MANDING IN CHILDREN WITH AUTISM: TRANSFER OF CONTROL FROM ADULTS TO PEERS

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MANDING IN CHILDREN WITH AUTISM:
TRANSFER OF CONTROL FROM ADULTS TO PEERS

A Thesis
Presented to
The Graduate Faculty
Central Washington University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Experimental Psychology

by
Michael Layne Miller
November 2016
We hereby approve the thesis of

Michael Layne Miller

Candidate for the degree of Master of Science

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Dean of Graduate Studies
ABSTRACT

MANDING IN CHILDREN WITH AUTISM: TRANSFER OF CONTROL FROM ADULTS TO PEERS

by

Michael Layne Miller

November 2016

Individuals diagnosed with autism spectrum disorder (ASD) exhibit significant delays, regression, and deficits. One deficit area is that of communication and social skills with peers. The present study assesses whether children diagnosed with ASD can learn to transfer the skill of producing mands for familiar items from an adult to a typically developing peer. This study replicates previous research and extends it with three additional manipulations: (a) reduction of prompt dependence, (b) transfer of manding control from an adult to a trained typically developing peer, and (c) a generalization test to a novel but trained typically developing peer. Results demonstrate that for 2 out of the 4 participants manding could be systematically transferred from the adult to a typically developing peer, and then generalized to a novel, typically developing peer. Implications for future research are discussed.

Keywords: Applied Behavior Analysis, Autism, Social, Peers, Mands, Establishing Operations
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
</tr>
<tr>
<td>STATEMENT OF THE PROBLEM</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>4</td>
</tr>
<tr>
<td>LITERATURE REVIEW</td>
<td>4</td>
</tr>
<tr>
<td>Social Interaction</td>
<td>6</td>
</tr>
<tr>
<td>The Analysis of Verbal Behavior</td>
<td>8</td>
</tr>
<tr>
<td>Current Study</td>
<td>15</td>
</tr>
<tr>
<td>III</td>
<td>16</td>
</tr>
<tr>
<td>METHODS</td>
<td>16</td>
</tr>
<tr>
<td>Participants</td>
<td>16</td>
</tr>
<tr>
<td>Experimental Setting</td>
<td>21</td>
</tr>
<tr>
<td>Target Response: Manding</td>
<td>21</td>
</tr>
<tr>
<td>Materials</td>
<td>22</td>
</tr>
<tr>
<td>Equipment</td>
<td>23</td>
</tr>
<tr>
<td>Pre-Experimental Training</td>
<td>23</td>
</tr>
<tr>
<td>Experimental Phases</td>
<td>25</td>
</tr>
<tr>
<td>Data Collection</td>
<td>32</td>
</tr>
<tr>
<td>Experimental Design</td>
<td>35</td>
</tr>
<tr>
<td>Baseline Logic</td>
<td>36</td>
</tr>
<tr>
<td>Experimental Hypotheses</td>
<td>37</td>
</tr>
<tr>
<td>IV</td>
<td>39</td>
</tr>
<tr>
<td>RESULTS</td>
<td>39</td>
</tr>
<tr>
<td>VB-MAPP Assessment</td>
<td>39</td>
</tr>
<tr>
<td>General Results</td>
<td>40</td>
</tr>
<tr>
<td>Individual Results</td>
<td>41</td>
</tr>
</tbody>
</table>
TABLE OF CONTENTS (continued)

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training of Peer Trainers</td>
<td>52</td>
</tr>
<tr>
<td>Experimental Assurances</td>
<td>52</td>
</tr>
<tr>
<td>V DISCUSSION</td>
<td>55</td>
</tr>
<tr>
<td>General Discussion</td>
<td>55</td>
</tr>
<tr>
<td>Individual Findings</td>
<td>56</td>
</tr>
<tr>
<td>Synthesis of Past and Present Research</td>
<td>64</td>
</tr>
<tr>
<td>Limitations</td>
<td>71</td>
</tr>
<tr>
<td>Suggestions for Future Research</td>
<td>75</td>
</tr>
<tr>
<td>Concluding Remarks</td>
<td>76</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>78</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VB-MAPP Milestones Level 2: Average Score of Each Domain</td>
</tr>
<tr>
<td>2</td>
<td>VB-MAPP Barriers Assessment</td>
</tr>
<tr>
<td>3</td>
<td>Number of Training Sessions Required to Reach Criterion</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Percentage of total unprompted mands per opportunities for the spoon during baseline sessions</td>
<td>42</td>
</tr>
<tr>
<td>2</td>
<td>Percentage of total prompted mands per opportunities for the spoon during baseline sessions</td>
<td>43</td>
</tr>
<tr>
<td>3</td>
<td>Percentage of total unprompted mands per scheduled opportunities for non-experimental items during baseline sessions</td>
<td>44</td>
</tr>
<tr>
<td>4</td>
<td>Rikki’s percentage of total mands for the spoon, both unprompted and prompted, across all baseline and training sessions</td>
<td>46</td>
</tr>
<tr>
<td>5</td>
<td>Brett’s percentage of total mands for the spoon, both unprompted and prompted, across all baseline and training sessions</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>Margot’s percentage of total mands for the spoon, both unprompted and prompted, across all baseline and training sessions</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>Paul’s percentage of total mands for the spoon, both unprompted and prompted, across all baseline and training sessions</td>
<td>51</td>
</tr>
</tbody>
</table>
CHAPTER I

STATEMENT OF THE PROBLEM

Individuals diagnosed with autism spectrum disorder (ASD) exhibit significant delays, regression, and deficits in development in language, cognitive, self-help skills, and social skills. To treat the symptoms and behaviors prevalent with an ASD diagnosis, applied behavior analysis (ABA) utilizes evidenced-based methods of treatment to increase appropriate functional behaviors and decrease inappropriate behaviors. ABA therapy includes the following two primary treatment goals: (a) demonstration of skills in natural settings with limited support and (b) generalization of newly acquired skills across settings and individuals. Though skill acquisition has been demonstrated in all deficit areas, communication and social skills remain difficult to transfer to natural settings.

Two important treatment elements included in social skills training for a person with ASD are the inclusion of peers and generalization of learned skills across individuals. The first element is the inclusion of peers within treatment. People spend most time with their peers, so it is important that not only the peers be included treatment programs but also that peers learn how to interact with the individuals with ASD (Owen-DeSchyver, Carr, Cale and Blakeley-Smith, 2008). Generalization is also an important component in treatment goals (Kamps et al., 2002). The previously mentioned studies were able to demonstrate how these two components can be effectively implemented with treatment programs.
To create behavior change, a person must be motivated to interact. One method this is done is by requiring a person to make requests (also known as mands) to get needs met. Mands, one of the seven types of verbal behavior described by B. F. Skinner (1957), are paramount in social interactions. For the individual, mands function as a means to gain or acquire items or information from others (Sundberg, 2004). As individuals grow older, their peers possess the materials and information needed to have needs fulfilled. For this purpose, mands are necessary to motivate a child with ASD to interact with their peers. Mands alone are not enough to motivate one to interact. The manipulation of their environment is also required. Motivating operations are environmental factors that either increase or decrease the likelihood a response is emitted (Cooper, Heron, & Heward, 2007). These factors can be manipulated to increase or motivate responding. In terms of social skills, the manipulation is done by withholding items or information that a person wants or needs, also known as establishing operations. The mastery use of establishing operations and manding can increase the likelihood an individual with ASD will interact with their peers.

Previous studies have investigated the use of mands and establishing operations. In their study with individuals with intellectual disabilities, Hall and Sundberg (1987) suggested that establishing operations can be created by training verbally capable individuals to learn multi-component tasks, exposing them to the terminal reinforcers. Once the tasks are established, the removal or absence of a component may then evoke a manding response from the individual. Two studies (Lechago, Carr, Grow, Love, & Almason, 2010; Sundberg, Loeb, Hale & Eigenheer, 2002) extended the previous
research and found the same procedure could evoke mands for information (i.e., asking questions about an item instead of simply asking for the item) during multi-component tasks. Two additional studies (Pellecchia & Hineline, 2007; Taylor et al., 2005) used a similar procedure to determine whether mands could be evoked in the presence of peers also diagnosed with ASD. They found children with ASD did mand for items in the presence of peers with an ASD diagnosis.

The purpose of the current study is to determine whether children diagnosed with ASD can learn to transfer manding for familiar items from an adult to a typically developing peer. The current study replicates aspects of previous research (Hall & Sundberg, 1987; Lechago et al., 2010; Pellecchia & Hineline, 2007; Sundberg et al., 2002; Taylor et al., 2005), and extends the research with three additional changes: (a) reduced reliance on adult prompting, (b) transfer of manding control from an adult to a trained typically developing peer, and (c) a generalization test to a novel, trained peer. As such, a detailed summary of the relevant literature is warranted.
CHAPTER II
LITERATURE REVIEW

Children diagnosed with ASD exhibit significant delays, regression, and deficits in development as described in the DSM-V (American Psychiatric Association, 2013), and as defined by the National Institute of Child Health and Human Development (NICHD, 2013). ASD is a developmental disorder affecting how the individual interacts with and reacts to their environment. Individuals with ASD produce both excesses and delays. Reported excesses that occur in disruptive and aggressive behavior (e.g. failure to comply with instructions, intolerance to changes in routine), ritualistic behavior (e.g. self-stimulatory behaviors). In addition, deficits may include attending to their environment, language deficits, a lack of self-help skills, and the inability to initiate or maintain social interactions. Deficits in language and social interaction are most notably identified with ASD. Such language deficits may include non-functional repetition of words and phrases (including echolalia), the use of undefined vocalizations (e.g., babbling, moaning), or a lack of receptive (i.e. comprehension) or expressive (i.e., spoken) language. Regarding social interactions, an individual may not demonstrate the ability to imitate appropriate social interaction behaviors such as greetings, eye contact, conversation maintenance, and voice matching. In addition, the individual’s vernacular may be rather stringent and scripted, lacking the ability to adapt to the current social exchange (Centers for Disease Control and Prevention [CDC], 2016).

Observable manifestations of ASD typical behaviors often occur around 18 months of age, with earlier detection possible but often difficult to confirm until the child
is older (APA, 2013; Flynn & Healy, 2012; Jang, Dixon, Tarbox, & Granpeesheh, 2011; NICHD, 2013). It has recently been reported that one out every 68 Americans are diagnosed with ASD with diagnosis occurring as early as 24 months (CDC, 2016). Due to the pervasiveness of ASD, early detection and intervention are the preferred and standard practice for minimizing delayed or atypical development, and for maximizing the child’s ability to function within their environment.

Many treatments—both evidence based and non-evidence based—have been implemented and are sought by parents and service workers, alike. Treatments fit into one of four categories: behavior and communication therapies, dietary, medication, and alternative medicine (CDC, 2016). Bowker, D’Angelo, Hicks, and Wells (2011) surveyed 970 individuals who had a child diagnosed with ASD in which they identified the total number, types, and variety of treatments which they then contrasted with family demographics and with parental perception of efficacy. From completed surveys, the researchers identified thirteen treatments listed by the participants. The researchers stated that of all the procedures listed by the participants, ABA was the treatment most utilized by parents, with reports of high treatment efficacy.

ABA utilizes evidenced-based methods of treatment to increase appropriate functional behaviors and decrease inappropriate behaviors (NICHD, 2013). In addition to its use with individuals with ASD, ABA has been employed to enhance individual and group behavior in a number of broad areas including: safety training (Houvouras & Harvey, 2014), community involvement (Luyben, 2009), psychological/behavioral disorders (e.g., obsessive compulsive disorder, oppositional defiance disorder, Tourette’s
disorder) (Harvey, Luis, Elli, & Wong, 2009), drug rehabilitation (Silverman, Roll, & Higgins, 2008), traumatic brain injury (Heinicke & Carr, 2014), abduction prevention skills (Johnson et al., 2006), behavior skills training for caregivers (Miles & Wilder, 2009), and social skills training (Francisco & Hanley, 2012). The field of ABA has contributed to the research and development of interventions for the treatment of behavior problems and intellectual disabilities for over 60 years (Axelrod, McElrath, & Wine, 2012). Its generality and empirically demonstrated efficacy has led to increasing national acceptance and appeal.

