AN EVALUATION OF THE EFFECTS OF SIMULTANEOUS PHYSICAL PROMPTING WITH A SECONDARY PROMPTER ON IMITATION OF OBJECT MANIPULATION

by

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(Under the Direction of Rebecca Lieberman-Betz)

ABSTRACT

The purpose of this study was to evaluate the effects of simultaneous physical prompting with a secondary prompter on the acquisition of independent imitation skills in a pre-kindergarten student with autism spectrum disorder. The researcher used a single-case multiple probe across behaviors design to evaluate whether the intervention led to increases in object imitation. The intervention consisted of teaching trials in which a primary therapist modeled an action with an object and said "do this" and a secondary therapist immediately physically prompted the correct response to the task direction. Before each teaching session, the primary therapist ran a probe session to measure independent imitation progress. Results demonstrated a strong positive trend in independent imitation upon introduction of the independent variable to each behavior. This intervention is one that could be beneficial for children acquiring imitation skills in a home, clinic, or classroom setting.

INDEX WORDS: Simultaneous physical prompting; multiple stimulus without replacement; imitation; secondary prompter; autism spectrum disorder

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CHAPTER 1

INTRODUCTION

Imitation in young children is a prerequisite skill for many learned behaviors. For a typically developing child, imitation skills emerge during the first year of life and support development of early communication and language skills, and facilitate play among peers. Imitation allows children to learn a variety of responses without direct teaching of each response (Brown, Brown, & Poulson, 2008). Between 18-24 months of age, typically developing children's imitative behaviors gradually increase in frequency and complexity (Vivanti & Hamilton, 2014). Imitation contributes to social behavior from this age through adulthood, where individuals imitate peer behavior in a subconscious effort to gain knowledge and build relationships (Tomasello & Moll, 2010). Research shows that imitation helps children with nonvocal communication, allowing them to better access the environments they are in (Heimann et al., 2006). Imitation of gestures and signs could lead to a form of communication for a child who did not previously have an effective means of communication.

Children with ASD often have difficulty with the imitation of other people's movements. ASD has three main characteristics including abnormalities of social reciprocity, communication and language function, and abnormally restricted and repetitive behaviors and/or interests. The difficultly for children to mirror others is unique to ASD. Problems with imitation can help identify ASD in children as young as age two and continuing into adulthood (Rogers et al., 2003). Early in a child's life,

imitation involving motor movements, facial expressions and vocalizations provides children with a sense of connectedness to the world around them and is an early form of communication with social partners. Typically developing children use imitation for social learning during their first year of life. The inability to access this type of learning can cause delays in learning of all types for children with ASD in their early years. Motor imitation can help children to experience connectedness through shared experiences, emotions, and thought through the ability to reciprocate the actions of others (Rogers et al., 2003). In regards to teaching imitation, Koegel, O'Dell, and Koegel (1987) outlined the importance of teaching object imitation skills before teaching gesture imitation. Imitation research shows object imitation to be a simpler skill to teach and learn, due to the physical moving of the object often being reinforcing for the child (Koegel, O'Dell, & Koegel, 1987). For this reason, this study in particular chose to target object imitation before any other form of imitation for the participant.

Imitation Intervention in Children with ASD

In 2000, Hwang and Hughes provided evidence through their review of imitation studies that social interactive training has a positive effect on motor imitation skills. Social interactive training is an intervention that includes contingent therapist imitation of child behavior, naturally occurring reinforcement, time delay and specific environmental arrangement. Hwang and Hughes found that social interactive training increased imitation in young children with ASD in 16 different studies. The component of social interactive training that had the most evidence to support the growth of motor imitation across the studies was contingent imitation. The review also suggested that time delay is a more effective intervention for children who display functional vocal communication

skills before intervention. For children who did not make vocal word approximations before intervention, time delay only was only effective when the therapists used it in conjunction with other behavioral intervention strategies (Hwang and Hughes, 2000).

Garfinkle and Schwartz (2002) evaluated the effects of least to most prompting on the independent peer imitation of preschool students with ASD. The therapist conducted the study in a small group setting using a multiple baseline across participants, and showed increases in all of the participants' independent imitative acts of their peers. The study did not give evidence to support how many teaching trials it takes on average for a child with ASD to learn an imitative skill with minimal prompting.

Ingersoll and Gergans (2007) demonstrated the effect of parent-implemented reciprocal imitation training (RIT) on participants' independent imitative behaviors. The participants included three and four year old children with a diagnosis of ASD and their mothers. Components of RIT are described in other studies, including contingent imitation by the therapist, least to most prompting, and verbal praise for independent imitative acts. Ingersoll and Gergans used a multiple baseline across participants design to demonstrate increases in spontaneous imitation as a result of RIT; however, the results did not generalize well to other settings with any of the participants (Ingersoll & Gergans, 2007). This could be because the praise provided for independent imitation may not have been reinforcing the target behavior at a high enough level. Parent implemented interventions can be beneficial for families in helping children get more therapy time each day; however, there is a high risk of low procedural fidelity which can skew the results of an intervention.

In 2007, Ingersoll, Lewis, and Kroman discussed teaching imitative use of gestures in children with ASD. They used a multiple baseline across participants design. Much like the previous study discussed, this study implemented RIT components including contingent imitation by therapists, linguistic mapping, following the child's lead, and contingent reinforcement. For gestural imitation specifically, researchers used a prompting procedure, which consisted of three nag model prompts, then moved to a physical prompt. A nag model prompt consisted of modeling the targeted action every 30 seconds after the initial task demand to help participants learn the correct response. Once the participant performed the gesture, independently or physically prompted, the therapist provided verbal praise to the child. The intervention for imitation proved successful in increasing imitative acts and generalized in some way for all participants. There was also an increase in the Motor Imitation Scale scores for all participants, although these results varied in levels of statistical significance (Ingersoll, Lewis & Kroman, 2007).

