INCREASING PEER-TO-PEER VOCAL MANDS IN YOUNG CHILDREN
WITH AUTISM SPECTRUM DISORDER

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ABSTRACT

This study evaluated the effects of least-to-most prompting strategies to increase peer-to-peer vocal mands. Three preschool-aged children with autism spectrum disorder (ASD) participated in this study, which focused on increasing mands towards same age peers with ASD. Highly preferred tangibles were delivered from the peers to the target participants, contingent on a correct independent or prompted mand. Generalization was programmed within the study as peers were alternated and sessions were conducted both in a separate, discrete trial room and within the natural classroom setting. Results of the study suggest that the teaching package with least-to-most prompting increased peer-to-peer mands for the three target participants.

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CHAPTER 1

INTRODUCTION

A significant and common deficit of those with autism spectrum disorder (ASD) is a lack of vocal communication (American Psychiatric Association, 2013; Diagnostic and Statistical Manual of Mental Disorders DSM-V, 2013). Many people with ASD may have limited or no verbal abilities. Because of this lack of ability, communicating wants and needs, from most basic to complex, can be difficult. Their inability to express what they want and need, their preferences, or their inability to engage in social conversation can be a cause for an increase in problematic behavior such as aggression, crying, screaming, self-injurious behavior, and many other forms of maladaptive behavior (Carr & Durand, 1985; Sundberg & Partington, 1998).

For young children with ASD, their lack of communication may inhibit their abilities and opportunities to develop meaningful relationships with peers and to engage in cooperative play interactions (Plavnick & Vitale, 2014). When young children with ASD cannot appropriately request for toys from their peers, they may grab toys, engage in aggression, or other problem behavior, which may further isolate them from their peers. This can ultimately limit their opportunities for socialization with other same age peers (Carr & Durand, 1985).

Language-training interventions may include teaching mands and other verbal operants defined by Skinner (1957) such as echoics, tacts, and intraverbals. Interventions capitalizing on Skinner's analysis of verbal behavior are comprised of mand training, tact training, functional communication training, and imitation training, among others. Skinner defines a 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; p. 35). In other words, a mand is a request, command or a demand in which the verbal operant often identifies its reinforcer. For example, if a child uses the mand, "cup, please," she is identifying "cup" as the reinforcement that she will receive after emitting the mand.

Mands are the only verbal operant that Skinner identifies as requiring a motivating operation as its antecedent, as opposed to only a discriminative stimulus as occurs in Skinner's other verbal operants. When the effects of a stimulus condition is in effect, a motivating operation will momentarily alter the reinforcer value and the frequency of occurrence of a response class within a person's behavior repertoire relevant to those stimulus conditions (Michael, 1988). Motivating operations distinguish between the effects of deprivation and satiation, or evocative or abative effects (Cooper, Heron & Heward, 2007). For example, if water deprivation is a current stimulus condition for a person, this motivating operation increasing the value of water as a reinforcer and increases the likelihood that a person will engage in any behavior in their repertoire that has been reinforced with water in their past.

Teaching manding and choice making have long been recommended in treatment plans for individuals with developmental disabilities (Durand & Carr, 1992). Individuals who display challenging behaviors such as aggression, social withdrawal, or self-injury often need to be explicitly taught how to mand as a replacement for challenging behavior. Such challenging behavior has a history of specific reinforcement that now functions as a mand (Carr & Durand, 1985; Cooper et al., 2007; Plavnick & Vitale, 2014; Sundberg & Partington, 1998). Directly teaching mands provides children with appropriate verbal

behavior to effectively have their wants and needs met. Further, teaching children to mand can be a first step towards more communication, including learning more complex verbal operants such as mixed verbal operants including tacts and intraverbals.

Many studies have examined manipulating motivating operations (Taylor, Hoch, Potter, Rodriguez, Spinnato & Kalaigian, 2004) and using interrupted chain procedures to teach manding (Albert, Carbone, Murray, Hagerty & Sweeney-Kerwin, 2012; Shafer, 1994). Interrupted chain procedure manipulates establishing operations (EO) by contriving the environment so that the reinforcing value of a neutral stimulus is dependent on another stimulus (Shafer, 1994). These studies have added to the research concluding that contriving motivating operations is essential to increasing manding. However, contriving motivating operations is not always sufficient to teach manding. Taylor et al. (2005) found that directly teaching peer-to-peer mands to children with ASD was necessary to increase manding. Purely contriving motivating operations by a peer having possession of a preferred food instead of an adult having possession of the food, was not effective in teaching target participants to direct their mands to peers instead of adults.

Differences in the topography of the mand, either using vocal language, speech generating devices or Picture Exchange Communication System (PECS) have all been studied (Paden, Kodak, Fisher, Gawley-Bullington & Bouxsein, 2012; Charlop-Christy, Carpenter, Le, LeBlanc & Kellet, 2002; Kodak, Paden & Dickes, 2012). These studies provide evidence that various communication forms can be used in language training and can function as a mand.

