the recent research of Lora et al. (2014). The current investigation focused on the importance of implementing these procedures in a natural school setting (e.g., Taylor et al, 2005), recognizing the value of research in real world circumstances (Kratochwill, 1978; Gast & Ledford, 2014, p. 97). Differential reinforcement procedures were included, similar to those implemented in Pellecchia and Hinline (2007). Edible reinforcers and items were included in mand sessions in attempt to maintain motivation, as described in Kodak, Paden, & Dickes (2012).

Although elements from each of these research studies are replicated in the current investigation, this study combines many elements that were not together in any one previous investigation. No previous investigation has evaluated peer mand training with elementary-aged students in a public school environment. Although differential reinforcement was used in the past (Pellecchia & Hinline, 2007), the form of differential reinforcement applied in this investigation differed significantly in that it was consumable as opposed to increased duration with items for unprompted responses. The procedures were designed to simultaneously teach manding and discriminative reinforcer delivery behavior with measures to monitor both areas of responding. Including these elements in the investigation was intended to provide a framework for developing peer manding behaviors unlike those previously established, with the goal of providing the educational community with replicable procedures for implementing this intervention in the classroom and in future research.

7.1 RESEARCH QUESTIONS

The goal of this investigation was to answer two research questions, one regarding the ability of this treatment package to increase the rate of unprompted mands during sessions and the second regarding the ability of this intervention to increase delivery of reinforcers to peers. The researcher and team recognize that both mand behaviors and the delivery of desired items to peers are foundational skills needed for the development of future play skills and are vital to sustain play interactions. A brief explanation of the findings on these questions is outlined below.

7.2 UNPROMPTED MANDS

What effect(s) will the introduction of a peer-to-peer manding treatment package consisting of the use of differential reinforcement and time delay procedures have on the rate of unprompted peer mands in individuals with autism and IDD?

A review of participant unprompted mand rate data (Figures 1 & 3) indicates that a treatment package consisting of differential reinforcement and time delay procedures resulted in increased unprompted mands across all participants. Carter demonstrated an immediate and considerable increase in unprompted mand behaviors following his introduction to the intervention, and most of the participants showed a more gradual increase during the intervention phase (Calvin, Caleb, Mark, and Bella). The only participant who demonstrated low levels of unprompted mands when introduced to the intervention was Isaiah.

7.2.1 Addressing Low Response Rate (Isaiah)

Isaiah's low rate of responding may be accounted for by a few variables. One issue identified was that Isaiah was not strongly reinforced by edible reinforcers. Even with additional time spent on edible reinforcer identification, Isaiah was still not regularly eating food when delivered as a reinforcer for unprompted responding. He was also receiving a substantial amount of edible reinforcement for the high number of unprompted deliveries of reinforcers he was demonstrating towards his peer partner. Even when the best edible reinforcement was only given for unprompted mands and less preferred edibles were given for unprompted deliveries of reinforcement, the research team still observed low mand levels. His peer partner's high rate of mands and Isaiah's strong unprompted delivery of reinforcer behavior also may have had an effect on Isaiah's manding rate.

In addition, instructors attempted to manipulate motivation by changing the edible reinforcers and mand items available. It was hoped that the novelty of new items would potentially cultivate motivation resulting in increased unprompted mand behavior. When these minor adjustments did not result in the increase in unprompted mands desired, the team determined that it was necessary to make a slight modification to the reinforcement procedures for Isaiah. The instructional team noted Isaiah's history of success with the use of praise as a reinforcer. The team added a slight change to the reinforcement delivered when Isaiah made an unprompted mand in the intervention phase. When implementing the intervention-praise modification (IV-P), Isaiah received an edible and social praise for an unprompted mand response. When this procedural modification was introduced, Isaiah demonstrated immediate increases in responding.

7.2.2 Unprompted Mand Intervention Summary

All the participants demonstrated increased unprompted peer mands when introduced to the intervention package consisting of time delay, differential reinforcement, and controls for motivation. Isaiah was the only participant who needed the slight modification of praise added to increase his responding. Additional phases of the investigation were included to assess the sustainability and generalization of the responding overtime. Although these were not research questions, it was hoped that assessing responding in various conditions might provide some initial insight helpful for future investigations.

7.3 WITHDRAWAL

In the withdrawal phase all prompt procedures and instructor-facilitated reinforcement were removed in an attempt to assess if manding skills would maintain without instructor supports. In the withdrawal phase, although the six primary participants demonstrated variability in responding, all continued to demonstrate unprompted mands when instructor facilitated differential reinforcement and time delay prompt procedures were removed.

7.3.1 Calvin's Increased Mands in Withdrawal

Calvin showed a considerable increase in unprompted mands when the treatment package from the IV was removed. It is possible that the withdrawal of the additional reinforcement for unprompted responses actually increased motivation for the items present due to the principle of

deprivation. It is also possible that extinction effects resulted in increased mands because his partner was not fulfilling all mands within 3 s. In the withdrawal phase, it was not unusual for it to take longer than 3 s for a peer partner to fulfill a mand by delivering the requested item. Without the prompt procedures by the adults for the delivery of reinforcer in the withdrawal phase, it was likely that participants would ask multiple times if their request was not quickly fulfilled by a peer. Both of these variables are possible explanations for the continued increase in unprompted mands in the withdrawal phase.

7.3.2 General Mand Withdrawal

Responding was variable in the withdrawal phase for Carter and the participants in Dyad 2 showed a decreasing trend throughout the phase (Mark and Caleb). Overall the participants continued to demonstrate the skill taught during the intervention phase. Some decreases in responding were anticipated because additional reinforcement was withdrawn quickly and without fading (Rusch & Kazdin, 1981).