In 2010, Ingersoll used a randomized control trial to replicate the Ingersoll et al. (2007) study to confirm the effectiveness of RIT in teaching imitation to children with ASD. This study examined the effects of RIT on imitation in the play setting for 2-4 year old children with ASD. While the control group received no RIT intervention, the treatment group received three hours of RIT per week for 10 weeks. The results showed increases in both object imitation and gesture imitation, with increases in object imitation being greater. The treatment group also saw an increase in score on the Motor Imitation Scale, suggesting that this naturalistic approach to teaching imitation is generalizable to many skills (Ingersoll, 2010).

In 2012, Ingersoll replicated these results, while also examining social-communicative effects of RIT in the natural environment (Ingersoll, 2012). Initial object interest and increases in spontaneous play acts are important because children who engage with more objects are likely to be more motivated by objects, and therefore may find imitation more intrinsically motivating as it is for most typically developing children (Ingersoll, 2010). This is another reason naturalistic intervention such as RIT can be beneficial in young children with autism.

In 2014, Du and Greer studied mirrored imitation. This study examined the effects of using a mirror to teach imitation to young children with autism using a multiple probe across participants design. The method for this intervention consisted of the adult sitting behind and slightly to the side of the child with a mirror in front of them. The adult presented the same task direction and stimulus, saying, "do this" while performing a motor action. If the child imitated the adult within 3 seconds of the initial prompt, the therapist provided verbal praise, gentle physical touch, and edible reinforcers as determined by their teachers and caregivers. The second group of children received standard imitation intervention, with the adult sitting face to face with the child and providing the task demand "do this". If the child independently imitated, teachers and caregivers gave them verbal praise, gentle physical touch, and edible reinforcers as appropriate. When compared to participants who received standard imitation intervention, the children who received with the mirror intervention had significantly better and more generalizable results (Du and Greer, 2014). This study provides evidence that the use of a mirror in imitation training is more beneficial than standard imitation

training. It also gives evidence that standard imitation training with no additional intervention can be ineffective and is typically not generalizable for children with autism.

Ingersoll (2008) points out limitations to current imitation interventions. She outlines the idea that teaching imitation in a discrete trail training setup with artificial reinforcers may limit generalization to the natural environment. This also brings to light that a DTT type intervention could make implementation for parents or other caregivers difficult in the daily home setting. Imitation taught in a controlled setting with artificial reinforcers targets the learning function of imitation, which may be a helpful prerequisite skill to teach many other behaviors such as self-help skills, but may not always generalize to the social-communicative needs of children with ASD as they access less salient, natural reinforcers (Ingersoll, 2008). Ingersoll also outlined the difference in what is reinforcing to most typically developing children as opposed to those with ASD. A typically developing child acquires imitation skills through the reinforcing benefit of social feedback such as eye contact or exchange of positive affect. Many children with ASD are not reinforced by social feedback and therefore require a more salient, nonsocial reward for accurate imitation in order to learn the skill. This often consists of some type of sensory feedback for the child (Ingersoll, 2008). Sensory feedback may consist of imitation that immediately results in a preferred sound, lights, taste, or feeling. Many studies do not explicitly pair this sensory feedback with social feedback such as eye contact or positive affect. If the therapist paired the two types of rewards, it may make the imitation skills more generalizable to a setting where the only feedback given is social or communicative.

In 1997, Stone, Ousley, and Littleford identified the level of difficulty from most to least for acquiring imitation skills in children with ASD. The study gave evidence to support that imitation of body movements was the most complex form of imitation, followed by non-meaningful object imitation and meaningful object imitation, in that order (Stone et al., 1997). Since meaningful object imitation proved to be the simplest of imitative behaviors for children with ASD, the researcher in this study chose to target this type of behavior with the intervention.

In order to expand upon the current research it could also be beneficial to perform a preference assessment before intervention to determine what is most reinforcing to the participant. If the only consequence for appropriate imitation is verbal praise and a child exhibits problem behavior maintained by social avoidance, this intervention could result in increases in problem behavior or even serve as a punishment for independent imitation. For these reasons, the researcher in the current study chose to conduct a preference assessment to identify a reinforcer before beginning intervention, and also collected data to identify how many intervention sessions it took for a child with ASD to learn chosen motor imitation skills. Since many studies used least to most prompting and/or nag model prompts, the researcher in this study chose to conduct teaching trials using only simultaneous physical prompting to ensure that the participant came into contact with a reinforcer during each teaching trial without practicing errors. The purpose of this study was to evaluate the effects of an imitation intervention consisting of simultaneous physical prompting on the acquisition of motor imitation skills in a pre-kindergarten student with a diagnosis of ASD.

CHAPTER 2

METHODS

Participants

The participant for this study was a 4-year old boy with special education eligibility in autism and speech or language impairment. The child attended a self-contained Low Incidence Disabilities classroom that focused on the use of intensive applied behavior analysis (ABA) in the classroom setting. The classroom served five other children with similar eligibility categories. The participant engaged in vocal stereotypy, but did not functionally communicate vocally. He used the Picture Exchange Communication System to communicate throughout the school day. The researcher chose the student to participate based on his lack of independent imitation as observed by teachers and therapists in the school setting.