Social Interaction

As stated previously, individuals diagnosed with ASD exhibit delays, regression, or deficits in social interaction. According to Okyere (1998), research has identified distinct social skill deficits prevalent in ASD. For example, individuals with ASD often exhibit no eye contact or socially inaccurate eye exchanges. Eye contact among typically developing individuals is commonly used to show or gain attention. Individuals with ASD tend to look at other environmental stimuli when interacting with others in their immediate environment. In addition to eye contact deficits, ASD is often marked by an observed inability to form attachments with others. This inability may be demonstrated by the lack of physical contact (e.g., disinterest in hugs, kisses), and a failure to engage in, and to maintain social interactions. During times of emotional escalation, some individuals with ASD are often unresponsive to external sources of soothing or comforting from parents and other caregivers. Individuals may also display an inability to experience empathy, understanding, or to express emotions appropriately. Although
many symptoms of ASD may decrease as children grow older, the lasting effects of poor social skills persist throughout their lifetime. Due to these deficits, individuals with ASD typically are unable to develop or maintain relationships (Jang et al., 2011).

One primary treatment goal for individuals with ASD is to be included in typical educational and recreational settings (Kamps et al., 2002); however, the lack of social skills can be a hurdle. Owen-DeSchyver et al. (2008) suggest classroom peers may lack knowledge about how to interact effectively with people with disabilities, thus adding to the individual’s isolation. In their study, the investigators performed training sessions with typically developing peers, informing them of the behaviors associated with the disability and teaching the peers how to interact appropriately with the target children. Results demonstrated the target child’s social interactions—both initiations and responses—with their peers increased after peer training. These results suggest untrained peers may lack knowledge about the behaviors of people with disabilities; however, they can learn to implement effective interaction strategies with their classmates.

The second goal of ABA is to ensure that newly acquired social skills generalize to different individuals and across different settings. Individuals with ASD may only demonstrate highly scripted responses in the presence of very limited stimuli—including specific people or the use of exact wording of instructions present within previous learning environments. To test different methods of increasing and maintaining social interactions, Kamps et al. (2002) systematically created opportunities for children diagnosed with ASD to interact with typically developing peers. Participants were assigned to one of three conditions: 1) a social skills group that consisted of peers
explicitly trained in social skills for playing with children with ASD, 2) a cooperative learning group consisting of peers trained as tutors to teach children diagnosed with ASD academic lessons, or 3) a control group comprised of a mainstream classroom with no formal social interventions. Results showed that the target children increased the frequency and duration of social interactions with trained peers (e.g., initiations with and responses to peers) in both the social skills group and the cooperative learning group. The findings suggest some methods of inclusion with typically developing peers may better help individuals with ASD in learning social skills, especially those structured activities where the peers are an active component of the learning process.

**The Analysis of Verbal Behavior**

In the book *Verbal Behavior* (1957), Skinner presented a behavior analytic approach to language and communication, focusing on the functionality of language as opposed to linguistic structure and form. Verbal behavior is defined as a speaker’s behavior that is reinforced by a listener, and which takes the form of verbal behavior (e.g., saying, “I like chocolate”) and non-vocal-verbal behavior (e.g., gesturing, sign language, and printed or written words) (Sundberg, 2004). Skinner proposed seven verbal operants: tacts, mands, intraverbals, echoic responses, copying of text, taking dictation, and textual responses. While each of these verbal operants is important, this paper will limit its discussion to mands since manding is the target operant of the study. For a detailed analysis of the other verbal operants, refer to Skinner’s book *Verbal Behavior* (1957).

**Manding: The Skill of Requesting**
The act of requesting or making demands is one key component in effective interpersonal communication. Within the behavior analytic community, the act of asking or demanding is referred to as manding. Manding functions as the verbal means for a speaker to have needs and wants fulfilled (Sundberg, 2004). Mands include such things as requests, commands, and demands. For an individual with ASD to function independently, or with limited assistance within their environment, manding is paramount. Skinner (1957) stated, “When we consider other types of verbal operants, we shall find that the behavior functions mainly for the benefit of the listener. . . [the] mand, however, works primarily for the benefit of the speaker” (p.36). Since mands are essential to the speaker’s ability to get his or her needs satisfied, it is critical that the listener precisely understands what the speaker is communicating. Mands can be characterized as partial (e.g., as a function of being thirsty, saying, “Juice”), pure (e.g., “Want juice” the same function), or full (e.g., “I want juice” the same function). Partial mands are easily confused with simple naming (a.k.a., tacts: defined as the labeling of the environment) because not enough relevant information is available to differentiate labeling from a request. For example, a speaker could say “Juice” when he wants juice, but he could also verbalize it to label something as juice. Therefore, pure and full mands provide a speaker with better control over the listener’s behavior.

When it comes to teaching manding, the motivation to communicate is an essential feature of successful communication. Motivation is an elusive construct that is difficult to define, measure, and manipulate. One effective approach to motivation is to employ the use of motivating operations: antecedent procedures or events that change the
reinforcing value of a stimulus or consequence, thus evoking a response (Cooper et al., 2007). Motivating operations are the precursors that alter one’s need or motivation to engage in a particular behavior, like asking for assistance (manding). Because many people with ASD lack the skill of manding, it is a common target behavior in the development of social skills. As a result, the use of motivating operations is commonly employed in manding interventions.

Motivating operations consist of two different operations: establishing operations (EO) and abolishing operations (AO). More specifically, establishing operations increase motivation by enhancing the effectiveness or value of a reinforcer. Thus, a person with a broken computer (EO) is more likely to request assistance in getting the computer repaired (mand). Abolishing operations (AO) decrease motivation by diminishing the value of a reinforcer. For example, having access to a second computer (AO) will result in a person with a broken computer to be less likely to request assistance to fix it. Because establishing operations make consequences more reinforcing, they are considered a crucial component of mand training.

Hall and Sundberg (1987) studied the effects of manipulating establishing operations to influence manding in individuals with intellectual disabilities. Hall and Sundberg determined that direct training procedures are needed to teach manding and facilitate generalization of manding. The researchers developed a training protocol in which the experimenter manipulated the situation by using (EOs) to evoke mand responses. Two deaf students diagnosed with severe mental impairment were recruited for the study. Each student was trained on different tasks that consisted of two or more
steps. Each subject was assessed to determine if they demonstrated the skill to name the
different items relevant to completing each activity, thus ensuring they had the sufficient
verbal capacity to provide appropriate labels with future mands. Once the individuals
demonstrated acquisition of the multi-step activities, one item was intentionally removed
from the view of the student (EO), occasioning the student to mand for the missing item.
Results showed manding can be evoked through systematic training; both individuals
increased their manding skills from pre-training to post-training. These results suggest
two important ideas. The first is that establishing operations can be created by training
verbally capable individuals to learn multi-component tasks, exposing them to the
terminal reinforcers. Second, once the tasks are established, the removal or absence of a
component may evoke a manding response from the individual. These findings proved
valuable in applying Skinner’s verbal behavior to clinical settings and in demonstrating
that, with careful planning, manding can be trained.

Sundberg et al. (2002) extended the work of Hall and Sundberg (1987) to examine
whether manding for information could be trained in verbally capable individuals with
ASD. The researchers operationalized manding for information as using “wh” questions
(e.g., what, who, where, when) to gain access to a preferred item. Participants were first
trained using an imitative prompt (called an echoic) which was later faded out after
successful sessions. The participants demonstrated the ability to mand for information
regarding familiar items (items with which they were trained) and for novel items (items
with which they were not trained) without echoic or imitative prompts.
In a study relevant to the current investigation, Lechago et al. (2010) combined the methodology of the previous two studies to examine the ability of children diagnosed with ASD to mand for information during a multi-component task. Three male children were recruited for the study. Testing confirmed that the three participants had higher functioning ASD and were verbally capable. Tasks used in the study were the construction of a baking soda volcano, making flavored milk, completing a table setting, solving a puzzle, spoon-feeding a baby doll, and controlling a remote-control truck. Training was terminated once a child demonstrated the ability to complete each task independently. Marding tests were conducted using an interrupted-behavior-chain. Experimenters required an echoic response from the participants in response to vocal-verbal prompts. A spoon served as the common stimulus removed from each task, and the children were trained to mand when the spoon was needed. Once a child demonstrated the ability to consistently and accurately mand for the spoon in one task, a generalization procedure was conducted by introducing other tasks requiring the spoon. The remote-control truck and puzzle task served as control conditions, requiring the child to mand for non-spoon items. The results showed each child improved in their ability to mand across activities. Not only were the participants able to mand for the spoon (the missing item in three of the tasks), but the children also manded for missing control items (the missing puzzle piece or truck). The findings suggest children with limited or delayed verbal repertoires can learn and generalize mands for items across a variety of tasks and stimuli.

The previous studies on manding employing different establishing operations to evoke a response (Hall & Sundberg, 1987; Lechago et al., 2010; Sundberg et al., 2002)
demonstrate that children with ASD can successfully learn to mand. However, the training in each study was always conducted with an adult trainer. Since peer interaction is a goal for individuals with ASD, it is imperative these children generalize these skills in the presence of a peer. Furthermore, peer-mediated intervention is considered best evidence-based practice for achieving age appropriate social skills (Flynn & Healy, 2012).

**Peer-mediated Mand Training**

Taylor et al. (2005) examined whether the manipulation of establishing operations can evoke manding-based interactions from one child with ASD to a peer also diagnosed with ASD. Three male children, ranging in age from 4 – 12 years old, participated in the study; each child had a formal diagnosis of ASD. Food presentation and consumption acted as the stimulus and reinforcer, respectively. A pre-treatment assessment occurred prior to the experimental condition to verify each target child could mand for snacks. For this study, the children were seated across from one another at a table. The study included three conditions: no establishing operation, establishing operation with a peer, and establishing operation with the adult. In the no establishing operation condition, each child (target child and peer) had a plate of food placed directly in front of them and were allowed to eat once the experimenter said, “Have a snack.” In the establishing operation with peer condition, the peer had a plate of food placed in front of him or her, while the target child did not. Access to the food was contingent upon the target child’s verbal request for the snack item. The establishing operation with the adult condition was similar to the peer condition except the adult also performed a prompt procedure after
failed attempts. The adult condition served to boost the target child’s mand responses. Generalization probes were intermittently introduced in the form of a novel peer, novel food item, or novel toy. The findings suggested that children demonstrated the ability to mand in the presence of a peer, and were able to generalize the skill from adult to peers. However, the transfer of control of manding from adult to peer required an additional systematic transfer of training condition as none of the participants demonstrated this ability until after the establishing operation with the adult condition.

Pellecchia and Hineline (2007) further examined this transfer of control from adult to peer—the peer was also diagnosed with ASD. The experimenters attempted to demonstrate a systematic transfer of control using four conditions. The conditions consisted of mands with an adult instructor, mands with a parent, mands with a sibling, and mands with a peer diagnosed with ASD. The adult, parents, and siblings were trained on the stimuli and prompt delivery procedures. The peer, however, was trained only to present the reinforcer. Target children moved on to the subsequent condition after demonstrating 75% mastery on two consecutive sessions at each level. Items used as reinforcers consisted of preferred edibles and tangibles, accompanied by social praise. Results showed the target children were less able to generalize mands toward siblings and peers.

**Current Study**

The goal of the current study is to determine whether manding, taught by an adult, will transfer to a trained peer who facilitates the interaction. Successful transfer-of-control over manding from adult to peer will be further tested with a second
generalization test with a novel, unfamiliar peer. Failure to obtain a transfer of stimulus control from an adult to the peer will result in explicit mand re-training with the peer, followed by a generalization test with a novel peer. The question of interest for the current study is to ascertain whether children diagnosed with ASD can learn to mand for experimental and non-experimental items and whether that skill will generalize to a novel, unfamiliar peers. This extends previous research (Hall & Sundberg, 1987; Lechago et al., 2010; Pellecchia & Hineline, 2007; Sundberg et al., 2002; Taylor et al., 2005) with additional manipulations in mand prompting (e.g., least intrusive to most intrusive prompting), a transfer of control from adult to peer condition, and a generalization probe to assess generalization to a novel peer.
CHAPTER III

METHODS

Participants

The current study recruited child participants from two discrete categories: children with ASD, and child peers that were typically developing. For clarification purposes, the target child with ASD will be referred to as the learner, the adult (primary investigator) used to teach the learners will be referred to as adult teacher. Peers will be referred to as untrained peer (before the peer was trained to facilitate manding), peer trainers (after receiving formal training to facilitate manding), or novel peer trainers (during the generalization probe).