7.4 GENERALIZATION

The purpose of the phase was to assess if the skills taught in the intervention phase generalized to other students from the general education classroom without specific training. Although teaching manding skills with other peers with language delays, autism of IDD, is of value, ultimately the hope is that the skills taught in intervention sessions will transfer to typical peers and across situations. A significant body of research highlights the importance of generalization

of skills across settings and individuals (Stokes & Baer, 1977; Prelock, Paul, & Allen, 2011, p. 125; Charlop et al., 1985). Pellecchia & Hinline (2007), Kodak et al. (2012) and Lorah et al. (2014) all assessed the generalization of peer manding skills by incorporating different peer partners with language deficits, however, none of the previous peer manding studies assessed the generalization of peer manding skills to general education peer partners (Kodak et al., 2012; Paden et. al., 2012; Taylor et al., 2005; Lorah et al., 2014, Pellecchia & Hinline, 2007). Pellecchia and Hinline (2007) brought attention to the important of skill generalization across participant groups (parents, siblings, and peers), but no previous peer manding study has assessed the transference of skills to neurotypical peers. All six primary participants in the current study demonstrated generalization of the skills from the intervention to the generalization phase. When partnered with general education peers, the primary participants often demonstrated decreased levels of responding during initial sessions, but responding increased with more time in the phase. This may be an indication that after adjusting to the conditions, and repeated exposure to new peers as a reinforcer delivery agents, that the new peers became conditioned reinforcers serving as relevant stimuli for manding.

7.5 MAINTENANCE

The maintenance phase was included in the design in hopes to assess the strength of the skills developed over time without additional support. Lorah et al. (2014) was the only previous peer manding research study (Kodak et al., 2012; Paden et. al., 2012; Taylor et al., 2005; Pellecchia & Hinline, 2007), which attempted to assess the maintenance of skills. As seen in Lorah et al. (2014), all six of the primary participants in the current study demonstrated continued responding

to unprompted mands during the maintenance phase. It was anticipated that there would be a decrease in the rate of unprompted mands, but it was hoped that unprompted mand behaviors would maintain over time (Rusch & Kazdin, 1981). The lowest levels of unprompted mands in the maintenance phase were observed from Bella and Isaiah.

7.5.1 Bella Mand Maintenance

Bella demonstrated overall lower rates of responding throughout all phases of the investigation when compared to other participants. This lower level of responding was likely influenced by her problem behavior exhibited throughout sessions. Isaiah's rates of unprompted mands in the maintenance phase were higher than Bella's, but not as high as the other participants.

7.5.2 Isaiah Mand Maintenance

The reduced responding in the maintenance phase by Isaiah was not surprising seeing that his rate of unprompted mands when initially introduced to the intervention was low. Isaiah demonstrated high rates of reinforcer delivery behavior and lower levels of manding in this condition. In the maintenance phase, Isaiah still demonstrated unprompted mands, just not at a rate as high as seen during the more recent phases of the investigation.

7.5.2.1 Histories of reinforcement

It is hypothesized that as a result of reinforcement histories, some individuals are more likely to respond to the mands of others while some others are stronger manders. The dynamic of "give and take" is representative of behaviors observed in typical peer relationships and social

exchanges. Often there is one peer or friend who asks for things more frequently and there is often another friend who fulfills requests more frequently. In the partnership of Dyad 3, Isaiah served frequently in the fulfilling role rather than the manding role. Although it is possible to mand and fulfill and time same time, or very close to the same time, these interactions play a role in responding and do not appear to be truly functionally independent. One participant's reinforcer delivery rate can be, and often is, heavily influenced by the mand rate of his partner. If a partner is manding at a very high rate, the fulfillment of deliveries appears in some situations (like Isaiah's) to result in decreased mands. Despite the high rate of mand behaviors by his partner, and his high rate of reinforcer delivery behaviors, Isaiah still demonstrated unprompted peer mands during the maintenance phase. Possibly switching partners in future sessions, to a partner with a lower rate of unprompted mands, would give Isaiah the potential to mand at a higher rate.

7.6 REINTRODUCTION OF INTERVENTION

Reintroduction to the intervention was determined necessary due to Caleb's lack of responding on reinforcer delivery in the maintenance phase. Mand levels maintained steady in the return to intervention phase with some slight variability across the modifications to the intervention. Both Caleb and Mark demonstrated higher levels of manding at the end of the IV-2 modification, during the last few days of the investigation. Reintroducing the intervention in attempt to increase Caleb's reinforcer delivery behavior did not appear to have a negative influence on the mand behavior of either participant. It is anticipated that with continued responding at the levels observed in the reintroduction to the intervention IV-2 modification that Caleb and Mark would

be ready to have the modifications and the overall intervention procedures faded away in the near future.

7.7 UNPROMPTED MAND SUMMARY

Throughout all phases of the investigation unprompted mand rates maintained higher than those seen prior to the introduction of the intervention. The rate of unprompted peer mands was variable across participants and phases, but an overall increase was observed. Only one of the six participants, Isaiah, indicated the need for a procedural modification based on his responding on the mand measure. The addition of the praise procedure for Isaiah appeared to be successful in its intended purpose and should be considered by others if edible differential reinforcement is not effective in increasing unprompted responses. When looking at the introduction of the treatment package in the intervention phase, an observable increase in unprompted peer mands was seen across all participants and an analysis of responding in this condition was the primary focus of the investigation. Although additional phases were assessed, these phases were included to provide initial findings on questions that may arise, such as: (1) how long do participants need to receive the treatment package for to maintain continued responding, (2) will the responding transfer to other peers, and (3) will the responding maintain over time if the treatment package has been removed? Participant response rates in the phases of the investigation following the primary intervention were included to allow the research community to begin to assess some of these relevant factors. It appears that although responding maintained across conditions, most of the participants demonstrated lower rates of responding than were observed in the intervention condition. This may be an indication that participants would have benefited from intermittent

intervention sessions or a gradual fading of the time delay prompt procedures and application of differential reinforcement (Rusch & Kazdin, 1981).

7.8 UNPROMPTED DELIVERY OF REINFORCERS TO PEERS

What effect(s) will the use of time delay procedures and differential reinforcement have on the rate of deliveries of preferred items to peers in individuals with autism and IDD?