Before beginning intervention, the researcher conducted the *Motor Imitation Scale* (MIS; Stone, Ousley, Littleford, 1997) as referred to in introduction, with the participant. This scale evaluates the participant's ability to imitate meaningful tasks with objects, non-meaningful tasks with objects, and motor movements. His raw score averaged across three administrations was a 2/32, indicating that imitation was an area of great concern. Before intervention, teachers reported that the student did not reliably attend to his name by orienting his head in the direction of an adult when they called his name. Teachers also reported his classroom data on gross motor imitation as a stable zero-celerating trend for the previous six months. Teachers and the speech language

pathologist agreed that the student was typically easily distracted and his attention to task was brief.

Setting

The primary therapist conducted baseline probes, intervention sessions, and intervention probes in the classroom setting. The therapists conducted all sessions in the classroom in which the student receives daily instruction. For all sessions, the student and the therapist(s) sat on a rug in the front of the classroom, face-to-face with an upside down plastic cube chair between them to simulate a table in a more natural environment. The rug was located in front of a bookshelf that blocked potential competing stimuli in the rest of the classroom to encourage attention to the task. The student and the primary prompter had approximately 18 inches between them during sessions. In the teaching trials, the secondary prompter sat directly behind the participant on the floor with 6-8 inches between them. This allowed the secondary prompter to easily, physically prompt the participant to complete the imitation task.

Materials

Materials for the study consisted of a plastic cube chair (18 in x18in x 18in), a plastic rattle (5in x 2in), a small plastic car (3in x 2in) with wheels that rolled, and a small plastic dog (4in x 3in). Researchers recorded data on paper data sheets with pens. For the preference assessment, the researcher gathered six preferred items in the classroom based on teacher observation of student preference. For this participant, the items consisted of sour gummy worms, Oreos, Skittles, a musical drum with lights, a plastic airplane with lights and sound, and a plastic truck with lights and sound. The participant reliably selected Oreos during the preference assessment; therefore, the researcher used small

pieces of an Oreo (around 1/8 of the cookie) as a reinforcer during all probe sessions and teaching trials.

Preference Assessment

The researcher conducted a multiple stimulus without replacement preference assessment before beginning baseline data collection to identify the most potent reinforcer for the participant (DeLeon et al., 1996). This started by identifying both tangible and edible reinforcers that were currently used in the classroom that the student had previously expressed interest in according to teachers. The items used in the preference assessment were sour gummy worms, a piece of an Oreo, a skittle, a light up airplane that made music, a singing toy drum, and a toy fire truck with lights and sounds. The researcher placed all six items on a large tray on the floor and gave the task direction "pick one". Once the participant made a choice, they were given one minute of access to each tangible item and were able to consume each edible item. After one minute of access or consumption of the edible, the researcher recorded the item on the data sheet and removed it from the line up. This continued until all items had been chosen. The researcher conducted the assessment three times. Oreo was the most selected item in the preference assessment and the researcher determined this to be the reinforcer for the study. IOA data were collected for all three assessments and showed 100% agreement across all assessments.

Dependent Measures and Definitions

The researcher defined successful imitation of the first behavior, rattle shaking, as: shakes rattle back and forth at least once to make "rattle" noise. This was further

defined as: orientation toward primary prompter and back and forth movement of at least one inch. The second behavior, car pushing, was defined as: uses hand to push car across tabletop with some lateral movement, as demonstrated. This was further defined as 15.24 cm or more of lateral car movement. The third behavior, dog hopping, was defined as: "hops" toy dog across tabletop with some lateral movement, as demonstrated. This was further defined as greater than one inch of vertical movement and greater than two inches of lateral movement.

All behaviors had to be emitted correctly within five seconds of the primary prompter presenting the task direction and stimulus. Response definitions were listed on data sheets for each behavior. Paper data sheets were used to collect child data during baseline probes, teaching trials, intervention probes, and generalization probes (see Appendix B). The researcher graphed the data in Microsoft excel from the paper data sheets.

Interobserver Agreement and Procedural Fidelity

Before collecting baseline data, the researcher trained six therapists to be both primary and secondary prompters. Their training consisted of a model followed by three independent trials per prompter. The criterion for mastery was one hundred percent accuracy for three consecutive trials. The researcher recorded these trials on video and collected primary and interobvserver agreement (IOA) data on the therapists' fidelity in intervention. IOA for these sessions was 100% across all therapists. The researcher gave refresher trainings every three weeks to the therapists to ensure there was no drift from accurate implementation of the intervention and to ensure procedural fidelity.

When data collection began with the participant, IOA was collected on all but two probe sessions across conditions with 100% agreement on all probe sessions. IOA was collected for 7 out of 30, or 23% of teaching sessions to ensure procedural fidelity. Of the teaching sessions in which procedural fidelity data were collected, the mean level of procedural fidelity was 92% with the lowest being 80% and the highest being 100%.

Experimental Design

This study used a multiple probe across behaviors design to test the effectiveness of simultaneous physical prompting on teaching meaningful object imitation. The researcher chose a multiple probe design to demonstrate experimental control without having to remove an advantageous intervention. This design worked well for this study because it did not require a reversal of the dependent variable to demonstrate experimental control as object imitation may be a behavior that the student does not stop engaging in when intervention is removed. A multiple probe design was used rather than a multiple baseline design because it is more practical in the classroom setting. There was also a concern of experiencing threats due to fatigue of the participant with a multiple baseline design. To move to the next behavior, the participant needed to engage in accurate, independent imitation for a minimum of 80% of trials per session for four consecutive sessions. The researcher chose these mastery criteria in an effort to be sure the behavior was thoroughly learned before moving onto the next behavior.