CHAPTER 2

LITERATURE REVIEW

The majority of studies published to date have focused on teaching children with ASD to engage adult-directed mands, (Betz, et al., 2010; Charlop-Christy, et al., 2002; Hernandez, Ingarvsson & Tiger, 2007; Kelley, Shillingsburg, Castro, & Addison, 2007; Plavnick & Vitale, 2014) although some studies have taught peer-to-peer directed mands (Carr & Durand, 1985; Hanney, 2015; Kodak et al., 2012; Madzharova, Sturmey & Jones, 2012; Sidener, Carr, Karsten, Severtson, Cornelius & Heinicke, 2010). Most children naturally mand to adults more frequently than they mand to their peers. This disproportion in manding to adults may be explained by the more immediate, contingent reinforcement of mands provided by adults (Paden, et al., 2012). When manding to a peer, it is possible that there is a longer delay to reinforcement, or no reinforcement at all. Because of this delay, children may be more likely to mand to an adult due to the immediacy of reinforcement. However, directing mands to peers is just as essential as manding to adults. Manding to peers creates opportunities for peer socialization and interaction, which is typically already lacking in children with ASD. Being able to effectively mand to peers may also promote generalization to novel individuals. Since peers are frequently together in classrooms and community settings, these are natural opportunities for the children to engage in social interaction and play. By teaching peer-to-peer verbal behavior, students with ASD are able to optimize their time with peers by potentially increasing skills like social interactions and reciprocal play. Further, having functional verbal behavior such as manding to peers decreases problematic behaviors that may occur surrounding sharing and turn taking (Kodak, et al., 2012).

Sidener et al. (2010) evaluated teaching typically developing children acquisition of verbal operants by comparing teaching pure mands or pure tacts separately, and teaching mands and tacts together at the same time. The results of the three experiments within this study indicate that mand-only and tact-only training was more effective in language acquisition than the combination of mand-tact training. This study supports that mands should be directly and singly trained, and should not be assumed to automatically develop with the training of other verbal operants.

Paden et al. (2012) taught children with ASD to emit peer-to-peer mands using PECS. In this reversal design, two children with ASD who had no vocal ability were taught to exchange a card with their peer for access to a selected toy. During baseline, participants displayed only adult directed mands. During the intervention, all adult directed mands were placed on extinction. The intervention increased peer-to-peer mands to up to four times per minute. Adult directed mands also substantially decreased. In addition, brief social interactions with peers (e.g., playing with the toy together) increased during intervention, indicating an overall increase in peer interaction as an additional benefit to the intervention.

In a similar experiment, Kodak et al. (2012) also used a reversal design to teach peer-to-peer mands to two children with ASD who used PECS for communication. This study successfully replicated Paden et al. (2012) findings, further providing support that differential reinforcement of alternative behavior (DRA) plus extinction and prompting is effective in teaching peer-to-peer mands. The participants showed no peer-to-peer mands during baseline phases. During intervention phases, independent peer-to-peer mands increased while the experimenter used both prompting of peer-to-peer mands and

extinction of adult-directed mands. DRA was used to differentially reinforce independent and prompted target mands with 10-s of access to the desired, associated item. Adult directed mands were placed on extinction and used as an opportunity to prompt a peer-to-peer mand. This study additionally evaluated the treatment effects on manding to a novel peer, traveling across the room to mand and manding in a more natural setting. Both participants were able to engage in peer-to-peer mands from distances across the classroom and with both trained and novel peers. This indicates that naturalistic teaching that programs for generalization may be more useful when implemented in applied settings.

Hanney (2015) conducted a two-part study comprising of conditioning peers as reinforcers in the first study and teaching peer-to-peer manding in the second study. In the second study, four participants with ASD were taught to mand to novel peers and previously conditioned peers. The experimenters used most-to-least prompting with a time delay to teach the target mand by delivering vocal prompts, increasing the time delay prior to prompt delivery and systematically fading out these prompts to facilitate independent mands. None of the participants engaged in peer-to-peer mands during baseline. During intervention, three out of four participants displayed high levels of manding to both the novel and conditioned peers. The results of the study indicated that the participant's prior ability to mand from adults may have been an indicator of success when teaching the children to mand to peers.

Many evidence-based interventions have been successful in increasing language acquisition to children with ASD. However, most interventions have focused on increasing communication with the adult as the listener of the mand and with the adult

delivering reinforcement. The current study extends previous research (Hanney, 2015; Kodak, et al., 2012; Paden, et al., 2004) by examining the effects of teaching vocal peer-to-peer mands with peers delivering reinforcement. This study seeks to answer the questions: (a) What are the effects of a teaching package with least-to-most prompting on increasing peer-to-peer vocal mands with children with ASD? (b) What are the effects of programming for generalization of peers and settings within the study procedures?

CHAPTER 3

METHODS

Participants

Three preschool-aged children with ASD served as participants in the study (Jason, Tommy, and Noah) and four children, also with ASD, served as peers (Mark, Bryan, Matt, and Christopher). All participants attended preschool through the county's intermediate unit and a therapeutic after-school program for socialization and behavioral needs. They attended the therapeutic after school program three days a week for two hours each day, while they attended preschool on the days or mornings that they did not attend the after-school program.

The Adaptive Behavior Assessment System-Second Addition (ABAS-II; Harrison & Oakland, 2003) and the Childhood Autism Rating Scale, Second Addition, Standard Version (CARS2-ST; Schoplier, Reichler, & Rochen Renner, 2010), were both used to assess the participants' adaptive behavior and communication skills. The classroom teacher scored the CARS-2. The participants' parents scored the ABAS-II for ages 0-5. Many of the items in the section for pre-academic skills in the ABAS-II did not apply to the participants since they cannot yet perform those skills, therefore this section was omitted. The lack of scoring in that area seemed to account for a slight bias in the scores. For that reason, the sole score from the communication section of the ABAS-II is also reported for each participant. The items in the ABAS-II that were counted towards their scores included communication, community use, home living, health and safety, leisure, self-care, self-direction, social and motor.