Lorah et al (2014), is the first investigation in this area that has given attention to the importance of the delivery of reinforcing items to peers. Without developing this skill set (although it is possible to increase manding behaviors), play skills are not likely to sustain without bidirectional benefit. The treatment package implemented, including time delay for prompt procedures and instructor-facilitated differential reinforcement, was designed in attempt to increase the unprompted delivery of reinforcers to peers, giving proper attention to the importance of fulfilling the wants of the play partner as well as gaining access to preferred items. A review of participant response rates indicates a functional relation in the increase of unprompted peer reinforcer deliveries across all participants with the introduction of the treatment package. Upon entering the intervention phase, all participants demonstrated an increase in the unprompted deliveries of reinforcers to peers except for Caleb.

7.8.1 Caleb's Reinforcer Delivery Behavior

An initial variable assessed when considering Caleb's lack of responding was the potential difficulty of understanding of the articulation of his peer partner Mark. Although we assessed

that Caleb could locate all Mark's preferred items as a listener before starting the investigation, we did not check to see if Caleb could locate the items as a listener based on the way that Mark pronounced his preferred items with his articulation issues. In future investigations, one might consider conducting the pre-session listener responding assessment with the peer naming the item to be selected. In this investigation, it appears that through time in the intervention phase, the prompt procedures taught the peer partner what item was being requested with modified articulation through the time delay and reinforcement procedures. For example, it appeared possible that Caleb did not initially respond to "Sooey-Doo" when his partner Mark was seeking the Scooby-Doo, because he did not recognize the request. After repeated graduated guidance prompted trials to deliver the item in the intervention, it is likely that Caleb learned to respond to the articulation difficulties of his peer. This may have been one factor contributing to the slow rate of unprompted deliveries exhibited by Caleb.

Another factor that added complexity to this dyad was that they both demonstrated similar interests. Attempts were continuously made throughout the investigation to identify items for mand sessions that were highly motivating for one participant, but not highly motivating for the other participant. In Dyad 2 there appeared to be times when the peer partner's play items were so reinforcing for the participant that peer partner's mands were ignored. For example, Caleb was so engaged with the "See and Say" (toy intended for his partner Mark to request), that he did not respond to Mark's requests for "banana." Motivation checks conducted at the beginning of the sessions were somewhat helpful in indicating if this could be a potential issue, but at times the partners' similar interests appeared to compete with appropriate social interactions.

After three sessions in the intervention phase without an increase in the unprompted delivery of reinforcers by Caleb, a modification was made to the procedures where differential reinforcement was given for prompted deliveries of reinforcement (IV-1). Prior to adding this change, Caleb was not demonstrating enough unprompted deliveries to regularly contact the instructor-facilitated reinforcement defined in the basic intervention (IV) procedures. This lack of contact with reinforcement was resulting in minimal movement and it was appearing unlikely that deliveries would increase at all without a slight change to the intervention. Once receiving the IV-1 modifications, where reinforcement was given for prompted deliveries, it still took repeated sessions before Caleb started to show increases in his unprompted reinforcer delivery behavior. Once delivery rates were high in with the IV-1 modifications, the instructional team noted the deliveries were generally not connected with peer mand behaviors. This responding indicated that a block procedure on free deliveries should be implemented. Once the block procedure was implemented (IV-2), Caleb showed stable increased rates of responding, which were considerably higher than the baseline unprompted reinforcer delivery rates. Although Caleb did not show immediate responding with the basic intervention procedures (IV), with minor modifications to the procedures he demonstrated increased responding in his delivery of reinforcers to peers.

7.8.2 Bella's Reinforcer Delivery Behavior

Bella's unprompted reinforcer delivery behaviors were also a little bit lower than the unprompted reinforcer delivery behaviors seen among the other primary participants once introduced to the intervention. Her response rates demonstrated an increase from the response levels in baseline, and a functional relation was observable across phases, however the change in her level of

responding was smaller than that of the other participants. It is hypothesized by the team, that the demand to fulfill peer mands may also have served as an antecedent to some problem behavior for this participant. Her problem behavior does appear to have likely influenced her response rates.

7.8.3 Carter's Reinforcer Delivery Behavior

Carter's initial reinforcer delivery levels were lower, but this appears likely connected to his peer partner's reduced mand rate during early intervention sessions. Although Carter could have freely delivered items, reinforcer delivery rates were generally higher if the number of peer partner mands were higher. As Isaiah's mands increased so did Carter's unprompted reinforcer delivery behavior.

7.8.4 Unprompted Reinforcer Delivery Intervention Summary

All primary participants showed increases in the unprompted delivery of reinforcers to peers in the intervention phase, and only one of the participants demonstrated the need for slight procedural modifications to reach stable improved reinforcer delivery responding. The remaining phases of the investigation provide an introductory glimpse into how these behaviors responded under various changes in condition and across time. The core focus of the investigation was to assess if the implementation of the treatment package procedures would result in increased responding in the intervention phase, but how participants responded to the withdrawal of procedures, when partnered with neurotypical peers, and when sessions are reduced to weekly is of relevance to practitioners and researchers alike.

7.9 WITHDRAWAL

All six primary participants continued to show unprompted reinforcer delivery behaviors when the prompt procedures and differential reinforcement procedures were withdrawn. As anticipated in the withdrawal phase, a few of the participants demonstrated decreasing trends throughout the withdrawal condition (Calvin and Mark). The decreasing trends may have been the result of the loss of additional reinforcement and the increased effort that was needed to fulfill peer requests independently. Possibly fading these elements out slowly as opposed to dropping them completely may have kept the unprompted reinforcer delivery rates higher (Rusch & Kazdin, 1981).