Procedures

Prior to beginning baseline, the Motor Imitation Scale was conducted with the participant to determine current levels of independent imitation across different behaviors. This scale was used as both a pre-test and a post-test in the study in order to

select target behaviors, and in an effort to determine whether the intervention would impact performance on the MIS. After completing the MIS, baseline probe sessions began. Baseline sessions were run for each behavior until they reached stability or a contratheraputic trend. Baseline probe sessions and treatment probe sessions were run identically. In the probes, the primary prompter sat on the rug in the front of the classroom, face-to-face with the participant. A plastic cube chair sat between them with the flat side of the chair facing up to serve as a table. The primary prompter began by holding the object and saying "student name, do this". The participant then had 5 s to emit the correct response as outlined in the response definition. If the response happened after the 5 s, the response was coded as incorrect. If the participant did emit a correct response with less than 5 s between presentation of the task direction and stimulus and beginning the response, he was provided with a small piece of an Oreo (the highest preferred reinforcer based on the MSWO) and verbal praise. Verbal praise consisted of "good job!" or "you did it!" followed by "you earned some Oreo". Prompters recorded data on paper data sheets as listed in Appendix B. The therapist ran one baseline session for each of the three behaviors on the first day of data collection, and then began to focus on one behavior at a time while intermittently probing the other behaviors before beginning intervention for them. Once the researcher observed stability in baseline responses for a minimum of three sessions, intervention began.

One week prior to beginning intervention, all imitation goals in the classroom setting were put on hold and the selected reinforcer (Oreo) was not used for anything outside of the study. Intervention consisted of sessions using a secondary prompter to

physically, simultaneously prompt imitation from behind the participant. Each session included five consecutive trials.

For the first behavior, rattle shaking, the primary prompter sat across from the participant with a cube chair in between them. The secondary prompter sat behind the participant with no more than 15.24 cm between them. The primary prompter first presented the task direction "student name, do this". Immediately following presentation of the task direction and shaking of the rattle, the secondary prompter placed their hand over the hand of the participant, and physically prompting the shaking of the rattle back and forth at least one time with at least one inch of movement, and made a sound with the rattle. As soon as secondary prompter finished prompting the imitative behavior, the participant was given verbal praise and was provided with a small piece of Oreo, identical to the response for accurate independent imitation in the probe sessions. This was conducted for five trials per session. In between each trial, both the primary and secondary prompters took data on their own procedural fidelity. For teaching sessions that had IOA on procedural fidelity, a third researcher sat nearby and collected data on implementation of the intervention as well. Probe sessions were never conducted with less than two hours between the last teaching trial and the next probe to ensure that the participant was retaining the learned behavior.

Generalization

Generalization probes were taken at the end of the study to determine if the learned imitative behaviors generalized across settings from a controlled setting away from other students to a more naturalistic and social setting in the classroom's play centers. This was probed during intervention for the second behavior, car pushing, and

again at the end of the study for all three behaviors. In addition to generalization probes, the researcher used the Motor Imitation Scale as a pre-test and post-test to determine the student's level of independent imitation before intervention and after intervention was complete. The motor imitation scale probes imitative behaviors in the form of meaningful object imitation, non-meaningful object imitation, and gross motor imitation. This scale provided multiple opportunities for the participant to show generalization of imitation across behaviors outside of the direct intervention (see Appendix A). The scores on this assessment showed the participant's ability to apply the learned skill to other behaviors, which will serve him well in the pre-kindergarten curriculum and help him to better access his environment.

Social Validity

This study was conducted with the intention of teaching a skill that would generalize to other settings and behaviors to help the participant grow his repertoire of prerequisite behaviors for standard pre-kindergarten behavioral objectives. The ability to imitate behaviors opens the door to a multitude of skills and behaviors that children need to move forward in their learning. In this study, the participant had imitation goals in his IEP, as well as other goals for which imitation is a prerequisite such as identifying body parts with just a model prompt making the study also externally valid.

CHAPTER 3

RESULTS

The data analyzed were taken from baseline probe sessions, probe sessions conducted during the intervention condition, and generalization probes (see Figure 1). The researcher first conducted a single baseline probe session to assess accuracy of all three behaviors. The researcher recognized an immediate, stable, trend in the baseline probe sessions for the first behavior. Once three data points were collected with stable percent independent imitation from the participant, the researcher moved into intervention for the first behavior. In the probe session following the first day of intervention, the participant increased to 20% independent imitation of rattle shaking. Following the initial increase in independent imitation, the level and trend of the tier 1 intervention data followed no stable trend in a therapeutic or contratheraputic direction until session 13. Following session 13, the data showed a positive trend and an increase in level and stability. Performance in the intervention condition for the first behavior ranged from 0% independent imitation to 100% independent imitation for 5/5 trials. The participant reached criteria for mastery on session 17 and the researcher moved onto the next behavior.

Intermittent baseline probes for the second behavior, car pushing, were conducted at session one, five, eight, and ten. All of the intermittent probes showed zero percent accurate imitation of car pushing. Consecutive baseline data were collected starting at session 18. The level during baseline was at zero, and the data showed a zero-cellerating

trend across three data points. Following the first session of intervention in the second tier, independent imitation immediately increased to 80%, and moved into 100% across the following four consecutive trials. This data showed an immediate increase in level from baseline to intervention. Following implementation of intervention, the participant displayed percent accuracy ranging from 80% to 100%. The participant reached mastery criteria for the second behavior after only four consecutive intervention sessions at session number 25.