Jason was a 4-year-old boy diagnosed with ASD, who required very substantial support and had a language impairment. Jason was also diagnosed with a combined type/severe Attention Deficit/Hyperactivity Disorder. According to the ABAS-II, Jason scored in the extremely low range for his General Adaptive Composite Score (GAC). He received a scaled score of 3 and a qualitative range of extremely low in the communication skill area. Jason fell in the mild-to-moderate symptoms of ASD when assessed using the CARS-2. He had a raw score of 30.

Tommy was a 5-year-old boy diagnosed with mild ASD, who required substantial support in the areas of social communication, and requiring support in the area of repetitive behaviors/restricted interests. According to the ABAS-II, Tommy scored in the extremely low range for his GAC. He received a scaled score of 4 and fell in the borderline qualitative range for the communication skill area. Using the CARS-2, Tommy was scored in the mild-to-moderate symptoms of ASD, with a raw score of 36.

Noah was a 5-year-old male diagnosed with mild ASD, requiring support in the areas of social communication and repetitive behaviors. According to the ABAS-II, Noah scored in the extremely low range for his GAC. He received a scaled score of 5 and fell into the borderline qualitative range for the communication skill area. Noah scored into the mild-to-moderate symptoms of ASD according to the CARS-2. Noah received a raw score of 31.

Through direct observation and staff reports, Jason, Tommy, and Noah were reported to have vocal communication and the ability to independently and spontaneously mand for a variety of tangibles with adults in their natural environment; however, they showed little vocal manding with peers. All participants demonstrated an ability to

independently engage in echoics of at least three full sentence mands (e.g. "I want water") in order to be included in the study.

Lack of vocal peer-to-peer manding was defined as no vocal request being made when there was an obvious motivating operation. For example, a peer having an item in their procession, and the participant engaged in grabbing or taking away the item from the peer without first making any vocal request for the object. Lack of peer-to-peer vocal manding was also observed when the target student manded to adults for an object in a peer's possession, instead of manding directly to the peer.

For each participant, two peers with an ASD diagnosis were selected to deliver reinforcement to establish peer-to-peer mands (Mark, Bryan, Matt, and Christopher). Peers were selected based on a checklist, which evaluated his ability to independently follow simple directions like "sit down," "hand me the toy," or "give the toy to…" Peers were able to engage in parallel or cooperative play for at least 5 min. Peers with frequent problem behavior such as aggression or elopement, particularly when denied access to preferred items, were excluded from participation. To program for generalization, peers were randomly matched with different participants during each session using a random number generator.

Materials and Settings

All sessions were conducted at a therapeutic after-school program for children with ASD located in the suburbs of a large city in the Mid Atlantic region of the US. The program was run by a non-profit organization that serves children and adults with a variety of disabilities. The therapeutic after-school program was specifically funded through the organization's Children's Behavioral Health department. Participants were in

a group of three to four children, with two staff per group. The day included lunch, facilitated choice play, story time, arts and crafts, group games, sensory activities, playground time and other cooperative play stations. All students in the group had ASD. The childrens' treatment plan goals included cooperative or parallel play, requesting from adults and peers, initiating social interactions, responding to social interactions, transitioning, etc. Some children in the group were able to engage in higher levels of play like pretend play using verbal language with another peer. Others were able to participate in a shared game or share a toy with staff facilitation.

To program for generalization, the intervention sessions took place both in the natural classroom setting with all peers in the room and in a separate classroom with only the participant, peer, experimenter, and additional data collector present (during interobserver agreement and procedural fidelity checks). The two settings used for intervention sessions were randomly alternated using a random number generator and assigning even numbers to the separate room and odd numbers to the natural classroom. Baseline sessions were always conducted in the separate room. Maintenance probes were only conducted in the natural classroom setting.

Of the 20 intervention sessions for Jason, 11 sessions took place in the classroom and 9 took place in the separate room. Of the 14 sessions for Tommy, 8 were in the classroom and 6 were in a separate room. Of the 8 sessions with Noah, 3 sessions took place in the classroom and 5 sessions were in the separate room.

The separate room was a completely empty, small room with no items, chairs, tables, shelving, etc. The room had two windows, one door entrance and a closet, which was locked any time the participants were in the classroom. The natural classroom had

three windows and one door entrance. There were two tables in the room, one used for children activities and the other used for staff paperwork and materials. The room had one wall of cubbies and two small shelving stands. There was artwork, a white board, bulletin board, schedules and visual pictures on the walls. Toy shelves and bins were outside the classroom, however, there were some toys inside of the classroom since other children in the classroom may have been using them during sessions. When sessions were conducted in the classroom, other staff were responsible for attending to other peers not included in the study.

The materials needed include toys that were gathered from each participant's reinforcement assessment.