Learners

Four children were recruited as learners for the study: Brett, Margot, Paul, and Rikki. The children were recruited from Therapeutic PATHWAYS located in Modesto, CA. The program provides early intensive behavior therapy (EIBT) intervention for children with intellectual impairments. Informed consent was obtained in writing from the guardians of the learners before assessment and participation in the study. Ongoing assent from the learners and peers was obtained prior to and during all relevant phases of the study.

Rikki. Rikki was a 7-year-old girl diagnosed with ASD. Based on the Vineland Adaptive Behavior Scales, 2nd Edition (VABS-II) (Sparrow, Cicchetti, & Balla, 2005), Rikki scored in the below average range for communication and socialization. She demonstrated poor attending skills during structured and unstructured activities. Rikki did
verbally communicate her needs to adults if she was unable to access items independently (i.e., she tried to perform tasks by herself but would request assistance when she was unable to complete the task); however, she did not use mands. Regarding peer interactions, Rikki engaged in parallel play but no associative or interactive play. At the time of the study, she was receiving ABA 15 hours per week.

**Brett.** Brett was a 5-year-old male. He was diagnosed with mild-to-moderate symptoms of ASD based on the *Childhood Autism Rating Scale, 2nd Edition (CARS-2)* (Schopler & Van Bourgondien, 2010). On the *Autism Diagnostic Observation Scale, 2nd Edition (ADOS-2), Module 2* (Lord et al., 2012), he was diagnosed as demonstrating symptoms of ASD in the high range. Brett verbally communicated his needs with familiar adults. Play with peers consisted mainly of associative play, responding to social bids but not initiating them. During the time of the study, he was receiving ABA services 40 hours per week.

**Margot.** Margot was a 4-year-old female diagnosed with ASD. On the * Adaptive Behavior Assessment System, 2nd Edition, (ABAS-II)* (Harrison & Oakland, 2003), Margot scored in the extremely low average range for the adaptive functioning skills. She communicated verbally her needs with adults (e.g., hunger, toy preferences) when asked, but did not initiate mands. Her peer interactions consisted of parallel and associative play, with interactions composed mainly of imitation of the peers’ actions and words (i.e., echolalia). She did respond to peers’ social bids, but did not initiate social requests. At the time of the study, Margot received ABA services 40 hours per week.
Paul. Paul was a 5-year-old male with a diagnosis of ASD. On the VABS-II (Sparrow et al., 2005), Paul scored in the moderately low range in the socialization domain and the adaptive behavior composite. For the Gilliam Autism Rating Scale, 2nd Edition (GARS-2) (Gilliam, 2006), Paul scored in the very likely range for ASD. Regarding peer interactions, Paul engaged in associative play, responding to peers’ social requests, but did not use manding. At the time of the study, Paul received ABA services 40 hours per week.

Selection Criteria for Learners

Each learner was required to demonstrate fluency across several domains, including attending, motor imitation, echoic behavior, and vocal naming, all under direct instruction. Attending was defined as the ability to reference and interact with stimuli within their environment. Motor imitation was defined as an individual’s ability to mimic the actions of others in the environment. Echoic behavior is similar to motor imitation except it requires the individual to produce verbalizations matching that of the speaker (e.g. “repeat after me”). Vocal manding is the ability to use vocalizations (i.e., spoken words) to label items in the environment. Task completion was defined as a learner’s ability to complete task chains accurately. Each learner’s skill level was ascertained from multiple sources: clinical staff report, levels demonstrated from previous standardized assessments, and the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP) (Sundburg, 2008).

The purpose of the VB-MAPP was to assess an individual’s verbal skills according to different developmental milestones. The VB-MAPP was performed to
determine each learner’s current skill repertoire as it pertained to skills needed to participate in the study. Milestone Level 2 (18-30 months) was identified by the primary investigator as the level which assessed the verbal behaviors needed to qualify for the study. Milestones that the learners needed already be proficient (a score of 1) were tacts, listening and responding, and independent play. Milestones that each learner needed to demonstrate a skill deficit (a score of zero) on were mands and social behavior and social play. Milestones scoring consisted of two possible responses, 0 meaning the learner does not demonstrate the skill and 1 meaning the learner demonstrates the skill. The milestone assessment criterion was based on three different criterion scores for mands, social behavior and play, and prerequisite skills (tacts, listening and responding, and independent play). First, mands needed to be at least .25 or higher. The reason for allowing a higher score is that the milestone assessment for mands did not examine mands with peers so a higher score was acceptable; however, a minimal level of manding needed to be present with adults thus a minimum score of .25 was selected. Second, for the domain of social behavior and play, a lower score of .25 or less was necessary as it was important that the learners played in the same setting of the peers but not mand from them. The final milestone assessment criterion encompassed three different domains: tacts, listening and respond, and independent play. These domains were selected as prerequisite skills in which the learner needed to demonstrate without any additional teaching during the study. For each of these prerequisite skills, the learners needed to exhibit an average score of .8 or higher to be included in the study.
In addition to the milestone assessment, the *VB-MAPP* included a barrier assessment. The barrier assessment portion examined behaviors that may compete with learning thus inhibiting the learner to acquire new skills—i.e., barriers to learning. For the barrier assessment, scores range from 0 to 4, with 0 meaning the learner does not exhibit a barrier behavior and 4 meaning the learner exhibits strong barriers to learning.

Participation criterion for inclusion in the study were based on scores from the milestone assessment and barrier assessment. For criterion of inclusion to participate, the learners needed to exhibit an average score—average across 21 skill domains—of two or lower. According to the *VB-MAPP*, a score of two represented moderate problem behaviors. Any average score higher than two would result in exclusion from the study.

The information obtained was used to assess suitability for the current study. In addition to the aforementioned criterion, children that communicated via non-vocally (e.g., gesture, ASL, etc.) were excluded from the present study.

**Peers**

Four typically developing children were recruited to serve as peer trainers and novel peers. These peers were Gabby (6), Devon (7), Lexie (11), and Teagan (6). It must be noted that Gabby and Devon were siblings living in the same home. None of the recruited peers were members of the immediate or extended family of the learners. Peers were between the ages of 6-12, consistent with previous child-to-child training studies (Abramovitch, Corter, Pepler, & Stanhope, 1986; Jones & Schwartz, 2005; Kamps et al., 2002; Owen-DeSchryver et al., 2008; Taylor et al., 2004). Peers were recruited from the Modesto, California area. Postings were placed at Therapeutic PATHWAYS. Informed
consent was obtained in writing from all parents prior to any child being included in the study.

**Participation Criteria for Peers.** For purposes of this study, learners and potential peer trainers underwent an informal assessment as part of a play session with an adult to verify they demonstrate the ability to follow simple instructions. In addition, peers were observed on their capacity to follow simple directions with the absence of refusals or disruptive behaviors. Refusals and disruptive behaviors included turning away from the adult, throwing or pushing items or people, walking away, aggression to self or others, performing an action not relevant to the request, and verbal statements (e.g., “This is stupid”, “I don’t want to.”, “No”, and “Why do I have to do this?”). Study inclusion criterion for the peers consisted of no more than one redirect (e.g., the investigator having to re-present of the original instruction) on no more than three occasions.

**Experimental Setting**

The investigation was conducted at Therapeutic PATHWAYS. The location was suitable since learners were already present, there was access to a variety of toys, and the facility possessed the needed space to run the study. Due to limited availability, sessions were conducted in three different rooms; however, each room allowed a door to be shut to limit distractions.

**Target Response: Manding**

The current study required each learner to use vocal, verbal language to produce a pure mand for missing items necessary for the completion of the activity. The adult teacher (or peer trainer) made access to the missing item available contingent upon the
learner’s ability to request accurately for each item using a pure mand. According to Skinner (1957), a pure mand possesses additional words such as “Want”, “Need”, “Where”, “Please”, or “Who has”, combined with the name of desired item (e.g., “Need cup”, “Where cup?”, “Cup, please”, etc.). For the present study, mands that lack these critical elements (e.g., “need”, “want”) were considered incorrect. Additionally, pure mands exhibited for items or activities not relevant to the current step in the activity (e.g., “I want volcano blow up”) were considered incorrect. These requirements were meant to avoid any ambiguities that may arise in identifying a single response as a correct mand for the relevant item, or from non-task related manding. To evoke a pure mand from the learner, the adult teacher (or peer trainer) withheld one item essential to completing the task—specifically the spoon.

Materials

The current study builds upon work of Lechago et al. (2010), thus similar activities were used. The activities used were a volcano (requiring baking soda, food coloring, vinegar, squeeze bottles, and a plastic spoon), spoon catapult (requiring popsicle sticks, rubber bands, lint ball, and a plastic spoon), ice cream sundaes (requiring ice cream, syrup, sprinkles, a small paper cup, and a plastic spoon), a flavored drink (requiring a small paper cup, drink mix, water or milk, and plastic spoon). The spoon was essential to complete each activity, thus it alone was withheld from the learner to evoke pure mands. All items necessary for completing the activity were available for the learner and peer to use, with the spoon randomly withheld during pre-determined trials (i.e., trials that were randomly selected as spoon/non-spoon trials prior to the training session).
This procedure of presenting the spoon during random trials was designed to account for over-generalization of manding for the spoon even if the spoon was present. It was necessary for the study that the learner demonstrates the skill of identifying that the spoon was missing to mand for it, and was not under stimulus control of other stimuli. In addition, data coders scored over-generalization if the learner manded for a spoon with other unrelated activities during the baseline phases.

**Equipment**

A Canon™ digital camera with video captioning capabilities was used for this study. It was placed in front of the participants. The camera captured video during all phases of the study, both baseline and training. During the duration of the study, the camera was only used for the study and for no other purposes. The primary investigator was responsible for setting up the camera before sessions and storing the camera in a locked drawer after the sessions.

**Pre-Experimental Training**

**Tact Training and Task Completion Training**

This initial phase served two functions: to assess and train the learners to name the spoon, and to train the learner and the peer trainers to complete the experimental activities. Training sessions lasted no more than 30 minutes. If the learner did not meet the task mastery criteria by the end of the 30-minute training session, the training session was reintroduced on the next day that the child was available. This occurred only once, with Margot.
**Tact Training with the Learner.** The learner was placed in a room with the adult teacher to assess and, if necessary, train tacting for the spoon. The adult teacher held up the spoon and said: “What is it?” If the learner failed to respond within 5 seconds after the discriminative stimulus (SD), the adult trainer named the object (i.e. a full model tact). If the learner failed to imitate within the 5 seconds after the prompt, the adult teacher says “Let’s try again,” the item was hidden from site to start another trial. This phase was terminated once the learner produced a correct tact for the spoon on two consecutive trials.

**Task Completion Training.** The purpose of task completion training was to ensure that both the learners and peer trainers are capable of completing the experimental activities. The children were trained individually. The adult teacher began by describing and modeling the target activity in a systematic manner. The child was then asked to repeat those steps. A total-task chaining procedure was used. Total-task training is the presentation of all steps included in a task with social reinforcement occurring after each step. For the learner, each activity was presented twice with the adult prompting each step before the learner was allowed the opportunity to independently complete each step in the chain. With the peer trainers, the activity was presented once before they are allowed the opportunity to independently complete each step in the chain. Assistance was only provided if the child failed to complete any given step. Gestural and physical prompting was used to assist the learner in completing the task. Different criteria were used for learners and peer trainers regarding successful task completion. For the learners, independent task completion score (e.g. no assistance from the adult teacher) had to be
80% or better on two consecutive trials per each activity. For the peer trainers, independent task completion score (e.g. no assistance from the adult teacher) had to be 100% or better on two consecutive trials per each activity.

**Experimental Phases**

There was a total of eight possible experimental phases in the current study:

- Phase I: Baseline 1 with a untrained peer
- Phase II: Mand training with an adult teacher
- Phase III: Baseline 2 with a untrained peer
- Phase IV: Mand facilitation training between adult teacher and peer trainer
- Phase V: Baseline 3 with peer trainer
- Phase VI: Transfer of manding control from adult teacher to peer trainer
- Phase VII: Baseline 4 with a peer trainer
- Phase VIII: Generalization probe to a novel peer trainer

To ensure a smooth transition from one phase to the next, phase completion depended on the learner achieving a mastery criterion (e.g. 100% appropriate manding on two consecutive trials). Failure to achieve the criterion set for any particular phase resulted in the learner repeating that phase until mastery criteria were achieved.