Intermittent baseline probes were taken for the third behavior at session 5, 10, and 15. These data were at zero for all intermittent probes. The researcher began consistent baseline data collection for the third behavior, dog hopping, at session 26. The level of this data was zero and showed a zero-cellerating trend across three data points. Intervention for this behavior began following session 28. Immediately following intervention, the participant exhibited zero percent accurate imitation for two sessions. During the third intervention probe, accuracy increased to 40% in session 31. Starting at session 31, the data displayed an accelerating, therapeutic trend and an increase in level ending at 100%.

Following intervention sessions, generalization data were taken for sessions in a different setting. When a probe session was run for each of the three behaviors in the centers setting in the classroom, the participant exhibited 100% accuracy across all three behaviors. These results are displayed in Figure 1. The closed circles indicate probes for the three behaviors; rattle shaking, car pushing, and dog hopping. The open circles indicate generalization probe sessions conducted in the centers setting. The phase change lines indicate when intervention began for each behavior.

When intervention sessions and generalization probes were complete, the researcher ran the motor imitation scale for a second time with the participant. The results of the MIS prior to intervention showed the participant's raw score averaged across three administrations to be two out of 32, or about 6%. Following intervention for all three behaviors, when the MIS was run again, the participant earned a score of 31 out of 32, or about 96%. These results are also displayed in Figure 2.

Figure 1

Effect of Simultaneous Physical Prompting on Independent Object Imitation

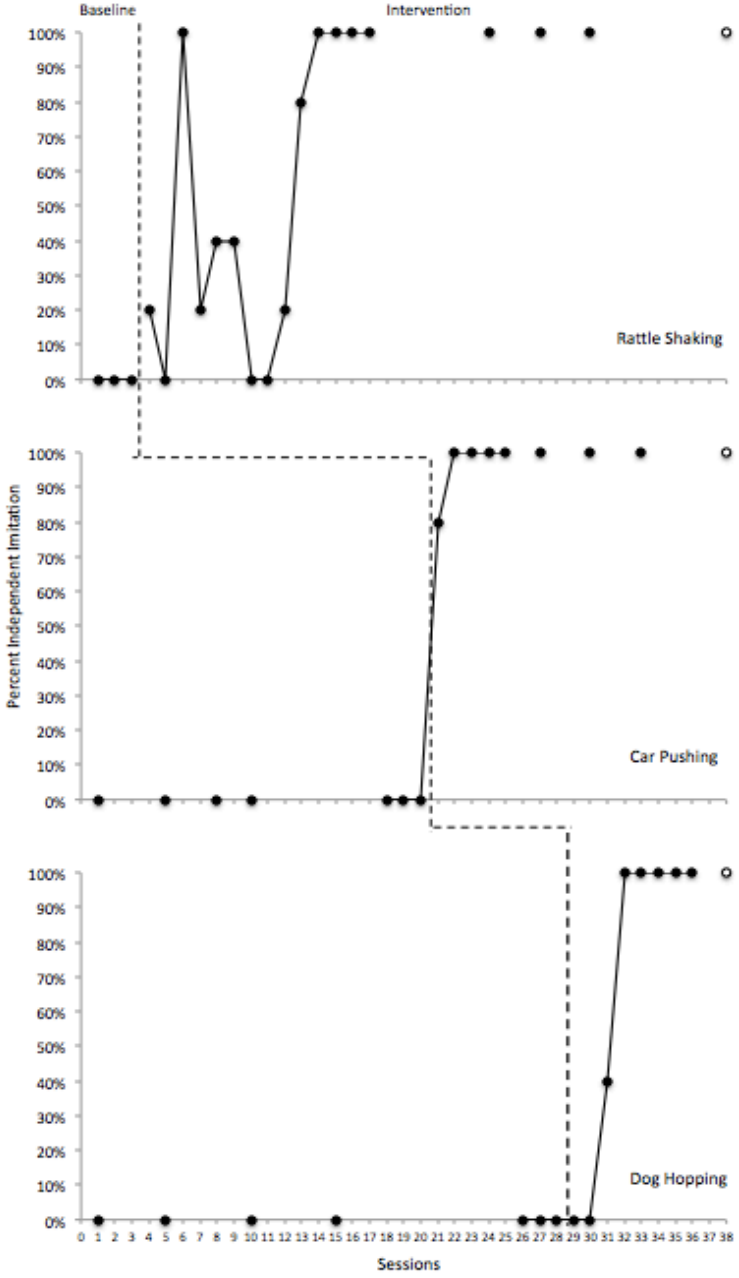

*Figure 1.*Percent of independent object imitation during baseline probe and intervention probe sessions. Open circles represent generalization probes of the same behaviors in a