Dependent Variable

The dependent variable was the participant's percentage of independent vocal peer-to-peer mands. An independent mand was recorded if the participant spontaneously used a sentence frame to emit a target mand, directed to a peer, without any prompting from the experimenter. Generalized sentence frames such as, "Can I have the (*item name*)," "I want (*item name*)" or "I need (*item name*)," were recorded as independent mands as long as the participant emitted at least three words, including a pronoun, verb and the name of the target item. The participant was required to say the item name for the response to be considered an independent vocal mand. For example, "I want that," or "My turn," was not recorded as correct. A correct mand was only considered peer-to-peer if the participant's eye gaze was in the direction of the peer. A prompted mand was recorded if the participant correctly said the target mand or a fragment of the target mand to a peer only after a gestural or vocal prompt from an adult (e.g., "I want…"). A nonresponse was

recorded if the participant engaged in no vocal response or if the participant made any other response that did not match what was prompted. There were no nonresponses recorded during the study.

Data Collection

The experimenter was the primary data collector throughout the study. Data were collected throughout each session in the classroom and in a separate room. The data sheet was divided into a table of 10 trials. Each row of the table represented 1 trial. The data collector would circle either, "independent," "prompted," or "nonresponse," for each trial. The total number of independent mands were converted into a percentage by dividing the number of independent mands by the total number of opportunities for the session (ten trials). The acquisition criteria was defined as the participant using an independent, correct, target mand to a peer for at least 90% of opportunities across three consecutive sessions.

Interobserver Agreement

Two additional data collectors collected data for interobserver agreement (IOA). IOA was taken on 33% of baseline sessions for each participant. IOA was taken on 30% of Jason's intervention phase, 29% of Tommy's intervention phase and 25% of Noah's intervention phase. The first data collector was the after-school program's clinical supervisor who was a Board Certified Behavior Analyst and had 10 years of experience working with children with ASD. The second data collector was a lead-staff member who was in graduate school for clinical counseling and had three years of experience working with children with ASD. Prior to the start of the study, both data collectors reviewed the operational definitions and were trained using practice sessions with children who

attended the program. They were taught to record data on independent mands, prompted mands and nonresponses until they reached 100% agreement in practice sessions. The experimenter calculated IOA by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. IOA was 96.6% (range, 90 - 100%) during baseline phases and 95% (range, 80-100%) during intervention phases.

These same data collectors also assessed procedural fidelity by using a checklist of the task list of procedures. They were trained to collect procedural fidelity data by reviewing the task list steps and taking procedural fidelity data during practice sessions with children who were not included in the study. They needed to reach 90% accuracy during practice sessions. Procedural fidelity data were collected on 33% of baseline sessions for all participants. Procedural fidelity was taken on 25% of Jason's intervention phase, 29% of Tommy's intervention phase and 33% of Noah's intervention phase. The task list for baseline included six items, and the task list for intervention included eight items. Procedural fidelity data was 94.3% (range, 83 - 100%) during baseline phases and 89% (range, 62.5 – 100%) during intervention phases. The most frequent procedure that was missed was having the participant and peer seated 1-2 feet apart, or starting with a partial verbal prompt instead of a gestural prompt. The participants not sitting 1-2 feet apart often occurred in the separate classroom where the participants had more room to move around.

Social Validity

Three different surveys were used to measure the social validity of this study. Staff responses to the surveys are shown in Table 1. A simple two question survey was given to the participants asking whether they liked learning to ask to share with their

friends and whether they think sharing is being a good friend. A similar survey was given to the peers asking whether they liked learning to share with their friends and whether they think sharing is being a good friend. The participants and peers answered these questions by pointing to a happy face, neutral face or sad face.

A more in depth survey was given to staff that work with the participants and peers at the therapeutic after-school program. The staff survey was given four weeks after the intervention sessions were completed. The staff were asked to rate the following items on a Likert scale (1 = strongly disagree; 5 = strongly agree). These questions gathered information on whether the staff thought that (a) peer-to-peer manding is an important skill to teach to this age and diagnosis, (b) if they liked the intervention procedures used in the study, (c) if they could see immediate generalization of these skills in the generalized group classroom, and (d) if they still see maintenance of the skill after a month following the study.

Experimental Design

This study used a multiple-probe across participants research design. Each participant was exposed to a continual baseline for three sessions immediately prior to the start of the intervention phase. When the first participant showed no improvement in his baseline phase, the intervention was introduced. Once the first participant, Jason, reached at least one data point of 90% independent mands, the intervention was introduced to the second participant, Tommy. Once Tommy reached at least one data point of 90% independent mands, the intervention was introduced to the third participant, Noah. Experimental control was demonstrated when each participants' performance visually improved from baseline with introduction of the intervention.

Procedures

Preference Assessment. All three participants had restricted interests focusing on toy trains and cars. They were observed to play with these same types of toys during the after school program, every day across a two-week period. Specific toys that were played with the most were written down into a list. Before baseline began, the experimenter used a one-time seven-item Multiple Stimulus Without Replacement (MSWO) assessment (DeLeon & Iwata, 1996) with each target participant using the items written down during the observation. The most highly preferred item was identified for each participant. Jason's was a Mickey Mouse toy car, Tommy's was Thomas the Train toy and Noah's was a Percy train toy. All preferred items that were used during the preference assessment were kept in a clear plastic bag, which was kept in an office and not accessible to the participants during any other time of the day besides during the study sessions. The plastic bag was in the room and visible at the start of each session. To start the session, the identified toy from the MSWO was presented to the participant. However, if the participant manded to staff for another one of the toys in the plastic bag at the start of the session, that toy was used during the session. After the toy was selected, the toys in the plastic bag were removed from the room so they were no longer visible once the session started. Giving the participant the option for toy selection ensured that a motivating operation was present. Participants were already able to independently tact all seven of the item names used in their MSWO and kept in the plastic bag. This was assessed by the experimenter pointing to the item and asking, "What is this?"