Increasing trends were also seen in some participants during this phase (Bella & Caleb). When the 3 s time delay prompt procedures were removed during this phase some peer participants' partners were observed to make multiple requests for items due to the delayed responding or no responding demonstrated by their peers. This repeated requesting was not observed in the intervention phase because a prompt for the delivery of the reinforcer would have occurred before there was a lot of time for additional mands to be exhibited. The repeated request behavior may have contributed to the increased reinforcer delivery behavior observed in some participants. Bella also appeared to demonstrate increased problem behavior when physically prompted through the graduated guidance model to deliver the reinforcer to her peer. When she was not being prompted to deliver reinforcers, lower intensity and less frequent problem behavior were observed, and higher rates of manding and reinforcer delivery were observed. Isaiah and Carter demonstrated high rates of variability in responding, but overall maintained rates of responding observed at the end of the intervention phase when they moved into the withdrawal phase. All participants continued to demonstrate reinforcer delivery

behaviors in the withdrawal condition and even those participants with decreasing trends throughout the phase were responding at levels considerably above reinforcer delivery behaviors observed during baseline.

7.10 GENERALIZATION PHASE

This portion of the investigation was used to assess if the primary participants would continue to deliver reinforcers to their peers if the peer partner was a neurotypical peer from the general education class. A significant body of research highlights the importance of generalization of skills across settings and individuals (Stokes & Baer, 1977; Prelock, Paul, & Allen, 2011, p. 125; Charlop et al., 1985). No previous peer manding study has assessed reinforcer delivery generalization to general education peers (Kodak et al., 2012; Lorah, et al., 2014; Paden et al., 2012; Taylor et al., 2005; Pellecchia & Hineline, 2007). In the current investigation, all of the participants demonstrated continued responding and generalized unprompted peer reinforcer delivery behavior to their general education play partners without specific training. There was also considerable variability in the request rates of the typical peer partners, which ultimately affected the primary participants' unprompted reinforcer delivery rates. Mark demonstrated observable increases in peer reinforcer delivery behavior. This was likely because his previous peer partner struggled with reinforcer deliveries. When partnered with a peer that had a stronger skill set, Mark flourished in the peer interaction. Calvin also demonstrated strong responding during this phase. Although his rate of responding was similar to that observed in the withdrawal phase, the nature of the interaction was very different. In the mand sessions with Zoe, Calvin

demonstrated strong turn taking play, often sharing the same item back and forth and talking about it, or taking turns playing a game.

Isaiah and Carter demonstrated continued strong responding during the generalization phase, but their reinforcer delivery levels were lower than in the withdrawal phase. It is hypothesized that their reinforcer delivery levels were lower during this phase because their generalization peer partner did not appear to make requests at a rate as high as their previous peer partners. Isaiah also demonstrated qualitatively different interactions during this phase. He demonstrated turn taking and social commenting. He demonstrated generalized motor imitation skills that were also not targeted during the investigation. When his peer was playing with a hand held electronic toy, he got a hand held electronic toy and began to begin to play. Overall Caleb demonstrated continued reinforcer delivery behavior in the generalization phase, but he did exhibit a decreasing trend during this phase. The decrease in unprompted reinforcer delivery behavior at the end of the phase may have been connected with an absence during this period that was noted as due to illness.

Bella also demonstrated a decreasing trend during the generalization phase, but still demonstrated response levels above those observed during baseline. Bella demonstrated behaviors while interacting with her play partner Zoe that also appeared qualitatively different in nature than the responses observed during previous conditions. Bella was observed telling pretend stories that included her peer partner's name during the sessions. She was also observed asking her peer partner if she was ready for a sleepover, if her peer partner would smile, if her peer partner would be her friend, and if she could give her a hug. Despite the decrease in responding, there were still positive social interactions occurring. As noted previously, the peer play partner in the generalization phase did not demonstrate nearly the same frequency of

requests as was made by Bella's previous peer play partner Calvin. All six participants generalized reinforcer delivery behaviors to novel general education peers, but the levels of responding decreased for some participants.

7.11 MAINTENANCE PHASE

When sessions were reduced to one time each week, five of the six primary participants still maintained peer reinforcer delivery behavior. Reinforcer delivery rates remained strongest for Mark, Isaiah, and Carter. Bella and Calvin demonstrated lower rates of reinforcer delivery behavior in maintenance sessions, but this is likely related to problem behavior rates. Bella was not manding at high rates, therefore Calvin was not delivering at high rates. Bella's problem behavior was occurring at a high rate, likely interfering with her reinforcer delivery rate.

7.11.1 Caleb's Reinforcer Delivery in Maintenance

Caleb demonstrated almost no reinforcer deliveries in the maintenance phase. He demonstrated one delivery in two 12-min sessions and the one delivery that occurred appeared to be incidental. His peer partner was continuing to mand, but by the end of the second maintenance session without deliveries, Mark demonstrated a grab for a desired item instead of a mand. His grab was likely because his mands were not getting him access to his desired items. It was determined that it was necessary for Caleb to go back into the intervention to rebuild his capacity to deliver reinforcers to his peer play partners. Although five of the six participants showed success in the maintenance phase on this measure, Caleb's difficulty may be an indication that the sessions

needed to occur more regularly for him to maintain that skill, or that the intervention needed to be faded slowly away instead of removed abruptly as seen in the withdrawal phase (Rusch & Kazdin, 1981). The similar interests of the two participants were likely a factor that was limiting delivery behavior. Since Caleb could interact with Mark's intended play items, he did not appear as motivated to respond to Mark's mands. Caleb also had a lower initial VB-MAPP score (88.5) than many of the participants and it is possible that he needed a more expanded language repertoire in order to anticipate greater success and maintenance of play skills.

Assigning Caleb a play partner with more proficient language skills may also have assisted him. His partner, Mark, had the lowest VB-MAPP score (86) of all the participants when beginning the investigation. Strategic partnering may have assisted Caleb in demonstrating higher reinforcer delivery rates and maintenance of that skill over time. As noted in the initial intervention section, Mark's articulation may also have played a role in the limited reinforcer delivery observed by his peer partner Caleb. If partnered with a play partner without articulation challenges it is possible that Mark would have demonstrated high rates of responding that maintained over time.