Figure II

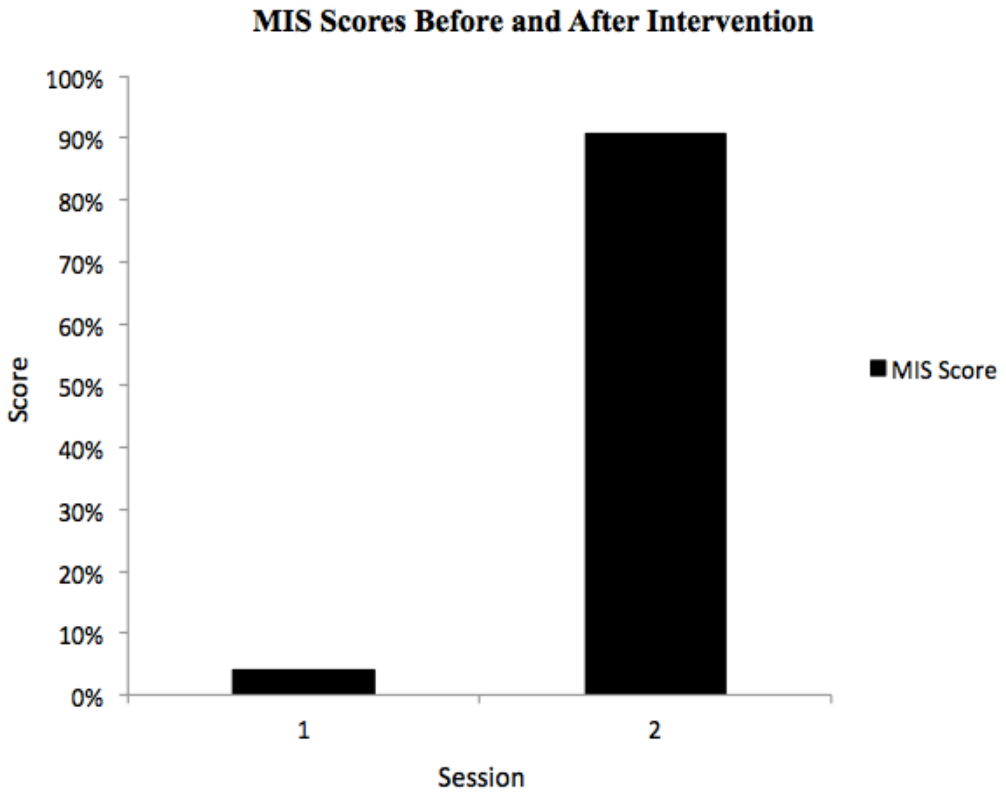

Figure 2. Percent of actions the participant successfully completed on the Motor Imitation Scale before and after intervention.

CHAPTER 4

DISCUSSION

The purpose of this study was to evaluate the effects of simultaneous physical prompting on object imitation for a pre-kindergarten student with ASD. The baseline data gave evidence to support the student's lack of accurate imitation skills. During intervention, there was an increase in accurate independent object imitation. The accelerating trend in the data following intervention for all three behaviors suggests effectiveness of the intervention. The drastic increase in scores following intervention on the Motor Imitation Scale, used as a pre and post-assessment, suggest that the learned imitation skills generalized to other behaviors including non-meaningful object imitation and gross motor imitation. As the simplest form of imitation as outlined by Stone, Ousley, and Littleford in 1997, non-meaningful object imitation was taught first with the idea that it would generalize to more complex imitative behaviors, which it did.

This study adds to the literature in several ways. First, Ingersoll (2008) suggested that teaching imitation in a controlled, discrete trial training context might limit potential for imitation in other settings with more distractions and less salient reinforcers. This point helped form the foundation for this study and the procedure of conducting probes and intervention sessions in a more naturalistic classroom setting. The participant in this study sat on a rug in the classroom where play often takes place to engage in intervention sessions and probes. Additionally, by using a simultaneous prompting procedure with

physical prompting during teaching trials, the participant was not able to practice errors during intervention. In this study, it proved to be effective in the learning of imitative behaviors. This suggests that not allowing students with ASD to practice errors may lead to quicker learning of imitative skills. Finally, the use of a secondary prompter to physically prompt imitative behaviors was developed from the Du and Greer 2014 study, which used mirrored imitation in an effort to decrease confusion for participants. By having a secondary prompter behind the participant, there was an effort to decrease complexity and confusion for the participant. The errorless learning procedure used in this study allowed the participant to practice only correct responses during intervention, as well as allowing him to access reinforcement each time the behavior was exhibited (five times per session).

Limitations

This study is limited in that baseline generalization probes were not conducted. While generalization probes were conducted following intervention, their data hold less significance as there is no direct baseline data to compare them to. It could also be beneficial to conduct baseline and post intervention generalization sessions on vocalizations for students who do not emit functional vocalizations. Although not part of this study, the participant was observed to vocally imitate sounds and the word "mama" after engaging in the imitation intervention. This study only examined the effects of the intervention on one participant, making it difficult to conclude that the results are applicable to other populations. The study did not control for potential imitation teaching that could be happening in the home setting as the participant's caregivers were not asked to change any current behaviors. In addition, a multiple baseline design rather than a

multiple probe design could show greater experimental control of the data. This design was avoided due to difficulty of implementation, as well as the concern that the participant could experience fatigue or lose interest in the intervention with many baseline sessions. A multiple baseline design could also lend itself to the practicing of errors for the participant, which the participant better avoided with the multiple probe design. Implementation of this study could be a limitation in a classroom setting where there is not always an extra staff member to serve as a secondary prompter. The requirement of intermittently monitoring multiple tiers can be time consuming, and requires additional staff or researchers to have IOA.

Implications for Future Research

Future research on the topic of imitation training may consist of longitudinal studies showing how the teaching of imitation using simultaneous physical prompting with a secondary prompter affects students in their future learning and academic achievement as compared to those who did not receive the intervention, or those who received a different imitation intervention. In addition, this study lends itself to replication with other participants and in different settings. Future studies could test this intervention in a more naturalistic setting with other children or more objects of interest around the student. Researchers could also conduct future research to directly compare the effects of this errorless learning procedure to a least-to-most prompting procedure to identify which is more effective and efficient.