Training sessions lasted no more than 30 minutes. Participants earned access to non-experimental toys after training trials. Another observer watched recorded videos of the training sessions to assess treatment integrity. Treatment integrity was assessed for 30% of the videos. For the baseline phases, a Mean Count-per-Interval procedure was
used to determine inter-observer agreement (IOA) between the primary investigator and research assistant. IOA was collected on 30% of the recorded interactions. Baseline phase data collected included 1) mands (a.k.a., pure mands), 2) other verbal interactions with peer (i.e., other verbal behavior, 3) incorrect verbal interactions, and 4) over-generalizations.

**Phase I: Baseline 1 with untrained peer**

Once the learner demonstrated the ability to name and complete the tasks in the presence of an adult teacher, their level of manding was assessed with a untrained peer. The learner and untrained peer sat side by side at a table where activities were presented by the adult trainer. This introduction of the children together was the first exposure the learner and the untrained peer had with one another within the parameters of the current study. The untrained peer received minimal instructions to play with the learner, and no formal mand facilitation training. The adult teacher did provide social facilitation to either participant once the play session begins (e.g., prompting, social enforcement). If either child addressed or approached the adults in the room, they were instructed to finish their activity. The learner and untrained peer had access to both experimental activities (i.e., activities used during training phases) and non-experimental activities. Non-experimental activities included toy planes, marble rollercoaster, crafts, and age-appropriate board games. The children gained access to the activities through a limited choice of both the experimental activities and non-experimental activities. The limited choice was defined as providing the children only two options of activities to choose from at one time. The purpose of this procedure was to ensure the children access each
activity. In the case where the children did not choose one of the limited choices, the adult presented two different activities from which the children chose. If the children did not select any of the experimental activities, the adult selected one for them. The children were told to finish the experimental activity before they could have access to the non-experimental activity. The purpose of sequencing the experimental activity before the non-experimental activity was to: 1) promote learner and untrained peer interaction by limiting activities, 2) build motivation to complete activities, and 3) counteract satiation. The process of limited choice and activity complete was repeated until each experimental activity had been completed at least once or offered at least twice—the children may not want to do all the experimental activities, so they were only presented twice.

**Phase II: Mand training with adult teacher**

In Phase II, a total-task chaining procedure was employed to teach the learner to mand. All items necessary for completing the activity were available for the learner to use, with the spoon randomly withheld during pre-determined trials. Again, this procedure of presenting and withholding the spoon during random trials was to test for over-generalization of manding for the spoon even when the spoon was present. Once the adult placed the activity items in front of the learner, the adult gained the learner’s attention by saying their name and then says “Let’s make (task completion activity name).” This placement of items and verbal instruction signaled to the learner a response was now required. The correct response (or pure mand) could be emitted at any step in the task until the step where the spoon was required. If the learner did not mand before the spoon-required step, then the learner was required to mand for the missing spoon
within 5 seconds after reaching the step in order to be considered an unprompted response (Jones & Schwarts, 2004; Lechago et al., 2010; McGee, Krantz, Mason, & McClannahan, 1983). If the learner provided a pure mand (e.g. “need spoon”, or “want spoon”, or “spoon please”) before or within 5 seconds of the step where the spoon is required, the adult teacher handed the spoon to the learner accompanied by social praise, and the activity continued.

If the learner failed to respond within 5 seconds after reaching the step where the spoon was required, the adult teacher then held the spoon up in the learner’s visual field to serve as a gestural prompt to the learner. If the learner failed to produce the pure mand within the 5 seconds after the gestural prompt, the adult teacher modeled the correct response (e.g., “want spoon”). The learner was then required to imitate the correct response, or the adult teacher would say, “Let’s try again” and set up for the next trial. If the learner failed on two consecutive trials, the adult teacher moved on to another task. The adult teacher returned to the failed activity once the learner had exposure to each subsequent task completion activity. This phase was terminated once the learner produced a pure mand—unprompted or prompted—for the spoon on two consecutive trials across two different activities. In addition, an over-generalization check was performed to ensure the learner did not mand for the spoon from the adult and/or peer when the spoon was already available to them—i.e., the learner only manded for the spoon when the spoon was missing or in the possession of the adult or peer. The learner had to demonstrate at least one successful over-generalization check before proceeding to the next phase.
Phase III: Baseline 2 with untrained peer

Once the learner demonstrated the ability produce a pure mand in the presence of the adult teacher, the learner’s level of manding with the same untrained peer was ascertained by placing them back together. This phase was the second exposure the learner and untrained peer had with one another within the parameters of the current study. Again, the untrained peer received minimal instructions to play with the learner, and no formal mand facilitation training. This time, the adult teacher did not provide social facilitation to either participant once the play session begins (e.g., prompting, social reinforcement). If either child approached or addressed the adults in the room, they were instructed to complete the activity. The learner and untrained peer had access to both experimental activities (i.e., activities used during training phases) and non-experimental activities (e.g., toy planes, marble rollercoaster, crafts, and age-appropriate board games). Procedures in this phase duplicated those in Phase I.

Phase IV: Mand facilitation training between adult trainer and peer trainer

In Phase IV, the peer from baseline 1 and 2 was trained how to facilitate the presence of the spoon. This training was performed by using a Behavioral Skills Training (BST) method. The adult teacher 1) described the skill of facilitating social interactions within the context of the activities; 2) explained why it would be important for them, the peer trainer, to facilitate the activities; 3) model how to facilitate the activities; and 4) had the peer trainer practice how to facilitate the activities across various scenarios (e.g., the learner producing a pure mand with or without a prompt, partial mands with or without a prompt, unrelated responses, and no responses). Feedback to the peer trainer was
provided during the training. Termination of this phase was contingent upon the peer independently withholding and presenting the spoon with 100% accuracy on two consecutive trials for each activity. This criterion was more stringent for this phase as it was paramount that the peer trainer demonstrates the skill to facilitate activities for manding with the learner.

**Phase V: Baseline 3 with peer trainer**

Once the peer trainer demonstrated the ability to elicit manding in the presence of the adult, the peer trainer and learner were placed back into the baseline setting. This phase was the third exposure the learner and peer trainer had with one another within the parameters of the current study. Phase V differed from the previous baselines, in that, the peer trainer had formal training on how to elicit a mand from the learner. Baseline 3 was a check to determine whether peer training alone is sufficient for the learner to mand in the presence of a peer. The remainder of the procedure duplicated those in Phases I and III.

**Phase VI: Transfer of manding control from adult to peer trainer**

During the transfer of control phase, the adult teacher remained seated behind the peer trainer, with peer trainer between the adult teacher and learner. Again, the purpose of this positioning allowed for an optimal learner and peer interactions, while allowing the adult teacher to intercede when necessary without positioning himself as the primary facilitator of the interaction. The adult teacher whispered prompts to the peer to provide guidance on how to present or restrict item access contingent upon the learner’s mands. This prompt style functioned such that all direct instructions and interactions would come
from the peer trainer—not the adult teacher. These prompts occurred during both experimental and non-experimental activities. As with the previous phase, the adult teacher provided least-to-most intrusive prompting while supervising the social interaction. If the learner did require more intrusive prompting (i.e., direct prompts from the adult teacher to the learner), the adult teacher repositioned himself on the other side of the table in front of the learner and peer trainer and provided instructions to both participants to complete the task in order move on to another activity. Data collection occurred during test and non-test activities to ascertain if mands for items generalize across activities. Criterion to proceed to Phase VII (Baseline 4) required the learner to produce a pure mand—unprompted or prompted—for the spoon and directed to the peer trainer on two consecutive trials across two different activities. If the learner failed to meet this criterion by end of the session with the peer trainer, the learner returned to repeat Phase II with the adult teacher to receive additional manding practice. The learner then returned to Phase VI with the peer trainer. For learners that did not demonstrate a transfer of control from the adult to the peer and demonstrated difficulty to mand with the adult during the re-introduction of mand training with the adult teacher (Phase II), their participation within the study was terminated.

**Phase VII: Baseline 4 with peer trainer**

Once the learner demonstrated a transfer of manding control from the adult trainer to the peer trainer, the learner and peer trainer were placed back into the baseline setting for another assessment. This phase was the fifth time (sixth in the case of Rikki) that the learner and peer trainer were together within the parameters of the current study. Baseline
4 was to determine if the learner would mand in the presence of a peer in a more naturalistic setting after the formal transfer of control. This phase differed from previous baseline phases, in that, the learner only proceeded to the next phase—peer generalization phase—if he or she produced a pure mand—unprompted or prompted—in the presence of the peer on 80% of opportunities. If a learner did not demonstrate the skill with a familiar peer trainer on 80% or more of opportunities, there would be no attempt to assess the generalization of the skill with a novel peer.

**Phase VIII: Generalization Probe to Novel Peer Trainer**

Contingent on successful Baseline 4 (Phase VII) performance, a final generalization probe was conducted to determine whether the learner would generalize to an novel peer trainer. The novel peer trainer would have previously mastered completing the same activities and was trained to use the same techniques (i.e., prompting mands), all with a different learner within the study. This was the first exposure the learner had with the novel peer trainer within the parameters of this study. The novel peer trainer was then randomly assigned to a second learner for the generalization probe. During the generalization probe, the level of manding with a novel peer trainer was ascertained again by placing them together in a naturalistic play setting similar to previous baseline phases. The remainder of the procedures duplicated those in Phases I, III, and V.

**Data Collection**

Data collection assessed the learner’s manding performance during baseline phases, treatment integrity across learner and peer trainer training sessions, and interobserver agreement (IOA) data during baseline phases. The main dependent variable
for the study was the percentage of total pure mands—prompted or unprompted—per opportunity. Manding data was separated into three categories: a) unprompted mands for experimental items, b) prompted mands for experimental items, and c) spontaneous, unprompted mands for non-experimental items. The percentage of correct mands was ascertained during each of the subsequent baseline phases, Treatment integrity and IOA data occurred only 30% of training sessions and baseline phases, respectively.

**Manding-based Data Collection**

IOA and treatment integrity was based on video recordings of baseline phases, test phase, and generalization phase. Video recording equipment was present during all phases. Two adults were present in the room with the learner and peer trainers throughout the study—one adult oversaw the interactions between the participants (baseline) and interacted with the children (test phases); the other adult monitored the video equipment and assisted in material preparation. Additional observers reviewed the captured videos retroactively for data collection purposes. Observers took frequency count data on independent mands, prompted mands, other verbal behavior, incorrect responses, and over-generalization.

**Interoobserver Agreement Data Collection**

IOA was assessed using methods previously outlined for use in ABA investigations and interventions (Cooper et al., 2007; Johnston & Pennypacker, 2009). Two individuals served as observers for data collection, the primary investigator served as the primary observer with a trained individual serving as the secondary or IOA observer. The secondary observer was trained on the behavioral definitions of appropriate
task completion and pure manding and trained to take frequency count data. The secondary observer practiced data collection by viewing in-vivo (i.e., videos made by the researcher for purposes of training) scenarios of social interactions and mands. As previously mentioned, a Mean Count-per-interval procedure was used to determine the level of IOA, with video clip intervals lasting five minutes in duration. The secondary observer was assigned 30% of the videos to code. Observers coded video recordings independently to ensure IOA integrity.

**Treatment Integrity**

Treatment integrity is the degree in which the treatment or independent variable was implemented as prescribed in the experimental methodology. Treatment integrity was obtained having a second observer collect data on the implementation of the treatment by the adult teacher to assess whether or not the treatment matches the methodology. For the current study, a second person watched video recordings of training sessions retroactively to assess the treatment integrity. This second observer was trained before starting the study on the operational definitions of each component involved in the training sessions. These components included the independent and dependent variable, what is considered a trial (e.g., stimulus control, discriminative stimulus), prompting procedures, and how the adult teacher should address correct and incorrect responses by the learner. The observer watched 30% of the training videos to assess treatment integrity.
Experimental Design

The current study used a non-concurrent multiple baseline across participants experimental design to assess treatment effectiveness. Multiple baseline designs are based on the same experimental logic as the classic ABA reversal design but are utilized when the target behavior is unlikely to return to baseline levels following the intervention—i.e., unable to “unlearn” the skill. Language skills are good candidates for the multiple baseline approach because once a skill has been acquired, the elimination of arranged reinforcers is unlikely to produce a return to nonverbal or minimally verbal baseline levels due to the presence of natural reinforcers in the child’s environment. For the current study, baseline was identified as being the most appropriate for the context of this study. As stated by Hayes (1981) and Watson and Workman (1981), clinical and applied settings may prove awkward for the use of a traditional (a.k.a., simultaneous or concurrent) multiple baseline design. Difficulties can arise related to participant availability and to ethical concerns regarding prolonged baselines before treatment can be implemented. Under such circumstances, modifications to the traditional design have been proposed that allow data to be collected during non-overlapping or minimally overlapping periods of time (e.g., days, week, months, years).