Baseline. During each 10-trial baseline session, the target participant and a peer were in the separate session room, along with the experimenter. Before beginning the

session, the experimenter presented the most highly preferred item to the participant, or gave the opportunity to choose another preferred item from the plastic bag. The target participant and peer were seated facing each other on the floor approximately 1-2 feet apart. The target participant's chosen toy was given to the peer upon the start of the session by saying, "You can play with this." There were no prompts given to the target participant to facilitate any mands. If the peer tried to give the participant the toy before the participant manded, the experimenter reminded the peer that it was time for him to play with the toy. Contingent on an independent mand to the peer, the experimenter prompted the peer to provide the target participant with the toy. Any mands for the item to the experimenter were placed on extinction during baseline, meaning the participant was not given the item and the experimenter withheld any prompts or attention.

Mand training. During mand training, as in Baseline, there were 10 30-s trials that lasted approximately 5 min for each session. The participant and the peer were seated adjacent to each other on the floor approximately 1-2 feet apart. The experimenter sat between the participant and peer. During the mand sessions, only mands towards the peer were reinforced, and mands towards the experimenter were placed on extinction. Before beginning the session, the experimenter presented the most highly preferred item to the participant, or gave the opportunity to choose another preferred item from the plastic bag. To begin the trial, the participant was told, "If you want the (*item name*), you need to say, I want (*item name*)." This direction was given for all sessions until the target participant reached at least 50% independence, after which the direction was no longer provided. After the direction was given, the target participant was given access to the selected toy, non-contingently. After 30-s of access, the experimenter prompted the target participant

to give the toy to the peer by manually guiding the removal of the toy and handing it to the peer if needed. As little verbal prompting and directions were given as necessary, however, if the participant engaged in any sort of whining or crying upon removal, the experimenter said, "it's (*peer's name*)'s turn," and manually guided the removal of the toy. The peer had 30-s access to the toy. At the end of 30-s peer access, the participant was prompted to mand for the toy using least-to-most prompts. Using a prompt hierarchy, the least intrusive prompt was a gestural prompt that points to the peer. The second level of prompt was a partial verbal prompt, "I…" The third level of prompt was a partial verbal prompt, "I want…" and a full verbal prompt was, "I want the (*item name*)." If the participant did not emit the target response within 5-s of the first prompt, the experimenter delivered the prompt again. If the participant still did not emit the target response, the experimenter delivered the next highest prompting level. This continued until a full verbal prompt was used. If the participant still did not respond after two full verbal prompts, the peer used the toy for the remainder of the 30-s trial, and then a new trial began. After two trials of the participant not responding after two full verbal prompts, the peer was asked to select a new toy from their bag of toys. If after two trials of the participant not responding after full verbal prompts with the second highest preferred toy, then the third highest preferred toy would was introduced. If there is no responding after full verbal prompts within two trials with this toy, that session was terminated.

Contingent on the occurrence of the target mand, either independently or with prompting, the participant was given access to the toy for 30-s. After the participant accessed the toy for 30-s, he was again guided to give the toy back to the peer, by

manually guiding the toy to the peer and saying, "It's (*peer's name*)'s turn," if needed.

This continued for 10 trials per session.   Behavior specific verbal praise (e.g., "Good

asking!") was provided by the experimenter contingent on a correct mand only during the

first trial of each session to avoid verbal praise being the maintaining consequence.

If the participant independently emitted the target mand at any time during the

peer's 30-s access, the peer delivered the toy to the participant for the remainder of that

30-s trial. If the participant attempted to take the toy from the peer without a target mand,

the participant looked at the experimenter while emitting a mand, or the participant used

an incorrect vocal mand, the experimenter used that opportunity for that trial to prompt

the participant to engage in the target mand.

The experimenter ignored any problem behavior such as screaming, whining or

crying that occurred in response to the 30-s ending and the experimenter returning the toy

to the peer. If the participant or peer tried to physically move away from each other

during sessions, the experimenter guided them back to the area by reminding them,

"we're playing over here right now." If the peer attempted to give the toy to the

participant during the peer's 30-s access, the experimenter guided the toy back to the

peer. If the participant gave the toy back to the peer any time during the participant's 30-s

access, the peer was allowed to keep the item for the remaining time in that trial, until the

next opportunity for the participant to mand.

Maintenance Probes

One maintenance probe was conducted two weeks after the end of intervention and

another two probes were conducted four weeks after the end of intervention. These

probes evaluated for maintenance of the manding behavior over time. Maintenance

probes were identical to baseline procedures, except all probe sessions were conducted in the classroom setting.

CHAPTER 4

RESULTS

Figure 1 displays the graphs for all three participants. The graph shows the percentage of independent peer-to-peer mands during baseline, intervention phases, and maintenance probes. Comparison data across participants is displayed in Table 2. All participants displayed low levels of peer-to-peer manding during baseline. The effects of the treatment package were effective in increasing peer-to-peer mands during intervention phases and maintenance probes. The evidence of experimental control that is observed in the graphs supports this finding. Experimental control is indicated by little to no overlap between baseline and intervention sessions, and no spill-over effect from one participant to another's data.