Five of the six participants maintained the delivery of reinforcing items to their peers during mand sessions when the sessions were reduced to one out of every five possible sessions. Although reinforcer delivery rates may have been reduced from recent phases of the investigation, there was still an observable increase in the rate of reinforcer deliveries from baseline levels.

7.12 REINTRODUCTION OF IV

When Caleb demonstrated limited responding in the unprompted delivery of reinforcers to peers during the maintenance phase, the team decided to reintroduce the intervention. Maintaining the skills to mand and deliver reinforcers to peers is of importance to long-term social success in the natural environment. Even though Caleb's mand skills maintained, it was determined necessary to reintroduce the intervention for the delivery of reinforcers to peers. Reintroduction of the basic intervention did not result in the desired changes. After three days back in the intervention phase, Caleb was still demonstrating close to zero unprompted reinforcer deliveries during mand sessions. Next the team implemented the IV-3 procedure, which combined the procedural elements of IV-1 and IV-2 from the initial intervention phase. The hope was that combining the two interventions would result in a fast and efficient increase in reinforcer deliveries. Responding with the IV-3 modification procedure remained very low and after five sessions, it was determined that the team would go back to the IV-1 modification to procedures. The team noted that the IV-3 procedure was difficult to implement with fidelity and almost no changes were observed in unprompted reinforcer delivery behavior. The team returned to the IV-1 modification (differential reinforcement for prompted deliveries), as this was the first modification to procedures observed in the initial intervention phase and it previously resulted in an increase in unprompted reinforcer deliveries. The team saw increases in the unprompted deliveries of reinforcers after a few sessions in the IV-1 phase and after high rates were maintaining the team returned to the basic IV procedure. Reinforcer deliveries remained high in the basic IV phase, but Caleb was demonstrating little regard for the manding behavior of his play partner. The IV-2 procedure was needed at this point to block free delivery and reestablish peer mands as the relevant stimuli for reinforcer delivery behavior. When in the IV-2 phase the

unprompted deliveries decreased, but were still above the rates of unprompted reinforcer delivery seen during the baseline and maintenance phases. The reintroduction of the IV phase was needed to get response rates to a level that would promote a two-way communicative exchange. It is possible that Caleb would have benefited from additional pre-requisites skill development and/ or more stringent inclusion criteria for participation in the study. It is also possible that partnering Caleb with a peer with different interests would have reduced his distraction with the reinforcing items in front of him. Regardless of the variables that may have influenced his reduced responding, the team demonstrated with minimal modification that the skills could be retaught.

7.13 PROBLEM BEHAVIOR

Although the primary investigator did not intend to include participants in the investigation that demonstrated problem behavior that interfered with instruction, one participant began to demonstrate problem behavior of concern shortly after beginning participation in the investigation. It should be noted that problem behavior was occurring for this student on most days upon entry to the school building and problem behaviors would frequently occur throughout the entire school day. Changes in the classroom staff and the expectations of the new instructional team may have had an influence on her behaviors during the investigation period. It is hypothesized that shortly after beginning intervention sessions, Bella began to see the research sessions as a period of increased demands. On many occasions problem behaviors occurred immediately after prompt procedures to deliver a reinforcer to her peer. Although her reinforcer delivery response levels in the intervention phase never met the mastery criteria, the team

decided that it would be in the participant's best interest to move her into the withdrawal phase where prompt procedures were removed. Although she demonstrated initial decreases in problem behaviors from the levels observed in the intervention phase, she still demonstrated problem behavior throughout the remaining phases of the investigation. When the team observed problem behavior was maintaining throughout later phases of the investigation and the intensity of problem behavior appeared to be increasing, the team determined it in the participant's best interest to discontinue sessions.

In future research it is recommended that investigators assess problem behavior and motivation variables with additional tools beyond teacher report and a records review. Bella appeared to demonstrate increased problem behavior when prompted to respond to her peer and when having to give up desired items. Actually assessing the participant's abilities to give up reinforcers through testing may have helped to identify this issue. Also assessing participant responses to prompt procedures before inclusion in the investigation may have provided meaningful information. Despite the problem behaviors, Bella demonstrated increased reinforcer delivery and peer manding behaviors following the introduction of the intervention. She maintained responding though at lower levels throughout all additional phases of the investigation. Instructors noted increased approach behaviors with her peers in the classroom and increased peer manding during unstructured play periods in the classroom. Although it is not recommended to include participants with problem behavior in mand sessions, it appears that Bella benefitted from the instructional sessions.

7.14 LIMITATIONS

One limitation of the current findings is that modifications to procedures were introduced. Although this provides practitioners with valuable considerations for problem solving failure to respond, it weakens the evidence of replication of the basic procedures. Individualized modifications also complicate procedures for instructors, allowing for potential issues with fidelity of implementation. Although procedural fidelity results were strong, the primary investigator should have developed fidelity checklists for any modified procedures. Qualitatively it was observed that fidelity in procedures were an issue when implementing the IV-3 modification procedures in the reintroduction phase for Caleb. Unfortunately this was not reflected in the procedural fidelity checklists because they were not individualized for the new modifications to procedures.

7.14.1 Participant Selection/ Criteria

The diversity of primary participants included in the study also presents a variable that adds to the complexity of the analysis of the results and could be viewed a limitation. All primary participants met the criteria outlined in the methods section, but potentially some other variables should have been considered when selecting participants for inclusion. It is possible that Caleb struggled the most with responding to the reinforcer delivery procedures because he was lacking in some other skill areas that might have allowed him to make more rapid and sustainable success in the intervention. Other assessment areas to consider before including participants maybe the rate of unprompted mands observed in instructional day, participant reinforcer diversity, overall VB –MAPP scores (Sundberg, 2007), and participant responses to graduated

guidance physical prompts. If the instructional team had tested physical prompt procedures on all participants prior to inclusion, the team may have identified some of Bella's issues with problem behavior prior to her introduction to the study. Further assessment may have helped the team to determine if a participant was optimally prepared for participation.