Both Hayes (1981) and Watson and Workman (1981) each detailed different methodologies in which non-concurrent multiple baselines are implemented. Christ (2007) determined that Watson and Workman’s (1981) method preserved the crucial elements of the traditional multiple baseline design despite possessing a non-concurrent variable. In the Watson and Workman (1981) method, baseline durations were pre-
determined (i.e., a priori), participants are randomly assigned to different predetermined baseline durations, and overlap was not required but may occur depending on the start-date of baseline. In other words, the duration of each baseline was predetermined and increased at equal intervals (i.e., the first baseline lasted one session, the second baseline lasted two sessions, baseline three lasted three sessions, and fourth baseline four lasted sessions). In addition, participants were placed into one of the four baselines by random assignment. The only aspect not controlled was each participants’ start date nor the number of days between sessions. The current study employed the Watson and Workman (1981) method of non-concurrent multiple baseline design to prevent extended baselines. The dependent variable was the percentage of successful pure mands over opportunities to mand for items from a peer during repeated baseline sessions.

**Baseline Logic**

Multiple baseline designs were based on a systematic decision process known as the steady state strategy (Cooper et al., 2007). The foundation of this experimental approach relies on stable behavior patterns under different conditions across several individual participants. This approach consists of predication, verification, and replication. Prediction was established by implementing the treatment to one baseline (i.e. learner) at a time, in a staggered and systematic manner. A change in the first baseline allowed us to predict changes in subsequent baselines contingent upon the implementation of the treatment. Verification occurred when changes in the target response occur after the treatment condition was implemented for each learner. Other ongoing baselines did not exhibit the same changes until the treatment was introduced at
a later point. This staggered treatment onset method verifies treatment efficacy and rules out extraneous variables such as history and maturational variables. Replication is demonstrated when the independent variable is administered to subsequent participants, with different behaviors, or in different settings, and the target responses change only after this administration. With each successful replication of the treatment effect, support was garnered for both treatment efficacy and for external validity (for a detailed review, see Cooper, et al., 2007). As mentioned previously, the current study used a non-concurrent multiple baseline design across persons using the Watson and Workman (1981) method where an a priori criteria was set for baseline duration, and there was randomization of which learner was placed in each baseline.

**Experimental Hypotheses**

There were six experimental hypotheses for the present study:

1. The learners would acquire pure, unprompted manding for the one item consistently used in all task completion activities (i.e. the spoon) only after specific mand training with an adult teacher.

2. The learners would acquire pure, prompted manding for the one item consistently used in all task completion activities (i.e. the spoon) only after specific mand training with an adult teacher.

3. The learners would successfully transfer control of pure, unprompted manding for one item (i.e. the spoon) consistently used in all task completion activities from the adult teacher to a novel, typically developing child (peer trainer) with minimal adult teacher intervention.
4. The learners would successfully transfer control of pure, prompted manding for one item (i.e. the spoon) consistently used in all task completion activities from the adult teacher to a novel, typically developing child (peer trainer) with minimal adult teacher intervention.

5. The learners who acquire manding with the first peer would successfully generalize pure, unprompted manding for one item (i.e. the spoon) consistently used in all task completion activities to a second novel, typically developing child (peer) without adult teacher assistance.

6. The learners who acquire manding with the first peer would successfully generalize pure, prompted manding for one item (i.e. the spoon) consistently used in all task completion activities to a second novel, typically developing child (peer) without adult teacher assistance.
CHAPTER IV

RESULTS

*VB-MAPP Assessment*

Tables 1 and 2 display the results of the *VB-MAPP* assessment. The table shows the mean score for each subtest including milestones and barriers. The learners’ scores on the milestones (as seen in Table 1) scored within acceptable limits to be included within the study. Although each learner scored high on the barriers assessment (Table 2), these behaviors did not impede the primary investigator from completing the milestone assessments.

Table 1

*VB-MAPP Milestones Level 2: Average Score for Each Domain*

<table>
<thead>
<tr>
<th>Subtests</th>
<th>Rikki</th>
<th>Brett</th>
<th>Margot</th>
<th>Paul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mands(^\text{A})</td>
<td>0.3</td>
<td>0.6</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Tacts(^\text{B})</td>
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<td>1.0</td>
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<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Independent play(^\text{B})</td>
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<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Social behavior and play(^\text{C})</td>
<td>0.0</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
</tbody>
</table>

*Note:* 1 denotes the learner demonstrated the skill and 0 denotes the learner did not demonstrate the skill.

\(^\text{A}\) For the Mand milestone, the only criterion was the learner needed to emit minimal manding skills with adults, which was an average score of \(\leq 0.25\). A lower score was acceptable because the learners would each undergo mand training with the adult.

\(^\text{B}\) Represents domains in which an average score of \(\geq 0.8\) or higher was necessary for inclusion.

\(^\text{C}\) For the Social Behavior and Play milestone, an average score of \(\leq 0.25\) or lower was required for inclusion.
Table 2

**VB-MAPP Barriers Assessment**

<table>
<thead>
<tr>
<th></th>
<th>Rikki&lt;sup&gt;B&lt;/sup&gt;</th>
<th>Brett</th>
<th>Margot</th>
<th>Paul</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVG score&lt;sup&gt;A&lt;/sup&gt;</td>
<td>1.4</td>
<td>0.2</td>
<td>0.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Range of scores</td>
<td>0-4</td>
<td>0-2</td>
<td>0-2</td>
<td>0-2</td>
</tr>
<tr>
<td>Median</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*Note:* 0 denotes the learner exhibited no barriers to learning, and 4 means the learner exhibited severe barriers to learning. The criterion for inclusion in the study was an average score no higher than score of 2. A score of 2 on the VB-MAPP is categorized as a Moderate Problem barrier.

<sup>A</sup> Average score across 21 different barriers

<sup>B</sup> Rikki demonstrated individual barrier scores above 2 on Impaired Social Skills (4), Response Requirements Weaken the MO (3), and Failure to Make Eye Contact (4)

**General Results**

Figures 1-3 show the results of learners’ manding for missing items from peers. Paul’s data is not included in Figures 1-3 as his participation was terminated for not achieving minimal performance criteria, which will be discussed in detail below. The learners that did complete the study increased in manding—either prompted or unprompted—for the spoon from their peers, with 2 out of the 3 generalizing the skill to a novel peer.

Figure 1 shows the percentage of opportunities to spontaneously mand (i.e., the step in the task when the spoon was necessary to complete the activity) that produced unprompted mands for the spoon during baseline sessions. One of the three learners (Brett) demonstrated a steady increase in unprompted mands for the spoon. Figure 2 shows the percentage of prompted opportunities to mand that produced a mand for the spoon in response to the prompt during baseline sessions. Two of the three learners
(Rikki and Margot) produced mands for the spoon in response to prompts after peer trainers completed prompt facilitation training with the adult teacher.

Figure 3 shows the percentage of opportunities to spontaneously mand for non-experimental items (e.g. marbles, markers, scissors, etc.) that produced unprompted mands during the baseline sessions. Rikki did not mand for non-experimental items until the generalization session. Brett and Margot had initially manded for non-experimental items during BL1. Brett continued to do so during the subsequent baseline conditions, with a high of 100% in BL4. However, during Generalization, Brett’s unprompted mands decreased to 0%. Margot did not produce additional unprompted mands for non-experimental items after the initial baseline until the generalization phase when spontaneous manding for such items increased to 100%.

**Individual Results**

Table 3 shows the number of training sessions each learner had to complete in order to reach criterion to proceed through each phase for each learner. Paul did not complete the study since his scores did not reach criterion after RT2. Figures 4-7 show all experimental phases—both BL and training phases—for each of the four learners. Please note that non-experimental items were not trained (i.e., the learners were only trained on the activities requiring the spoon), thus data on unprompted mands for non-experimental items are not presented in Figures 4-7. In addition, note that in Figures 4-7, there is no T2 (Phase IV: mand facilitation training with adult teacher and peer trainer) condition because T2 was the training condition for peer trainers only; participants did not take part in the T2 training sessions, only BL3 which followed T2.
Figure 1. Percentage of total unprompted mands per opportunities for the spoon during baseline sessions. Paul was not included on this graph since he did not meet criteria to complete the study. Baselines are represented by BL1, BL2, BL3, and BL4.
Figure 2. Percentage of total prompted mands per opportunities for the spoon during baseline sessions. Baselines 1 and 2 were not included as the peers were not trained to prompt until Baseline 3. For each learner, the session number in which Baseline 3 started is presented on the graph. For Brett, no prompted in illustrated for Baseline 4 because all of his mands were unprompted, which is represented by a N/A. Paul was not included on this graph since he did not meet criteria to complete the study. Baselines are represented by BL3 and BL4.
Figure 3. Percentage of total unprompted mands per scheduled opportunities for non-experimental items during baseline sessions. Paul was not included on this graph since he did not meet criteria to complete the study. Baselines are represented by BL1, BL2, BL3, and BL4.
Table 3

*Number of Training Sessions Required to Reach Criterion*

<table>
<thead>
<tr>
<th></th>
<th>Rikki</th>
<th>Brett</th>
<th>Margot</th>
<th>Paul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase II: mand training with adult teacher</td>
<td>1(1)</td>
<td>1(-)</td>
<td>2(-)</td>
<td>1(1)</td>
</tr>
<tr>
<td>Phase VI: transfer of mand control</td>
<td>1(1)</td>
<td>1(-)</td>
<td>1(-)</td>
<td>1(-)</td>
</tr>
</tbody>
</table>

*Note:* Numbers outside of the parentheses denote the initial training sessions. Numbers inside of the parentheses denote retrainings due to a failure to meet criterion to proceed to Baseline 4. Parenthesis containing a hyphen (-) denote that no retrainings occurred.

**Rikki**

The study (BL1) started for Rikki on May 17, with her participation concluding on June 27. Rikki participated in the study the longest, although she had only nine sessions. Her baseline sessions were typically one week apart, with the longest delay being nine days. Figure 4 shows the number of prompted and unprompted mands for the spoon during each of the trainings compared with prompted and unprompted mands for the spoon during each subsequent return to baseline.

Figure 4 illustrates the data for Rikki across the nine experimental conditions. The figure illustrates the number of prompted and unprompted mands for the spoon during each of the trainings compared with prompted and unprompted mands for the spoon during each subsequent return to baseline. In BL1, Rikki did not produce any unprompted mands for either the spoon or non-experimental items. During mand training with the adult teacher (T1), both unprompted and prompted mands for the spoon increased from BL1. After returning to baseline (BL2), Rikki continued to produce unprompted mands for the spoon, albeit at a decreased percentage when compared to T1 scores (i.e., she
Figure 4. Rikki’s percentage of total mands for the spoon, both unprompted and prompted, across all baseline and training sessions. Training session 2 is omitted from the graph, as it was peer training only. Baselines are represented by BL1, BL2, BL3, and BL4. T1 denotes mand training with the adult teacher; T3 denotes transfer of manding from adult teacher to peer trainer; RT1 denotes retraining of mand training with the adult teacher; RT3 denotes retraining of the transfer of control from adult teacher to peer trainer; and Gen denotes peer generalization.

decreased from 75% in T1 to 50% in BL3). Peer training (T3) occurred during the week immediately following BL2, thus BL3 occurred exactly one week from BL2. Following the peer training phase (T3), Rikki’s unprompted and prompted mands for the spoon both dropped to 0%. During the transfer of training phase (T3), prompted mands for the spoon increased to 50%. However, Rikki did not meet the minimum criterion to proceed BL4. Criterion to proceed to BL4 required the learner to produce a mand—unprompted or prompted—for the spoon on two consecutive trials across two different activities. After the reintroduction of manding training with the adult teacher (RT1), Rikki’s scores for unprompted and prompted mands for the spoon increase during the second transfer of control training (RT3) to 45% and 83%, respectively. Although prompted mands for the
spoon show a downward trajectory after the transfer of control training, the scores never dropped to 0%. Prompted mands for the spoon remained at an elevated level during Baseline 4 and generalization to a novel peer, 100% and 67%, respectively. Furthermore, Figure 3 shows Rikki began to mand for non-experimental items during the generalization phase, a response she had not demonstrated previously.