Previous research shows the importance of children with ASD learning to imitate. As a prerequisite skill for many other behaviors, meaningful object imitation can be beneficial to children with ASD in learning how to better communicate, connect with

others, and participate in appropriate play. This study provided evidence to support that using simultaneous physical prompting as a teaching method for meaningful object imitation is a successful intervention and the results may generalize to other behaviors or settings.

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APPENDICES

Appendix A

MIS

Manual for the Motor Imitation Scale (MIS)

Revised August 2015

The Motor Imitation Scale (MIS) was developed as a research tool to assess motor imitation skills in young children with ASD. It consists of 16 single-step actions that are modeled by an adult within a structured interaction. Half of the items require imitation of actions with objects, and the other half require imitation of body movements. The object actions are further divided into those involving "meaningful" vs "non-meaningful" actions. See **Figure 1** for a photo of the materials used in the MIS.

The MIS was originally published in the following article:

> Stone, W. L., Ousley, O. Y., & Littleford, C. L. (1997). Motor imitation in young children with autism: What's the object? Journal of Abnormal Child Psychology, 25, 475-485.

This manual contains information about the MIS items, administration, and scoring procedures. It can be downloaded from the University of Washington READI Lab website: http://uwreadilab.com/ (located under the "Tips and Resources" tab).

Fig. 1. Materials used in the MIS

MIS Items

Table 1 lists the 16 MIS items, along with the type of action they represent. The items do not need to be presented in the order they appear below and on the MIS Score Sheet (page 8). The sequence was initially conceived so that developmentally simpler actions could be presented first, and those requiring imitation of fine motor actions and imitation of "invisible" actions (i.e., those the child cannot see himself do) could be presented later in the assessment.

Table 1. MIS items and categories

Item	Type of action*
1. Bang spoon on table	Object; Non-meaningful
2. Shake rattle	Object; Meaningful
3. Clap hands	Body
4. Wave hand	Body
5. Push car across tabletop	Object; Meaningful
6. Push teacup across tabletop	Object; Non-meaningful
7. Walk toy dog across tabletop	Object; Meaningful
8. Walk hairbrush across tabletop	Object; Non-meaningful
9. Bend index finger up and down	Body
10. Scratch tabletop with fingers	Body
11. Open and close fist	Body
12. Drum with hands on tabletop	Body
13. Pull on earlobe	Body
14. Pat cheek	Body
15. Place small block on head	Object; Non-meaningful
16. Hold string of play beads behind neck	Object; Meaningful

* ***Note:*** *"Meaningful" object actions are those that are consistent with the natural use of the object, and "Non-meaningful" actions are those that are less likely to be associated with the object.*

MIS Administration Guidelines

1. The MIS should be presented in a playful, game-like style. We suggest keeping the materials in a colorful bag, and making a game out of pulling the objects out of the bag.

2. We usually try to administer the MIS at a table. Make sure that the work table is free from distracting items and that the child's hands are free. Remove the items from the previous MIS task before proceeding to the next. If you present items on the floor, it is best to demonstrate the actions on a well-defined space, such as on a mat or on the seat of a small chair.

3. Obtain the child's attention before demonstrating each action. Instructions such as "[Child's name], look at what I'm doing!" or "Look at me!" may be helpful in eliciting attention. Do not label the action, as that will make it difficult to determine whether the child is imitating your action or following your verbal cues. After the demonstration, say to the child, "Now you do it!" or "Your turn!" and place the material on the table in front of him or her.

4. We strongly recommend that you use non-descriptive sounds as you demonstrate each item, to increase children's interest and attention. We use sounds such as "bop-bop-bop" or "whee-whee-whee" and present them in rhythm as we model the action. However, it is critical that the sounds do not match the content of the action (e.g., do not make a motor sound while pushing the car, or say "shake-shake-shake" while shaking the rattle).

5. Three trials for each item are permitted. Each trial is scored Pass, Emerge, or Fail, which correspond to scores of 2, 1, or 0, respectively. Only the child's motoric response is scored; imitation of the vocalization does not earn credit. The child's best response for each item is scored and summed to obtain the total score, which can range from 0-32.

6. Items can be presented in any order. It may be helpful to begin with some of the object items, as they tend to be less difficult for some children.

7. Only immediate imitation responses are scored. Imitation of a previous action that occurs after presentation of the next item is not given credit.

MIS Scoring Guidelines

For each item, a score of 2 (Pass) reflects a complete imitation, a score of 1 (Emerge) reflects a partial imitation or an attempt but unsuccessful similar action, and a score of 0 (Fail) reflects no imitation. Examples of scores for each item are presented below. Note that the term "purposefully" is used to differentiate intentional actions (which receive credit) from accidental actions (which do not).

1. Bang spoon on table

2 = purposefully bangs spoon on table one or more times as demonstrated
1 = purposefully shakes spoon up and down without touching it to the table
0 = none of the above; may put spoon into mouth

2. Shake rattle

2 = purposefully shakes rattle back and forth at least once to make "rattle" noise
1 = purposefully bangs rattle on the table
0 = none of the above; may put rattle in mouth

3. Clap hands

2 = purposefully puts hands together to clap at least once
1 = purposefully puts hands together but does not clap (e.g., puts hands together but does not move them apart), OR manipulates examiner's hand to clap
0 = none of the above; may bang hands on table

4. Wave hand

2 = purposefully waves hand as demonstrated, with at least one complete wave
1 = purposefully moves hand in a way other than that demonstrated, OR manipulates examiner's hand to wave
0 = none of the above; may bang hand on table