7.14.1.1 Articulation assesment.

There should have been some type of assessment conducted prior to inclusion in the study that assessed articulation of mands prior to inclusion. Criteria should likely have been set to ensure that students that could not be easily understood by other peers should not have been included. If in future investigations researchers are considering allowing the participation of students with articulation issues, it is recommended that the team assess the partner's responses to items as a listener based on the articulation of the peer partner prior to inclusion. Some of the reinforcer delivery behavior of the peer partners for two of the participants was influenced by articulation difficulties (Mark and Carter). These difficulties in understanding the requests affected the rates of responding for both the primary participants (mands) and their partners (reinforcer delivery). The mands were often seen repeated multiple times because they could not be understood and there appeared to be an increased need for prompted deliveries of reinforcers to assist in "helping the peer understand" the item requested. Over time the peers began to show increased unprompted deliveries when the poor articulation stimuli became conditioned with the item. This issue was present during the initial introduction to the intervention phase and was observed again when general education peers were introduced to the investigation. Including participants with clear articulation could lead to faster responding by peers.

7.14.2 Instructor Scoring

Another limitation that may have to be considered when evaluating the results of the investigation is instructor scoring. When initially setting out to conduct the investigation the plan was to have the instructor participants (para educators and teachers) collect data on prompted mands and S^{r+} deliveries, unprompted mands and S^{r+} deliveries, and problem behavior. Shortly after introducing the intervention for Dyad 1, it became clear that it was difficult to collect data on so many measures, while also conducting the prompt procedures with fidelity. At this point it was determined that the primary investigator would collect data on the prompted measures and problem behavior via video data collection review. Overall interobserver agreement (IOA) rates across measures, data collectors, and participants remained very high, however the instructor and primary investigator only demonstrated 78% agreement on unprompted mand behaviors observed across sessions for Bella. Many of the scoring discrepancies that brought this agreement level down occurred early in the investigation. Training on scoring was conducted following agreement scores below 90%. Problems with the agreement rate for Bella were likely affected by the high rates of problem behavior that she demonstrated during sessions. At times the problem behavior presented in the form of mands for problem behavior. Consideration should be given to the lower rate of IOA when interpreting the results.

7.14.3 Motivation

Considerations regarding motivation are essential when evaluating the results of manding investigations (Hartman & Klatt, 2005; Sundberg, 1993; Sundberg, 2005; Sweeney-Kerwin et al., 2007; Taylor, et al., 2005). Although many efforts were made to protect against motivation

serving as limiting variable controlling participant responding, there are still elements of motivation that must be considered when interpreting the results and considering replication. The investigators conducted the multiple stimulus preference assessments and MO checks at the beginning of the sessions to increase the probability that items in sessions were likely to be requested (DeLeon & Iwata, 1996). Access to peer manding items was also limited throughout the rest of the instructional day in attempt to keep motivation for mand items strong (Hartman & Klatt, 2005). Food items were included as potential items to be requested to ensure that there were elements across multiple motivational categories available. All of these components were included in attempt to keep motivation strong and limit the effect fleeting motivation can have on mand rates.

Motivation checks were conducted on instructor delivered differential reinforcement and edibles were identified and organized based on preference level. Attention to differential reinforcement was a vital tool for the successful development of participant skills. Instructors were required to carefully attend to responses and deliver reinforcers as indicated. Careful attention to manipulation of motivation was needed to promote optimal skill success (Sundberg, 2005). Instructor participants had strong skills in the observation of participant responding, reading participant motivation, and the application of differential reinforcement. Without these technical skills, the outcomes of peer mand programming could be very different.

A wide variety of edibles were assessed to find manding edibles desired by one peer but not the other. Edibles attempted included oranges, apples, strawberries, grapes, raisins, bananas, kiwis, Nutri-grain bars, bacon, turkey bacon, Bagel Bites, pizza rolls, carrots, celery, candy corn, peach rings, Twizzlers, cookies (many types), M&Ms, Rolos, Reese's Peanut Butter Cups, marshmallows, fruit snacks, Pringles, pretzels, cheese puffs, cheese curls, Doritos, and several

others. If the instructor participants observed that a participant was not eating the edibles delivered for unprompted responses they would often switch to another edible that the participant showed interest in during that day or during a previous session. The instructor's ability to gauge ongoing motivation for food items and items used during mand sessions was of incredible relevance to the success of the investigation (Sundberg, 2005).

7.14.3.1 Motivation across peer participants.

An additional element touched on above is the challenge of controlling for motivation across peer partners. If there was a larger participant pool it may have been easier to match up partners with differing interests, which could be helpful for the initial introduction to manding and reinforcer delivery skills development. Partnering participants with different interests could simplify competing motivation issues. Although attempts were made to include items that were not very strongly motivating items for both participants in a dyad, there were times when an item was preferred and engaging for both participants. If a participant was highly engaged by the items that his peer was supposed to ask for this could compete with motivation to ask for items as well as interfere with responding to requests made by his peer partner. If an item was strongly motivating to a participant that was intended for his/ her peer and it was interfering with interactive exchange, this item was removed from the lot of toys that the peer could ask for after the session. This is another example of how controls for motivation were embedded in attempt to promote skill development. If working to develop an expanded skill set in the future, instructors may consider developing a skill sequence that works toward more advanced play skills such as fulfilling requests of peers when items are highly motivating to both participants. Although partners with competing motivation could be a limitation that might effect mand or

reinforcer delivery rates, attempts were made to control this variable by removing items if this issue was identified.

7.14.3.2 Duration of investigation effects MO for mand items.

After being involved in the study for many sessions, some participants began show decreased motivation for items that were identified as highly reinforcing during the initial preference assessment time. New items were introduced to the overall lot of reinforcers throughout the investigation to maintain participant interests. There is no way to guarantee that fleeting motivation did not have an influence on mand rates, but attempts were made to keep items novel and motivation checks were conducted at the beginning of each session to ensure that there was interest in multiple items for each session. Controls for motivation were implemented, but mand rates are still likely to be somewhat reflective of the instructor ability to read and manipulate motivation.