**Brett**

Brett began BL1 on May 18, with his participation concluding on June 10. His baseline sessions ranged from 2 to 3 days apart. Due to availability and responding during sessions, Brett progressed rapidly through the study. Table 3 shows the number of training sessions required Brett to meet criterion; he only required one exposure to both manding training with the adult teacher (T1) and transfer of control training (T3).

Figure 5 shows the data for Brett across seven experimental conditions. The figure illustrates the number of prompted and unprompted mands for the spoon during each of the trainings compared with prompted and unprompted mands for the spoon during each subsequent return to baseline. Initially, Brett produced unprompted mands for the spoon on 33% of opportunities during session 1 of BL1; however, his manding dropped to 0% by session 2 of BL1. Brett’s unprompted and prompted mands increased during mand training (44% and 50%, respectively) with the adult teacher (T1). However, unprompted mands returned to 0% during BL2. During BL3, after peer training was complete, Brett’s unprompted mands for the spoon increased to 50%, while he did not mand for the spoon during any prompted opportunities. However, prompted mands for the spoon increased to 100% during the transfer of control training phase (T3). During
BL4, both unprompted mands for the spoon and non-experimental items (see Figure 3) increased to 100%. In fact, there were no prompted opportunities for the spoon because Brett manded for the spoon each unprompted opportunity, thus not needing a prompt. During the generalization to a novel peer phase, all responding with the peer diminished to 0% for unprompted and prompted mands for the spoon, and unprompted mands for non-experimental items (see Figure 3).

![Figure 5. Brett’s percentage of total mands for the spoon, both unprompted and prompted, across all baseline and training sessions. Training session 2 is omitted from the graph as it was peer training only. Baselines are represented by BL1, BL2, BL3, and BL4. T1 denotes mand training with the adult teacher; T3 denotes transfer of manding from adult teacher to peer trainer; and Gen denotes peer generalization. During BL4, Brett produced unprompted mands for the spoon 100% so there was no need or opportunities for prompted mands.](image)

**Margot**

Margot began BL1 on May 19, and her participation concluded on June 27. Baseline sessions ranged from one day apart to a week apart. Margot had the most sessions within the study (n=11). Table 3 illustrates the number of training sessions
required for Margot to meet criterion, which were two consecutive sessions of mand training with the adult teacher (T1) and one session of the transfer of control training (T3).

Figure 6 illustrates the number of prompted and unprompted mands for the spoon during baselines and trainings for each of the seven phases of the study. Margot’s unprompted responses for the spoon occurred at 0% of opportunities during BL1. However, unprompted mands for non-experimental items started at 33% and decreased to 0%, averaging 35% across four sessions (see Figure 3). Due to low scores during her first exposure to the mand training session with the adult teacher (T1), Margot was required to complete an additional session. Her scores increased from 17% for both unprompted and prompted mands for the spoon to 92% and 100%, respectively. During a return to baseline, unprompted mands for the spoon decreased to 50% but were improved from BL1. After peer training, Margot stopped responding with unprompted mands for the spoon (0%), while increasing in prompted mands (75%) for the spoon. This trend continued through the transfer of control training (T3) and BL4. Although prompted for mands for the spoon decreased to 33% during the generalization phase, she did produce mands in the presence of a novel peer. Furthermore, Margot produced unprompted mands for non-experimental items during the generalization phase 100% of opportunities (see Figure 3). Table 3 illustrates the number of training sessions required for Margot to meet criterion, which were two consecutive sessions of mand training with the adult teacher (T1) and one session of the transfer of control training (T3).
Figure 6. Margot’s percentage of total mands for the spoon, both unprompted and prompted, across all baseline and training sessions. Training session 2 is omitted from the graph as it was peer training only. Baselines are represented by BL1, BL2, BL3, and BL4. T1 denotes mand training with the adult teacher; T3 denotes transfer of manding from adult teacher to peer trainer; RT1 denotes retraining of mand training with the adult teacher; RT3 denotes retraining of the transfer of control from adult teacher to peer trainer; and Gen denotes peer generalization.

Paul

BL1 started for Paul on June 6. Paul’s participation in the study was terminated on June 20, following a week-long vacation from June 13th to June 17th. Baseline sessions ranged from a day apart to a week apart. Table 3 illustrates that Paul required two non-consecutive sessions of mand training with the adult teacher (T1) and one session of the transfer of control training (T3), followed by termination to proceed within the study.

Figure 7 shows the number of prompted and unprompted mands for the spoon during each of the trainings compared with prompted and unprompted mands for the spoon during each subsequent return to baseline. During Baselines 1 and 2, Paul did not produce any unprompted mands for the spoon. After the peer training phase (T2), there
was a slight increase in unprompted and prompted mands for the spoon (17% and 25%, respectively). The transfer of control training (T3) occurred after a week-long vacation. During the transfer of control training (T3), unprompted mands decreased to 0%, while prompted mands for the spoon increased to 67%. Though unprompted mands for the spoon did increase, Paul did not meet criterion to proceed to Baseline 4, thus mand training with the adult teacher (T1) was reintroduced. Paul again did not meet criterion during the reintroduction of mand training with the adult teacher (RT1), thus his participation was terminated. Unprompted mands for non-experimental items also did increase. As seen in Figure 3, these responses remained at 0% throughout the study. Table 3 shows that Paul required 2 non-consecutive sessions of mand training with the adult teacher (T1) and one session of the transfer of control training (T3).

![Figure 7](image_url)

*Figure 7.* Paul’s percentage of total mands for the spoon, both unprompted and prompted, across all baseline and training sessions. Training session 2 is omitted from the graph as it was peer training only. Paul did not meet criteria to complete all phases in the study, with his participation ending after the reintroduction of Treatment Session 1. Baselines are represented by BL1, BL2, BL3, and BL4. T1 denotes mand training with the adult teacher; T3 denotes transfer of manding from adult teacher to peer trainer; RT1 denotes retraining of mand training with the adult teacher; and Gen denotes peer generalization.
Training of Peer Trainers

All peer trainers responded well to the training of how to evoke a mand from the learners without and with prompts. After the initial practice of different scenarios, they demonstrated the ability to withhold the spoon and to provide gestural prompts, as needed.

Experimental Assurances

Item Over-generalization Check

Over-generalization was defined as the learner manding for the spoon if and when the spoon was readily available without restriction (i.e., in front of the learner and there was no response required in order to sue the spoon). The over-generalization check was implemented to ensure the learner did not make this error. Each learner did not over-generalize manding for the spoon on 100% of opportunities. Two opportunities of over-generalization checks occurred for each learner for each phase. Trials and activities were randomly selected for the over-generalization checks.

Reliability Measures

Inter-observer Agreement. A mean count-per-interval procedure was used to determine the level of IOA between the primary investigator and the research assistant. Prior to watching actual study videos, the research assistant underwent training, which occurred in four stages, where the person watched pre-selected videos to practice coding. Each progressed in difficulty, where video one isolated the different types of mands and video three was more fluid in the verbal behaviors. Video four was used to test IOA. From this test video, there was an IOA score of 100% for both unprompted and prompted
mands. Since the training was successful, the primary investigator coded 100% of the baseline videos post factum, and the research assistant coded 30% of the baseline videos post factum. From these scores, an IOA score of 85% was reached, with a range of 50% to 100%. This level of agreement is acceptable as the study was assessing a new treatment method and anything above 80% is acceptable.

**Intra-rater Agreement.** Intra-rater agreement occurred for Baseline 4 data. It was necessary for primary investigator to take real-time data on Baseline 4 to ascertain if the learner met criterion of producing either unprompted or prompted mands for the spoon 80% of opportunities. The primary investigator demonstrated 100% of agreement between real-time data and post-factum data.

**Treatment Integrity Assessment**

Treatment integrity data was assessed for the study. One research assistant observed training videos post factum to score treatment integrity of treatment phases, not baseline phases. Treatment integrity was taking on two dimensions: the adult’s teacher implementation of the training and the response of the participant. Data on the adult teacher focused on the consistent implementation of the independent variables and that all components of the independent variable were delivered. For the participants, data was collected on their response and then this data was compared to the adult teacher’s data (data was taken during the training session by the adult teacher). Treatment integrity was assessed for 30% of the training sessions, across both learner and peer trainer training sessions. An average treatment integrity score of 91% was achieved with a range of 84%-

53
100%. This indicates that the independent variable was delivered successfully for 91% of the opportunities.
CHAPTER V

DISCUSSION

General Discussion

Six hypotheses for the current study were as follows:

1. The learners would acquire pure, unprompted manding for the spoon after specific mand training with an adult teacher.

2. The learners would acquire pure, prompted manding for the spoon after specific mand training with an adult teacher.

3. The learners would successfully transfer control of pure, unprompted manding for the spoon from the adult teacher to the peer trainer with minimal adult teacher intervention.

4. The learners would successfully transfer control of pure, prompted manding for the spoon from the adult teacher to the peer trainer with minimal adult teacher intervention.

5. The learners who acquire manding with the first peer would successfully generalize pure, unprompted manding for the spoon to a 2nd novel, peer without adult teacher assistance.

6. The learners who acquire manding with the first peer would successfully generalize pure, prompted manding for the spoon to a 2nd novel, peer without adult teacher assistance.

All six of the hypotheses were addressed with the current research and, to some degree, were supported by the data. All four learners exhibited pure unprompted and
prompted mands for an item in the presence of the adult teacher. Results demonstrated that, for 3 out of the 4 learners, pure manding for an item could be transferred from the adult teacher to a peer trainer (i.e., the removal of direct adult interaction). Specifically, 1 out of the 3 learners who completed the entire intervention did exhibit unprompted manding with a peer trainer. Brett demonstrated unprompted manding for the spoon with a peer trainer, while Rikki and Margot demonstrated prompted manding for spoon with a peer trainer. In addition, 2 out of the 4 learners (Rikki and Margot) demonstrated generalization of the skill from a familiar peer trainer to a novel peer trainer, both with the spoon and with non-experimental items (e.g., scissors, marbles, markers).

**Individual Findings**

**Rikki**

**Learner Training Sessions.** The specific activities where Rikki exhibited the most difficulty were the catapult and the flavored drink. When Rikki first tried the catapult, she attempted to play with it without the spoon. After one correction and model of how to complete the catapult with a spoon, Rikki exhibited how to complete the task accurately. For the flavored drink, Rikki perseverated on slowly squirting the chocolate syrup in the milk, making circular patterns in the milk. For the first two trials, the adult teacher gave a gestural prompt of showing her the spoon and then modeling asking for a spoon. As Rikki continued to perseverate on squirting the chocolate syrup, the adult teacher would give her 5 seconds to squirt in syrup and then give a verbal prompt of “Rikki, that’s enough syrup.” With this verbal prompt, Rikki discontinued squirting in the
syrup and grabbed the spoon to stir and drink the flavored drink. This verbal prompt was used for the remainder of the study.

During mand training with the adult teacher (T1), Rikki dumped the box of baking soda into the volcano. Pouring the box was scored as an incorrect trial. The following two trials required a gestural prompt (e.g., showing the hidden spoon to her). Thus 67% of the trials were prompted. During the transfer of manding control phase (T3), Rikki exhibited poor attending behavior and engaged in elevated levels of stereotypy (e.g., singing and verbalizations not related to the context, while focused on slowly squirting liquids into containers). In addition, she began a new behavior with the volcano activity in which she would dump the entire box of baking soda onto the volcano before the peer was able to provide a gestural prompt for the spoon. As mentioned before, Rikki had to have mand training with the adult teacher (RT1) reintroduced.