Jason. As displayed on the top panel of the graph in Figure 1, during baseline, Jason had a mean of 3% (range, 0-10%) independent peer-to-peer mands. His verbal behavior in an attempt to gain the toy during baseline mainly consisted of crying, whining, grabbing towards the item, saying, "hey," or only stating the name of the item using one word. Once the intervention was implemented, Jason's independent mands immediately increased to a mean of 82.5% (range, 30-100%). Jason reached the criteria of 90% independent mands in the sixth session. After reaching the criteria of 90% independency, Jason's average of independent peer-to-peer mands for sessions 6 – 15 were 94.6% (range, 80 – 100%). During maintenance probes, Jason's manding continued to reach mastery criteria, as his mean of independency was 93.3% (range, 90 – 100%).

Percentage of non-overlapping data points (PND) was calculated by dividing the number of non-overlapping data points between baseline and intervention sessions, by the

number of data points in the intervention phase and multiplying by 100. The PND of Jason's graph is 100%, indicating high functional relation and an effective treatment.

Tommy. As displayed in the middle panel of the graph in Figure 1, during baseline, Tommy had a mean of 21.6% (range, 10 – 40%) independent peer-to-peer mands. Tommy engaged in some higher levels of independent target mands during the first three baseline sessions, and then decreased to lower levels of independent target mands during the three baseline sessions that immediately preceded his intervention sessions. Tommy's verbal behavior in an attempt to gain the toy during baseline consisted of crying, whining, grabbing towards the item, saying, "mine," "my turn," and, "pass it to me." Once the intervention was implemented, Tommy's independent mands increased to a mean of 78.5% (range, 40 – 100%). Tommy reached the criteria of 90% independent mands during the seventh intervention session. After reaching the mastery criteria of 90% independency, Tommy's average of independent peer-to-peer mands for Sessions 7 – 14 were 90% (range, 80 – 100%). During maintenance probes, Tommy did not meet mastery criteria. His independent manding mean across three maintenance probes was 66.6% (range, 60 – 70%).

Although there was one overlapping data point from baseline to intervention, the PND of Tommy's graph was 92.8%, still indicating that the treatment was effective. A functional relationship exists when looking at the increasing trend during the intervention phase and the lack of trend during baseline.

Noah. As displayed in the bottom panel of the graph in Figure 2, during baseline, Noah had a mean of 7.7% (range, 0 – 30%) independent peer-to-peer mands. Verbal behaviors that functioned as an attempt to gain the toy included grabbing for the item,

screaming, crying, and stating the name of the item using one word. During the intervention phases, Noah's independent mands immediately increased to a mean of 77.5% (range, 60-90%). Noah reached the mastery criteria of 90% independency on the sixth session. Noah remained at 90% independency for all sessions following the initial session of meeting the criteria. During maintenance probes, Noah reached mastery criteria of 90% independency during the first probe, which was taken 2 weeks following the last intervention session. However, during the four week maintenance probes, Noah reach 80% independency. His overall mean for maintenance probes was 83.3% (range, 80 – 90%).

There was no overlap in data points between baseline and intervention sessions and there was an immediate increase in trend once the intervention began. The PND for Noah's data was 100%, indicating strong functional relation and treatment efficiency.

CHAPTER 5

DISCUSSION

The purpose of this study was to investigate whether (a) a teaching package using least-to-most prompting was effective in teaching young children with ASD to mand to their peers and (b) programming for generalization of settings and peers within the intervention procedures was effective in teaching generalization of peer-to-peer mands. Results of this study provide evidence that using least-to-most prompting to teach peer-to-peer mands to children with ASD is effective. All three participants displayed a substantial increase in peer-to-peer mands both in a separate teaching environment and the naturalistic classroom setting, and across a variety of peers. In addition, participants were able to maintain high levels of peer-to-peer manding during maintenance probes that were taken two and four weeks after the intervention finished.

The graphs in Figure 1 reveal that the responding of all three participants was slightly different. Although all participants displayed an increase in independent peer-to-peer manding compared to baseline levels, Jason reached a higher and more steady level of responding compared to Tommy and Noah. Jason was the only participant who maintained mastery criteria for all three maintenance probes. The data do not indicate any reason for the higher responding that was seen with Jason. When looking at the middle panel of Figure 1, Tommy displayed higher levels of baseline responding, suggesting that he already had a higher peer-to-peer mand repertoire than Jason and Noah did during baseline. However, Tommy actually showed the least steady responding during intervention phases. Maintenance data for Tommy showed the lowest percentage of independent manding out of all three participants. Tommy often engaged in refusal

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behaviors during sessions. Tommy frequently changed his preference for which toy he wanted during sessions, whereas Jason and Noah almost always chose the same toy during every session. These factors may have led to his lower percentage of independent mands and lack of steady responding. Tommy often independently emitted mand responses such as, "my turn," and, "pass it to me," to peers. Unfortunately, the topography of that response was not included as a target mand. Furthermore, procedural fidelity data taken during one of Tommy's intervention sessions indicated 62.5% accuracy. Procedures that were not implemented correctly included having the participant and peer seated 1-2 feet apart, beginning the session by giving the toy to the peer instead of the participant, and starting the least-to-most prompt with a partial verbal prompt before using gestural. Tommy's problematic behavior during sessions made it more difficult for the experimenter to provide treatment with high integrity.