5. Push car across the tabletop

2 = purposefully uses hand to push car across tabletop with some lateral movement, as demonstrated
1 = purposefully gives car a push or flicks it so it rolls off the table
0 = none of the above; may examine wheels of car

6. Push teacup (upright) across the tabletop

2 = purposefully uses hand to slide upright cup across tabletop with some lateral movement, as demonstrated
1 = purposefully flicks cup across tabletop OR pushes it across table on its side or upside down
0 = none of the above; may hold teacup to mouth as if drinking

7. Hop toy dog across tabletop

2 = purposefully "hops" toy dog across tabletop with some lateral movement, as demonstrated
1 = purposefully "hops" toy dog in place (i.e., no lateral movement), OR flicks dog across table
0 = none of the above; may examine or mouth the dog

8. Hop hairbrush (on end) across the tabletop

2 = purposefully "hops" brush on end across tabletop with some lateral movement, as demonstrated
1 = purposefully "hops" brush in place (i.e., no lateral movement), OR slides brush across table on its side
0 = none of the above; may hold brush up to hair

9. Bend index finger up and down

2 = purposefully isolates one or two fingers and attempts an up and down motion with at least one finger
1 = purposefully moves hand up and down without isolating finger(s) as above. OR manipulates examiner's finger to bend
0 = none of the above

10. Scratch tabletop with fingers (both hands)

2 = purposefully uses both hands in "scratching" motion as demonstrated
1 = purposefully uses one hand in "scratching" motion, OR moves both hands on table using a different action
0 = none of the above

11. Open and close fist (one hand)

2 = purposefully makes a fist and opens it at least once
1 = purposefully closes fist but does not open it, OR manipulates examiner's hand to open and close fist
0 none of the above

12. Drum with hands on tabletop

2 = purposefully "drums" on table, with both hands hitting the table at least twice
1 = purposefully "drums" with one hand, OR "drums" with both hands hitting the table only once
0 = none of the above

13. Pull on earlobe

2 = purposefully brings hand to touch ear and grasps lobe (pulling motion may not be evident)
1 = purposefully touches another part of head, OR puts finger in ear, OR pulls on examiner's ear
0 = none of the above

14. Pat cheek

2 = purposefully brings hand to touch cheek (patting motion may not be evident)
1 = purposefully pats another part of head OR pats examiner's cheek
0 = none of the above

15. Place small block on head

2 = purposefully places block on own head using one or both hands (block does not need to remain on head)
1 = purposefully lifts block and places it on another part of body, OR puts it on examiner's head
0 = none of the above

16. Hold string of play beads behind neck

2 = purposefully holds strand of beads around neck, with the ends of both strands held behind the neck
1 = purposefully lifts strand of beads up to neck, holding ends of both strands in front of (or at) shoulders, OR drapes strand of beads around the back of the neck, with or without holding the ends of the strands in front
0 = none of the above

MIS Score Sheet

ID: _____ Date: _____ Examiner: _____ Total score: _____

Item	Trial 1	Trial 2	Trial 3	Best Score	Notes
1. Bang spoon on table					
2. Shake rattle					
3. Clap hands					
4. Wave hand					
5. Push car across tabletop					
6. Push upright teacup across tabletop					
7. Hop toy dog across tabletop					
8. Hop hairbrush on end across tabletop					
9. Bend index finger up and down					
10. Scratch tabletop with fingers of both hands					
11. Open and close fist					
12. Drum with hands on tabletop					
13. Pull on earlobe					
14. Pat cheek					
15. Place small block on head					
16. Hold string of play beads behind neck					

Score: 2=Pass 1=Emerge 0=Fail

Appendix B

Data Sheets

Session #: Date:

Probe Data Sheet Rattle Shaking

Student Initials _____ Primary Prompter Initials _____

Reinforcer selected from MSWO _____ IOA Data Collector Initials _____

Stimulus Presented: Primary prompter provides prompt "do this" while shaking a rattle back and forth enough to make "rattle" noise.

Successful Imitation: "Purposefully" shakes rattle back and forth at least once to make "rattle" noise. Purposefully defined as: orientation toward primary prompter and back and forth movement of at least one inch.

Reinforcer should only be provided if independent imitation is successful. 1 minute access to tangible or edible provided. Next stimulus presented after one minute of access or consumption of edible.

Trial #	Stimulus Presented (Y/N)	Successful Imitation (Y/N)	Reinforcer Provided? (Y/N)
1			
2			
3			
4			
5			

Percentage of Successful Imitation in Session _____

Session #: Date:

Teaching Trial Data Sheet Rattle Shaking

Student Initials _____

Primary Prompter Initials _____
Secondary Prompter Initials ____

Reinforcer selected from MSWO _____

IOA Data Collector Initials _____

Stimulus Presented: Primary prompter provides prompt "do this" while shaking a rattle back and forth enough to make "rattle" noise.

Simultaneous Physical Prompt: Secondary prompter sits behind participant and physically prompts shaking rattle back and forth at least once to make "rattle" noise.

Reinforcer should be provided immediately after physical prompt is delivered. 1 minute access to tangible or edible provided. Next stimulus presented after one minute of access or consumption of edible.

Trial #	Stimulus Presented (+/-)	Simultaneous Physical Prompt Given (+/-)	Reinforcer Provided? (+/-)
1			
2			
3			
4			
5			

Appendix C

MSWO Data Sheet

MSWO Data Sheet

Student Name: _____ **Date:** _____

Data Collector: _____ **Primary / Reliability (circle one)**

Session #: _____

Trial	Stimuli Selected	Target Behavior(s)	Notes
1			
2			
3			
4			
5			
6			