**Baseline.** Rikki began to show skill acquisition by BL2; however, during BL3—when the peer started prompting the spoon—Rikki’s attending decreased and stereotypical behaviors increased. Stereotypical behaviors consisted of slowly squirting the chocolate syrup, vinegar, and food color in a spiral pattern, and slowly stirring the chocolate syrup in the milk. In addition, she would engage in scripted talking and singing to herself. Due to these behaviors, the adult teacher in the room had to start redirecting her attention to the activities and stopping her from perseverating in the stereotypical behaviors. In addition, Rikki began pouring the baking soda into the volcano, even when the adult produced a prompt by showing her the spoon. Despite these redirects, her scores remained at 0% of opportunities. Rikki continued these behaviors into the transfer of
control training phase (T3). However, her performance improved during and after the reintroduction of the mand training with the adult teacher (RT1), mainly for prompted mands for the spoon. Her scores improved during the reintroduction of the transfer of mand training (RT3) and met criteria to proceed to BL4. During BL4, Rikki produced unprompted mands for the spoon only 33% of opportunities, and 0% of unprompted scheduled opportunities for non-experimental items. She did produce prompted mands for the spoon 100% of opportunities.

**Generalization.** Rikki’s mand responses during the generalization probe varied based on the activity and whether it was prompted versus unprompted. Rikki produced a unprompted mand for the spoon 14% of opportunities. She did produce prompted mands for the spoon 67% of opportunities. Per observation of the trials, Rikki would attempt to engage in stereotyped behaviors, but once the peer prompted the spoon, Rikki immediately manded for the spoon. Most interestingly is Rikki’s unprompted mands for non-experimental items. Rikki increase from 0% of scheduled opportunities during previous baselines to 67% of scheduled opportunities during the generalization. The same activities were used in the generalization phase as the baselines; however, Rikki demonstrated more attending during the activities when compared to previous phases and experimental activities presented during generalization. Anecdotally, Rikki increased in responding to social interactions by the peer, including answering questions, making comments about the activity, and laughing in response to the peer’s actions.
Brett

**Learner Training Sessions.** Brett demonstrated the skill of independently completing each of the experimental activities. He completed both the volcano and flavored drink accurately within two trials. For the catapult and sundae, Brett needed more trials to meet criterion. For the catapult, he attempted on the first trial to use the catapult without a spoon. He met criterion after three trials. With the sundae, during Brett’s first trial he tried to eat the ice cream out of the container using the ice cream scoop. The adult teacher corrected and modeled the correct response. For the second trial, he placed the ice cream in the cup but tried to eat the ice cream directly out of the cup without a spoon. A second correction and model were provided. For the third and fourth trials, Brett completed the task accurately thus meeting criterion.

Brett demonstrated he could complete the task of making a flavored drink in the task completion training phase, but for T1 he would not mix the drink. Furthermore, he would only sip the drink once and state he was done with it. The adult teacher demonstrated how to perform the task completion after each failed attempt, but Brett continued not to use the spoon. The spoon was placed on the table next to him to test if he would use the spoon without requiring a mand. Brett did not use the spoon during this trial, as well. For all future phases, the adult teacher offered Brett a beverage to drink but did not run mand trials with flavored drinks.

During the transfer of manding control phase (T3), Brett immediately attempted to talk to the adult teacher multiple times throughout the training session, which required the adult teacher to ignore the social bids and attempt to redirect him back to the peer by
prompting the peer to interact with him. Once the adult actively ignored him and prompted the peer to interact with him, Brett began interacting with the peer. He produced unprompted mands for the spoon 100% of opportunities and non-experimental items 100% of scheduled opportunities.

**Baselines.** During BL1, Brett produced unprompted mands for the spoon 50% of opportunities. This was seen primarily with the volcano activity. However, Brett’s mands for the spoon decreased to 0% of opportunities upon the second session of BL1. Brett increased in unprompted mands for the spoon after the peer training and continued to increase as he proceeded through the remaining phases—with the exception of the generalization phase. One reason for the increase in unprompted mands is the peer was now trained to allow Brett more opportunities to mand, as opposed to the peer immediately fulfilling the need.

**Generalization.** All mand responses dropped to 0% during the generalization phase. Brett attempted to request items from the adult teacher during this phase. When these attempts failed, he would talk about how he needed a spoon but did not ask the novel peer, even during opportunities where the peer produced a prompt for the spoon. On two occasions, Brett even walked around the room looking at different items, stating he needed a spoon. The adult teacher had to remind him to sit down and complete the activity. In terms of non-experimental items, Brett produced mands for non-experimental items throughout the study until the generalization phase. Unprompted mands for the non-experimental items mirrored responses for the spoon, in that, Brett would ask the
adult for items and look around the room, with the exception that on two separate trials he went to the peer’s side of the table and grabbed the needed item.

**Margot**

**Learner Training Sessions.** Margot did complete the task once access to another activity was made contingent upon her making the flavored drink but she did not drink it. Margot did choose the flavored drink activity when it was presented for the remainder of the study. For both the volcano and sundae, Margot required gestural prompts (e.g., pointing to the next item) during initial trials. Gestural prompts were required more so with the volcano as seen by the number of trials required to demonstrate the skill successfully by completing the task.

For the first session of T1, Margot’s attending behavior had decreased. She required many gestural and verbal prompts to attend to the stimuli and the adult teacher. In addition, response fluency was poor, taking 3-5 seconds to respond to questions or instructions. Because of these behaviors, a second session was required. During the transfer of manding control phase (T3), Margot initially attempted to make social bids with the adult teacher at the beginning of the session but increased manding with the peer as the session continued.

**Baselines.** During BL1, Margot did not emit any unprompted mands for the spoon. However, she did emit unprompted mands for non-experimental items, an average of 27% across four scores, with the last score before manding training 0%. During Margot’s initial mand training session (T1), her attending decreased, and response latency increased. Because of these behaviors, her mand scores were low—17% for both
unprompted and prompted opportunities. These low scores required another session of mand training with the adult teacher (T1). Scores during her second session of mand training improved—86% of all unprompted opportunities and 100% of all prompted opportunities. All disruptive behavior had improved thus leading to improved scores.

By BL2, Margot started producing unprompted mands for the spoon from the peer, though unprompted mands for non-experimental items continued at 0%. During BL4, after the peer trainer completed their training, Margot decreased to 0% in emitting unprompted mands but did emit prompted mands for the spoon 75% of all opportunities. This trend continued for the rest of the study. For both transfer of control training (T3) and BL4, Margot she produced prompted mands for the spoon 100% of opportunities, while continuing to emit unprompted mands for the spoon and non-experimental items.

**Generalization.** Scoring during the generalization phase show Margot did generalize prompted mands for the spoon but at a lower score of 33% of opportunities. Interestingly, Margot’s unprompted mands for non-experimental items increased from 0% of opportunities for the last four phases to 100% of opportunities. This is interesting not only for the increase in the score but also the peer produced limited social interactions (i.e., limited in terms of frequency and duration of the interactions). Thus, Margot continued to produce mands for the items—both the spoon and non-experimental items—even when the peer was not very interactive.

**Paul**

**Learner Training Sessions.** During task completion training, Paul did not show interest in having a flavored drink. Paul refused to make a drink even when another
activity was made contingent upon his showing how to make the flavored drink (e.g., “Show me how to make chocolate milk and then we’ll play with the catapult”). For the remainder of the study, he continued to reject making a flavored drink even if the peer did make one. Paul did verbally tell how to make a flavored drink. Regarding the Sundae, Paul first tried to eat the ice cream using the ice cream scoop. He did demonstrate how to make the ice cream sundae but began to refuse having to make one during later phases. Thus, data was only collected on the catapult and the volcano for all baseline and treatment phases.

During T1, Paul produced high scores for unprompted and prompted mands for the spoon, 86% and 100%, respectively. During these training sessions, Paul did need redirection from the adult to attend to the activities. His off-task behavior consisted of talking and asking about irrelevant topics (e.g., what street he lived on, when the next day would be he would go to school). In addition, he would make the same comments or ask the same questions, even after they were addressed by the adult teacher. Despite this, Paul did meet criterion to move to BL2.

For transfer of manding control (T3), Paul exhibited increased off-task behavior that consisted of asking questions and making comments not relevant to the context, sometimes asking questions or making comments previously addressed by the peer. In addition to stereotypy, he would perform the tasks incorrectly, at times laughing when he performed the activity wrong. Mand training with the adult teacher (RT1) was reintroduce to give Paul additional practice. However, he engaged in the aforementioned off-task and disruptive behaviors, which resulted in a failure to meet criterion. He
required multiple prompts to remain on task. Furthermore, he attempted to perform the
tasks incorrectly, smiling at the adult teacher. When the adult teacher ignored these
tries to perform the task incorrectly, Paul would produce a verbal correction of his
behavior (e.g., “No, I don’t pour the baking soda on the volcano”). It must be noted that
before the transfer of manding control phase (T3), Paul and his brother, Brett, went on an
unanticipated weeklong vacation, which could have affected his responding.

**Baselines.** Paul produced mands 0% of opportunities across unprompted mands
for the spoon and non-experimental items during BL2. During BL3, after the peer
training phase (T2), Paul did produce unprompted mands for the spoon 21% of
opportunities and prompted mands for the spoon 17% of opportunities. Throughout the
study, Paul engaged in frequent off-task and disruptive behaviors. As mentioned
previously, these behaviors consisted of repeatedly asking or talking about irrelevant
topics. He would also leave the activity to look at other items in the room or look out the
windows. In addition, Paul would perform the opposite of what was asked of him (e.g.,
performed the step wrong, looked at the adult or peer, and then laughed). These behaviors
occurred frequently during baselines phases requiring the adult teacher to redirect him
back to the task. However, when the adult did redirect him, Paul would start to talk to the
adult teacher. When peers directed him back to the task, he inconsistently complied with
their request.

**Synthesis of Past and Present Research**

These results replicated previous research (Hall & Sundberg, 1987; Lechago et
al., 2010; Pellecchia & Hineline, 2007; Sundberg et al., 2002; Taylor et al., 2005) on
mand training and manipulation of the EO. The study attempted to extend the previous research by teaching children with ASD to mand in the presence of typically developing trained and untrained peers both with and without an adult teacher in close proximity. Furthermore, the current study demonstrated generalization of manding to a novel peer in a play setting.

**Systematic Mand Training with Adults**

Hall and Sundberg (1987) studied the effects of manipulating establishing operations to evoke manding in individuals with intellectual disabilities. This was achieved by removing familiar items needed to complete an activity, requiring a mand to gain access to the items. Results showed manding was evoked through systematic training, in that, both individuals increased their manding for the missing items from an adult. The current study used the same procedure of task completion training and removal of a crucial item to complete the activity. In addition, the current study found similar results for the three participants that completed the study, primarily in the form of prompted mands.

Sundberg et al. (2002) extended the research performed by Hall and Sundberg (1987) to examine whether children with ASD could produce mands for information (in the form of “wh” questions such as what, who, where, when) to gain information about a preferred item. Results show the participants demonstrated the skill of manding for information about missing items in the presence of an adult. The results of Sundberg et al. (2002) are important because they demonstrated that participants could produce an increased response effort and novel verbal response topography to gain access to needed
items. The current study did not focus on mands for information but did require the
learners to produce pure mands—an increase in response effort for each learner. These
findings are generally consistent with the Sundberg et al. (2002) study.

Lechago et al. (2010) combined the methodology of the Hall and Sundberg (1987)
and Sundberg et al. (2002) to replicate and extend the ability of children diagnosed with
ASD to mand for information during a multi-component task. Lechago et al. (2010)
added three additional manipulations. The first manipulation was to keep one item
consistent across different activities: a spoon. Second, Lechago et al. (2010) included an
assessment to determine if the child would generalize manding for information about the
missing spoon to activities for which the participants did not go through systematic mand
training. As the child demonstrated the skill of manding for information about the
missing spoon, another activity, with which they were not formally trained, was provided
to them with the spoon missing. The third manipulation was to test for over-
generalization of manding for information for a missing item that was not spoon. This
was done by presenting activities in which the child was familiar with but did not include
the spoon (remote control truck and puzzle).

The current study used the methodological framework created in the Lechago et
al. (2010) study to extend research on mand training, with additional variations. First, the
current study did use activities where a spoon was required for all experimental tasks.
Second, an over-generalization check was incorporated. Where the Lechago et al. (2010)
study targeted over-generalization of the manding for the spoon, the current investigation
focused on assessing if the child would over-generalize manding for the spoon even when
the spoon was available to the learner without any response required to access it. Third, the current study assessed manding for items with activities not systematically trained and did not require a spoon (e.g., scissors, marbles, markers). Lastly, the current study assessed if manding behavior could be emitted in the presence of both a familiar and unfamiliar trained peer, instead of solely with an adult.