These results support and extend previous research (e.g., Hanney, 2015; Kodak el al., 2012; Paden, et al., 2012) that has focused on teaching peer-to-peer mands. As none of these studies have used least-to-most prompting to teach vocal peer-to-peer mands, this study is an important extension of both Paden, et al. (2012), and Hanney (2015), by showing that this teaching package is effective in increasing peer-to-peer vocal mands with children with ASD to other children with ASD. Paden, et al. (2012) is extended by providing evidence that peer-to-peer mand training is effective with vocal speech, as well as Picture Exchange Communication System (PECS). Further, this study suggests that using least-to-most prompting to teach peer-to-peer mands could be an alternative to using most-to-least prompting that has been used in similar studies (Hanney, 2015). The current study offers additional research for using both participants and peers with ASD

for mand training (Taylor, et al. 2005), instead of using typically developing peers. The current study provides research on the effectiveness of generalization of peer-to-peer manding, in which the peer and environment were alternated. Programming for specific generalization within the intervention procedures has not been seen in previous studies (Hanney, 2015; Paden, et al., 2012; Taylor, et al. 2005).

These implications are important for clinical practice when considering ways to teach communication to children with ASD. For children with ASD who already have a strong manding repertoire to adults, using a least-to-most prompting method may be beneficial in teaching children to mand to their peers. As lack of socialization between peers is characteristic of those with ASD, peer-to-peer mand training provides a means for peer interaction that directly benefits the speaker. Since results from this study showed a successful increase in communication towards peers, using this treatment package with children with ASD may lead to an increase in overall communication and socialization with peers. Verbal social interaction such as tacts and intraverbals were observed between the peers during study sessions, providing an unintended benefit of this study. Peers frequently tried to play together with the target toy and engaged in verbal interactions while talking about the toy together during sessions. The maintenance probes suggest that the treatment was effective in maintaining high rates of responding over time for two of the participants. Further, alternating settings and peers during the study proved to be effective in increasing the generalization of peer-to-peer mands.

Staff reports from the social validity surveys indicate that this treatment was valued in the areas of importance and effectiveness. The results of staff social validity are shown in Table 1. Both staff members who completed the survey strongly agreed with the

importance of teaching peer-to-peer mands to preschool age children with ASD and the intervention procedures. They also strongly agreed that they saw an increase in peer-to-peer mands by the participants a few weeks after the study ended. They agreed that the effects of the treatment were immediately effective. These results are consistent with what was inferred from the data; the intervention did not produce an immediate increase to mastery criteria, but did produce high rates of responding that met mastery criteria after 6 - 7 sessions and maintained at high rates.

All peers and participants selected the "happy face" for both questions on the child version of social validity surveys. Anecdotally, the participants and peers seemed to enjoy participating in the study. They were often smiling and stated that they, "wanted to play," when it was time to begin a session.

Limitations

The inability to control for stimulus control was a limitation of this study. Since the items that the participants' manded for were in eyesight, the mand was technically a tact-mand, and not a pure mand. With a pure mand, the only controlling variable is the motivating operation. With this study, the motivating operation was the deprivation of the toy. However, the toy also functioned as a discriminative stimulus, thus adding another controlling antecedent stimulus.

The teaching sessions themselves also seemed to function as a discriminative stimulus for emitting the mand. Since the toy was always delivered to the participant on a FR-1 schedule contingent on a target mand according to the controls of the study, the sessions were more contrived than what would typically occur in the natural environment (e.g., toy is not provided on fixed ratio-1 schedule in natural environment). For that

reason, participants quickly learned to emit the target mand during the teaching trials, however, were not observed to emit at this high level during natural classroom activities outside of the teaching sessions.

Lastly, when using the teaching procedures with the target participant, the peer began to use the target mand, as well. Although the peer learning the target mand from imitating from the target participant was an unintended benefit, the peer began to emit the target mand during the participant's 30-s access to the toy. As the peer did not receive the toy when he manded, this evoked some problem behavior associated with extinction, such as whining and crying.

Future Research

There are multiple areas of research that relate to peer-to-peer mand training. First, future research may seek to teach more effective listener repertoires to the peer, and to not only focus on the participant. For example, young children with ASD may allocate their mands to adults because of previous reinforcement histories that present the desired reinforcement immediately following the mand when it is mediated by an adult. Adults may function as a discriminative stimulus that signals more dense and immediate reinforcement, compared to peers who may not deliver immediate or any reinforcement contingent on a mand because of weak listener repertoires. Therefore, teaching peers to respond more quickly to peer mands may lead to a natural increase in peer-to-peer manding.

Future research could also evaluate combining procedures used in this study, along with procedures to promote generalized mands, such as gaining peer attention first before manding or walking across a room to mand. This study was contrived in the aspect

that peers were always sitting 1-2 feet apart. However, in the natural environment, a child may see an item that another peer has from across the room, and would need to learn to effectively walk over to the peer, gain their attention, and then use the appropriate mand. In addition, future research could evaluate using more than one item by doing a multiple baseline across behaviors (e.g., manding for multiple items such as toys, food, etc.)

Further, research could also focus on manding for items that are out of sight. Although this study used autoclitics that expanded the sentence to an explicit mand, when children are only using the name of the item as a mand, this may lead to uncertainty on whether their verbal behavior is a mand or tact. Therefore, teaching children to mand for items that are not present can accurately test the strength of the mand and teach pure manding.