7.14.4 Co-variation of Measures/ Partners

One additional consideration when evaluating the results of the study is that the measures are not completely independent and could be influenced by the response levels of the partner participant. Observable patterns were seen in responding, for example if a participant was a high rate giver then he may be a lower level mander (Isaiah and Mark), or if they were high level manders there was a tendency to be lower level deliverers (Caleb, Calvin, and Carter). This was not true for all participants, but most participants did show strength in one measure over the other.

It also appears that in some cases response patterns were influenced based on the mand and delivery rates of peer partners. If a peer partner was manding at a high rate and the

participant was fulfilling these mands, there was less time for the participant to mand for his own items. If a peer partner delivers items freely without the participant asking, this may result in reduced mands because mands are not needed to gain access to desired items. If a peer participant is not responding to mands, then it is likely that there would be increased mands to increase the likelihood of a delivery. Although all of these issues mirror the dynamics of adult social interactions and appropriate social interactions in children they have an affect on response rates that should be considered. Also, if a partner did not meet the criteria to move on to the next phase, his partner remained in the phase until criteria were met or a change was made. Some participants spent increased periods of time without access to the intervention/ next phase because other participants were not meeting the mastery criteria. When evaluating the response results on both measures it is of importance to also consider these response patterns side-by-side, taking into account the response rates of the peer partners.

7.14.5 Immediate Withdrawal vs. Fade

One potential limitation of the design was the immediate withdrawal of the reinforcement and prompt procedures in the withdrawal phase. The design included the immediate withdrawal of procedures in the withdrawal phase without a thinned schedule or fade because it offered methodological simplicity for replication. All of the participants did show continued responding in the withdrawal phase of the investigation on both measures when the treatment package was removed, but many of the participants did demonstrate decreasing trends during this phase. It is possible that modifying the design to use set fade procedures following the intervention phase could result in the maintenance of targeted behaviors without the decreased rates of responding observed in this investigation (Rusch & Kazdin, 1981). If continuing to develop this repertoire of

skills, considering rules for reduced supports and reinforcement might help to keep response levels higher over time.

7.14.6 Design Limitations

One additional limitation of the design is that both the manding skills and the delivery of reinforcer skills were being taught at the same time. As noted above, response rates on one measure were to some degree influenced by responding and procedures on the other measure. If trying to keep responding on each measure independent, separate phases of the investigation could be conducted to build one skill and then the other. Teaching delivery behavior without mand behavior however, presents some complexity that may result in behavior that is difficult to shape. If trying to get delivery responses under the direct control of peer mands, a peer mand must be a part of the antecedent. One could work on delivery skills when partnered with peers that have strong peer mand skills already, but this would not likely be a mutually benefiting instructional session as those observed in this investigation. One could also consider implementing a training phase where skills are practiced and developed separately and then are brought back to mand sessions. Each of these potential alternative designs offers potential benefits, but also suffer from limitations. A final option would be to have all sessions with typical peers partners. This may eliminate some of the problems with the skills of the peer partner influencing response rates, and could protect against the dysfunctional delivery of reinforcers to peers under the wrong functional control. Completing an investigation with the reverse model (general education peers for the primary intervention and peers with communication deficits for the generalization phase) could provide valuable insight to the most

effective and expedited way to teach peer manding with generalization across groups of individuals with and without language and communication delays.

7.15 IMPLICATIONS FOR PRACTITIONERS

This investigation demonstrates promising outcomes for practitioners. All six primary participants demonstrated increased unprompted mands and increased unprompted deliveries of reinforcers to peers when introduced to a treatment package including differential reinforcement for unprompted responses and prompt procedures following a 3 s time delay. This investigation provides a guide for teachers in the field to teach a vital social skill needed for the development of more advanced social skills. The procedures and design elements took practitioner feasibility and ecological validity into consideration (Kratochwill, 1978; Gast and Ledford, 2014). By having all procedures and primary data collection taken by teachers and para educators, the hope was to prove that teaching this social skill can and should be done by classroom teams. The procedural fidelity checklists provide clear guidelines for replication and because of issues with the responding of some of the participants; examples of slight procedural modifications are already outlined.

This investigation also demonstrates that some individuals may need more time working on skills than others. Caleb demonstrated difficulty with maintenance of the reinforcer delivery skills when the sessions were only offered once a week. This may be an indication that some students need to have sessions a few times a week until the skills were stronger. It may also indicate that a slow fading of differential reinforcement and prompt procedures was needed (Rusch & Kazdin, 1981). Practitioners may also see a benefit in focusing on the use of

differential reinforcement on one behavior while not focusing on another. If a student is a strong deliverer of reinforcers, it may not be needed to apply additional instructor-facilitated reinforcement for this skill and potentially it is logistically more feasible to focus on reinforcement of the targeted skill area needed (in this case manding). The withdrawal, generalization, and maintenance phases, were included to help practitioners identify how long a team may need to teach this skill or run sessions over time to promote long term sustainability and generalized responding. Although participants' responding varied based on the dyad, most of the participants demonstrated maintenance of the skills over time. There are still many unanswered questions, but it is hoped that this investigation provides at least a glimpse into initial considerations for teaching these critical skills.

7.16 IMPLICATIONS FOR RESEARCHERS

This investigation provides researchers with additional confirmation that peer manding is a vital social skill that can be taught. With the limited amount of research on this topic it is crucial that the research community continues to work to establish clear, replicable, efficient procedures for teaching peer manding that result in functional and generalizable peer manding behavior. Unlike most other investigations on this topic, this study has focused on the importance of developing skills as a listener and mander (Kodak et al., 2012; Paden et al., 2012; Taylor et al., 2005; Pellecchia & Hineline, 2007). This study provides specific information on controls for motivational variables. Detailed descriptions of motivational variables have been sparse in past peer manding research and are a vital component needed to develop functional peer manding repertoires likely to transfer to the natural environment.