Results from the Lechago et al. (2010) study showed each child improved in their ability to mand across activities, including those activities they did not have systematic mand training but did require a spoon—all in the presence of an adult only. In addition, the children in the study by Lechago et al. (2010) produced a mand for the correct item and did not over-generalize a mand for information about the missing items that were not a spoon (i.e., they also produced mands for information for a puzzle piece or a remote control). The current study produced similar results: a) participants increased in manding for missing trained item, b) participants did not error in over-generalizing the mand for the trained item to a different item, and c) participants produced mands for items that did not have formal training.

**Systematic Mand Training with Peers**

Taylor et al. (2005) examined whether the manipulation of establishing operations can evoke manding-based interactions from one child with ASD to a peer also diagnosed with ASD. Their study included three conditions: no establishing operation (food readily available to each child), establishing operation with a peer (food only available to the peer), and establishing operation with the adult (food only available to the adult with an added prompt/correction procedure).
The current study used two similar procedures to those of Taylor et al. (2005). First, the current study used the over-generalization check similar to the no establishing operation phase of Taylor et al. (2005) where the preferred item was available without a required response. Second, the baselines (BL1-4) and generalization phase of the current study were similar to the establishing operation with a peer phase utilized by Taylor et al. (2005).

In contrast, the current study incorporated four different procedures. First, peers were trained to prompt a response by showing the spoon, whereas Taylor et al. (2005) limited prompts to come from the adults only. However, in the current study if the learner did not respond to the peer prompts, the adult would provide general comments and questions about the task (e.g., “Are you done with your ice cream?”, “Finish the volcano so you two can play with the marble rollercoaster”) to direct action to the task. Second, in the current study the needed item was not initially in view of the learner in an effort to elicit spontaneous manding. The item only became visible only after they did not produce a spontaneous mand for the item. Taylor et al. (2005) had the items by the peer but in view of the child at all times. Third, the current study attempted to examine further the transfer of control. This was done by performing the mand training with the adult at the beginning of the training sessions (T1) instead of the end, as performed by Taylor et al. (2005). After teaching the peer trainer to facilitate prompting during baseline, a more systematic transfer of control phase occurred by having the learner and peer trainer sitting together, with the adult teacher sitting behind the peer trainer. All interactions—prompting and redirection—happened through the peer and not directly by the adult.
Lastly, the current study examined the transfer of mand control to typically developing peers, as opposed to a peer with an ASD diagnosis (Taylor et al., 2005).

Results from both Taylor et al. (2005) and the current study showed that children demonstrated the ability to mand in the presence of a peer, and were able to generalize the skill from adult to peers. The current study did not show a consistent increase across the learners in manding for the spoon with the peer trainer after T1 (the mand training phase with the adult), whereas Taylor et al. (2005) did demonstrate a consistent increase after their adult training phase, which they called establishing operation phase with an adult. Only Rikki and Margot produced spontaneous mands during the unprompted trials immediately after T1. After the systematic transfer of control training (T3), each learner produce a mand for the spoon 100% of opportunities—Brett produce mands during unprompted opportunities, while Margot and Rikki produce mands during prompted opportunities only.

Pellecchia and Hineline (2007) examined the transfer of control from adult to peer diagnosed with ASD using a different method than Taylor et al. (2005). They attempted to demonstrate a systematic transfer of control across four conditions, with the child progressing through each phase based on set criteria. The conditions consisted of unprompted and prompted mands with an adult instructor, parent, and sibling, and unprompted mands with a peer diagnosed with ASD. The adult, parents, and siblings were trained on the stimuli and prompt delivery procedures, while the peer with ASD only provided the reinforcer. The current study used an only one similar procedure of proceeding through each phase based on set criteria. Different methodological
components were used by the current study. First, typical developing peers were used. Second, only one adult was used throughout the study. Third, the adult trained the peer in the delivery of the desired item and how to prompt a response during failed unprompted opportunities. In addition, the current study used a systematic transfer of control procedure by pairing the adult teacher with the peer trainer. Results from the Pellecchia and Hineline (2007) study showed that the target children produced mands with adults and parents but were less able to generalize mands toward siblings and peers. Results from the current study, however, did find the learners produced prompted mands with the novel peers, mainly after peer training (T2) and transfer of control training (T3).

Recent Research on Mand Training

Research that is more recent has been conducted investigating mand training with children diagnosed with ASD, thus furthering the knowledge base of mand training. In 2015, Madzharova and Sturmey investigated if mothers of children diagnosed with ASD could be trained, via video modeling and feedback, to facilitate manding between their child and a typically developing sibling or peer. Mand training consisted of mothers setting up the activity—with one item missing from the activity—and telling the children to finish the activities. The mother then sat behind children. The mothers facilitated the prompting for incorrect responses or failures to respond, redirecting off-task behavior, and providing social praise for reinforcement. The sibling or peer was responsible for giving the missing item when the child produced a mand for it. Data showed the mothers were able to facilitate mand training. This study parallels the current research, in that, a
similar transfer of control training occurred. However, the current study focused primarily on learners demonstrating the skill without intensive adult interaction.

Plavnick and Vitale (2016) compared two different treatment training methods— in-vivo and video modeling—to teach manding for items from adults to children with ASD. The training procedure used script fading to teach children to mand for preferred items. Script fading was performed by using a card reader audio device or video modeling, which were in turn faded. Comparison of the two methods looked at acquisition rate and mastery of mands. Results of the comparison showed that children acquired and mastered manding for preferred items faster than that of in-vivo training. Investigators suggest video modeling may prove beneficial to a faster acquisition of manding for items. The current study did not use video modeling and employed different training methods; however, future research using the current methodology could look at using video modeling in training children with ASD to mand from their peers or peer training to facilitate mand training.

Limitations

The results of the current study supported—to varying degrees—the research hypotheses. However, all studies have limitations. The limitations of the current study can be summarized in four main categories: peer trainer behaviors, sample limitations, research setting artificiality, and experimental design limitations.

Peer Trainer Behaviors

The peer trainers exhibited different behaviors from one another. If the adult teacher did not address the learner’s mands or social bids, Teagan and Gabby would
immediately respond to the learners’ requests. Soon, they both began to anticipate when the learner would emit a request, and then fulfill the need before the learner made a request. As mentioned previously, the primary investigator had to include an instruction during peer training to wait and allow the learner an opportunity to respond during peer training. This instruction was given to all peers for consistency of training, even though Lexie and Devon did not demonstrate this anticipatory behavior. In the future, peer training should include greater emphasis on the need to wait long enough for the participants to respond.

Devon, Gabby, and Teagan were more likely to initiate social interactions with the learners, while Lexie was less likely to initiate. Furthermore, Lexie would provide only limited verbal and non-verbal responses when the learner did produce a mand. She was given individual instruction to make more social bids and be more responsive. Once she received her training, she appeared to initiate more social interactions. Lexie’s lack of social initiations could have possibly affected Brett’s responding during the generalization phase in which they were randomly paired together. Here, too, peer training should emphasize, to a greater degree, the importance of social interaction following learner manding.

**Sample Limitations**

Learners were recruited from a population of children receiving services at the same intensive behavior treatment program, which made scheduling more convenient. Each client received 15 to 40 hours of discrete trial training (DTT) and additional support in school settings and homes. Though none of their immediate programs used the exact
methods utilized in the present study, their therapy could affect the results of the study, as opposed to a child with ASD not involved an intensive behavior treatment program. Not all children who score on the autism spectrum receive such extensive treatment. As such, the data from the current study may lack a degree of external validity. However, the use of children in such treatment programs is consistent with previous research. Future cross-agency replication would extend the generality of these and other findings.

**Research Setting Artificiality**

Although the present study attempted to mimic a naturalistic environment for the learners to acquire and demonstrate the skill of manding with peers, certain aspects were contrived and sterile. To limit distraction, the primary investigator conducted each session in a closed room with only the learner, the peer trainer, primary investigator, and research assistant. In addition, the children sat at a table next to one another with a camera recording the session and the primary investigator controlled activities presentation. This environmental setup was not indicative of a typical school or social setting. For experimental purposes, these accommodations were necessary. As part of the ASD symptomology, attending in distracting environments tends to be a challenge for individuals with ASD. Thus, removal of all unnecessary stimuli was mandatory.

Additionally, a video camera contributed to the artificiality of the setting, but was essential for data collection. To counteract any effects its presence, the primary investigator always had the camera present during sessions, including pre-experimental sessions with both the learner and peer.
Also, contributing to the artificiality of the setting, activity presentation had to be controlled by the primary investigator for experimental purposes. This control allowed for each experimental activity to be presented at least once, and the primary investigator could facilitate activity selection in cases where the participants chose differing activities. This variable is less of a concern because it mimics center activities (i.e., structured activities) in academic settings.

The seating arrangements were also artificial, to a certain degree. Participants were required to sit next to each on the same side of the table, instead of opposite sides of the table. It was paramount for the participants to remain close to one another to limit distraction and off-task behaviors, and to occasion for trials to be conducted. Without this control, it would be possible for each child to traverse the room and activities, not encountering one another.

**Experimental Design Limitations**

A non-concurrent multiple baseline design was necessary to accommodate availability for the participants and peer trainers. Single-subject designs that rely on larger numbers of participants and volunteers are difficult simply due to logistics. Watson and Workman (1981) outline the justification for the use of the non-concurrent multiple baseline design by explaining the cost/benefit tradeoffs of running extensive baseline conditions and the impositions on parents, participants, and cooperating agencies. Although the design of the current study possessed the requirements dictated by Watson and Workman (1981) (*a priori* criteria for the baseline duration be set, and each participant was randomly assigned to *a priori* specified baseline durations), such
confounds as history effects and fatigue (particularly for those participants with the most baseline sessions) may exist within the study. Despite these concerns, the staggered nature of the intervention conditions and the observed data suggests any increases in mand responses appeared to occur after training began and after each phase change for each participant.

**Suggestions for Future Research**

The current investigation represents an important extension to the research into the establishment of manding, and, especially, spontaneous social manding in children on the autism spectrum. Replications using the techniques presented here are critical to determining its efficacy and viability in establishing real world manding interventions for these children. Future research should extend to the generalization and maintenance of the skill across settings, with novel social peers, and over time. Follow-up probes that assess whether the acquired skill has been maintained over time are important. Due to time constraints, the present study could not focus on the maintenance of the manding with peers, but follow-up probes are a necessary component of the development of new intervention methods. This requires additional consideration and examination to determine whether the participants more fully acquire and maintain the new skill. Leger (2016) suggests for a child with ASD to demonstrate a visible improvement with social skills, treatment must continue over time and across multiple settings.

Previous research (Gresham, Sugai, & Horner, 2001; Reinchow & Volkmar, 2010) suggests that skills taught in decontextualized clinical environments can lead to limited or reduced generalization and maintenance of the skill. For a treatment to be
viable outside the clinical setting, it is paramount for the skills to be practiced in those natural contexts where the skill will be demonstrated over time. Therefore, replication across multiple settings with additional generalization training and follow-up will likely be necessary. These components are especially necessary before any viable and applicable interventions, based on the current methodology, can be developed.

Additionally, future research should examine the contributing factors associated with increased exposure to peers before assessing generalization of a skill. For example, increased familiarity with peer may be a precursor for the facilitation of mand generalization for children with ASD. In other words, the type and amount of social encounter with peers (i.e., different degrees of familiarity) could be studied systematically prior to generalization assessment to determine whether familiarity enhances generalization of manding.

**Concluding Remarks**

The current line of inquiry replicated and extended previous studies (Hall & Sundberg, 1987; Lechago et al., 2010; Pellecchia & Hineline, 2007; Sundberg et al., 2002; Taylor et al., 2005) investigating environmental manipulations in order to evoke a manding response. The current study added to this line of research by teaching children with ASD to emit a mand in the presence of a typically developing peer without an adult teacher in close proximity to prompt either the child with ASD nor the peer. This extension of the previous is necessary because eventually children with ASD will operate in contexts where their peers control the materials and information needed in order to get their needs met. In addition, the current study is the first step in a long line of treatments
options to help those with ASD to interact with their peers. As these individuals come to understand that their peers are a resource (i.e., peers help teach and maintain these appropriate social skills), they will continue to observe and interact with their peers, thus encountering and making contact with natural contingencies and reinforcers.


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