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Table 1.

Staff Responses to the Social Validity Survey

Item	Ratings	
1. Peer-to-peer mands are an important skill for preschool children with ASD to learn.	5	5
2. I liked the procedures used in this study to teach peer-to-peer mands.	5	5
3. I thought the procedures used in the study were immediately effective.	4	4
4. I think the procedures used in this study are still showing effectiveness following a few weeks since the study has ended.	5	5

Note. 1 = strongly disagree; 2 =disagree; 3 = neither disagree /agree; 4 = agree; 5 = strongly agree

Table 2.

Results of Data Collection

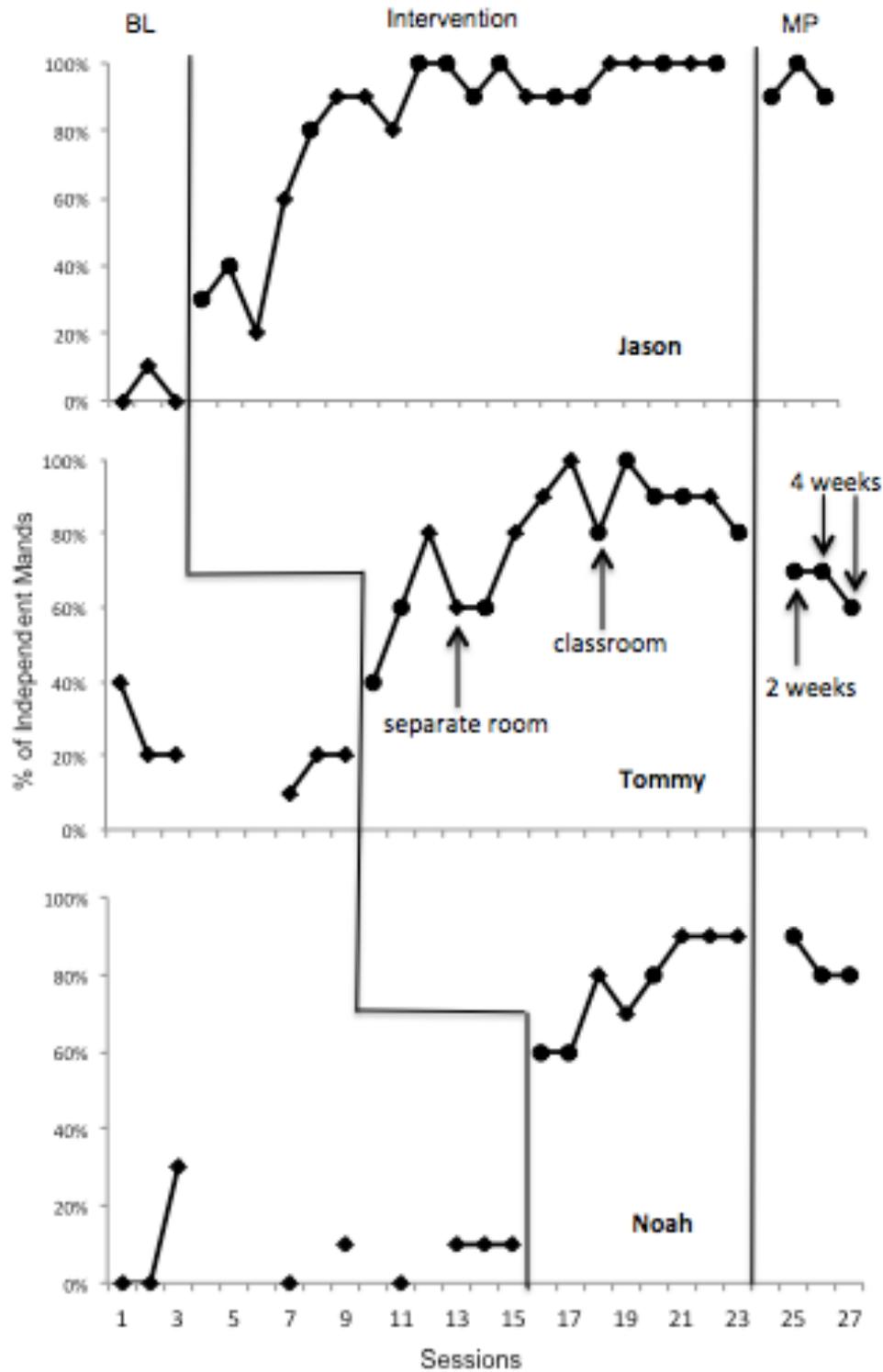|	Jason	Tommy	Noah
Baseline mean	3% (range, 01-10%)	21.6% (range, 10-40%)	7.7% (range, 0-30%)
Intervention mean	82.5% (range, 30-100%)	78.5% (range, 40-100%)	77.5% (range, 60-90%)
# of sessions until criteria	6	7	6
Mean after criteria was reached	94.5% (range, 80-100%)	90% (range, 80-100%)	90%
Maintenance probe mean	93.3% (range, 90-100)	66.6% (60-70%)	83.3% (range, 80-90%)

Figure 1. Baseline (BL), intervention phases and two and four week maintenance probes (MP) for Jason (top panel), Tommy (middle panel), and Noah (bottom panel). Diamond shape data points represent sessions in the separate room and circle shape data points represent sessions in the natural classroom.