7.16.1 Ecological Validity

A valuable element of this investigation unlike most other studies conducted before it is that this study was conducted in a public school by the school district employees that work with these students every day. So much research in special education is conducted in clinics or university early intervention settings, but there is limited research on teaching these skills in the public school environment. The complexities of training the classroom team and logistical management of working in public schools present challenges, but the value of research conducted in the “real world” settings is of incredible relevance (Kratochwill, 1978; Gast & Ledford, 2014). Not only does this research demonstrate that practitioners really can do it, but conducting research in the field also allows practitioners to gain access to new innovative procedures for teaching vital skills to their students. It is hoped that this investigation serves as a model that these procedures can be successfully implemented in the “real world” educational environment and encourage other researchers to take on the challenge to conduct more research in public school classrooms with instructors as implementers.

7.16.2 Mands for Attention, Information, & Social Commenting

This investigation did not begin to explore mands for information, mands for attention, social commenting, or generalized motor imitation of play skills. All of these behaviors were observed throughout the investigation, but were not measured in this current study. Other behaviors observed in sessions that may be of relevance to future research include orienting behaviors towards peers, and peer eye contact. If investigators are considering research in this area, developing measurement systems to assess these other outcomes could be of relevance.

7.17 CONCLUSIONS

This investigation provides an introductory analysis of the use of differential reinforcement and time delay procedures on unprompted peer mands and unprompted reinforcer deliveries. Overall participants demonstrated observable success across both measures. Although there were identified limitations that should be considered when reviewing the results, this model has developed controls for elements minimally addressed in previous work on developing peer manding skills like motivational variables and peer listener behavior (Kodak et al., 2012; Lorah, et al., 2014; Paden et al., 2012; Taylor et al., 2005; Pellecchia & Hine, 2007). This investigation is also the first to assess the generalization of peer manding skills taught through a generalization phase including elementary-aged general education peers. Although Pellecchia & Hine (2007) looked at peer and sibling behavior, and Lorah et al., (2014) and Kodak et al., (2012) assessed generalization across participants with similar communication needs, no research before has assessed peer mand behavior across peers with and without disabilities. This is of considerable importance and will hopefully serve as a springboard for other peer manding research. Previous research on peer manding provided limited information on the sustainability of responding after the teaching procedures were withdrawn. It is hoped that this investigation provides some insight into the key elements necessary for developing efficient instruction on such vital skill areas.

APPENDIX A

IRB APPROVAL



University of Pittsburgh
Institutional Review Board

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Memorandum

To: Rachel Kittenbrink
From: IRB Office
Date: 10/30/2014
IRB#: [PRO14060480](#)
Subject: The Effects of Peer-to-Peer Mand Training on Unprompted Peer Mand Frequency for Children with Autism and Intellectual/Developmental Disabilities

The University of Pittsburgh Institutional Review Board reviewed and approved the above referenced study by the expedited review procedure authorized under 45 CFR 46.110 and 21 CFR 56.110. Your research study was approved under:
45 CFR 46.110.(5)(6)(7).

This study has been approved under 45 CFR 46.404 for the inclusion of children. The IRB has determined that the written permission of one parent is sufficient.

The risk level designation is Minimal Risk.

Approval Date: 10/30/2014
Expiration Date: 10/29/2017

This study meets the criteria for an extended approval period of three years. In the event that any type of federal funding is obtained during this interval, a modification must be submitted immediately so the IRB can reassess the approval period.

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

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

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

Figure 6. IRB Approval Letter

APPENDIX B

PROCEDURAL FIDELITY CHECKLIST

Procedural Fidelity Checklist

Procedures: Motivation Check	Observed		
1. Present group of approximately 12 toys for each participant identified through the preference assessment process in front of each participant.	YES	NO	N/A
2. If approach behaviors are demonstrated for more than one item within one minute, remove items and use group of items for teaching session.	YES	NO	N/A
3. If approach behaviors are not demonstrated for multiple items in one minute, present the next group of potential reinforcers identified from the preference assessment process and repeat steps one and two.	YES	NO	N/A
4. Continue process until group of toys are identified for use within the session.	YES	NO	N/A
Procedures: Baseline/ Follow Up/Generalization/ Maintenance	Observed		
1. Present items identified from MO check process in next to the peer and out of the reach of the participant.	YES	NO	N/A
2. Prepare the environment/ reinforcers/ participants so delivery of reinforcer by peer can be completed with relative ease, and each student cannot reach their own highly preferred reinforcers.	YES	NO	N/A
3. Do not respond to mands by participants made to adults.	YES	NO	N/A
4. Replace items moved by participants every four minutes.	YES	NO	N/A
5. Instructors will demonstrate no verbal interaction with the participants.	YES	NO	N/A
6. Instructors will position themselves out of participant sight throughout session to the greatest extent possible.	YES	NO	N/A
7. *Generalization: Pair student with novel communicative partner.	YES	NO	N/A
8. ** Maintenance Probes: Implement sessions a minimum of five school days apart.	YES	NO	N/A

Procedural Fidelity Checklist (cont.)

Procedures: Intervention	Observed		
1. Implement all elements of baseline phase.	YES	NO	N/A
2. When MO for an item is demonstrated by participant, provide echoic prompt following 3 s time delay.	YES	NO	N/A
3. Differentially reinforce mand following delivery of the mand item by peer.	YES	NO	N/A
4. After a peer mand, provide graduated guidance physical prompt using a 3 s time delay for the delivery requested reinforcer.	YES	NO	N/A
5. Provide consumable differential reinforcement for the delivery of requested items.	YES	NO	N/A
6. Fade use of differential reinforcement for peer mands and peer delivery of reinforcers as responding increases.	YES	NO	N/A
7. If 30 s passes without a mand or the delivery of a reinforcer, instructor will provide prompt on MO guided mand.	YES	NO	N/A
8. If an error occurs in the mand or the delivery of the reinforcer use error correction procedures.	YES	NO	N/A

Figure 7. Procedural Fidelity Checklist

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