Effects of Three Teaching Procedures on Skill Acquisition in Tacting, Receptive Identification, and Matching in Young Children with ASD

Kailee Sherer Price

A Dissertation Submitted to the Faculty of

The Chicago School of Professional Psychology

In Partial Fulfillment of the Requirements

For the Degree of Doctor of Philosophy in Applied Behavior Analysis

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Abstract

Applied Behavior Analysis (ABA) is the standard practice in treating individuals diagnosed with autism spectrum disorder (ASD). In practicing ABA, behavior analysts utilize several different methods and interventions to increase skills acquisition in the protocols and procedures used during treatment. With ASD being diagnosed in 17% of children, it is vital that clinicians identify methods of teaching that best improve skills and children's connections with the outside world. Researchers in the study set out to compare three common methods used by behavior analysts to increase skill acquisition across three domains: receptive language, expressive language, and matching. Error-correction, errorless teaching, and rapid motor imitation antecedent (RMIA) were all applied to skills across the three domains in three children diagnosed with autism. In addition, preference data was taken on which teaching procedure was most preferred by participants. Results of the study showed both errorless learning and post response error correction leading to faster skill acquisition across participants. RMIA was the most preferred method by participants but was the least effective method in increasing skills across the domains and participants.

Keywords: applied behavior analysis, autism, rapid motor imitation antecedent, errorless teaching, error correction.

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Chapter 1: Nature of the Study

Background

Autism Spectrum Disorder (ASD) is a developmental disorder often diagnosed in individuals in early stages of development, typically between two and five years of age. ASD can be characterized by some common deficits in areas such as functional communication, play, socialization, adaptive skills, receptive and expressive language, and behavior. There are many common behaviors linked to ASD; however, it presents differently across cases (Roberts, 2013).

Applied Behavior Analysis (ABA) is the most common approach for individuals diagnosed with ASD. ABA provides evidence-based procedures to address assessment and treatment planning for individuals with the developmental disorder (Wolfe & Neisworth, 2005). Utilizing antecedent and consequent strategies as well as environmental manipulation and behavior analysis utilizes those evidence-based practices to increase skill acquisition across the domains in which individuals with ASD show deficits, but also strives to decrease maladaptive behaviors by replacing them with appropriate, more functional alternative behaviors.

This paper focused on improving skills across three domains in children diagnosed with ASD, receptive identification, expressive identification or tacting, and matching. In doing so, researchers compared three common methods utilized in ABA to increase skills in those areas, post-response error correction, errorless teaching, and rapid motor imitation antecedent.

Post response error correction is a procedure in which follows an incorrect response provided by an individual that will increase the accuracy of a future response. This error correction can be completed in different ways depending on the skill being targeted. This correction could be delivered in forms such as vocalizations or demonstrations of the correct response (McGhan & Lerman, 2013). Errorless teaching is a method in which practitioners

present directives followed by an immediate correct, prompted response to ensure a correct response is given by the client. This approach minimizes errors and allows clients to access reinforcement at higher rates (Roberts, 2013). In rapid motor imitation antecedents, the researcher presents a sequence of imitation directives in rapid succession prior to the presentation of a targeted directive (Tsiouri & Greer, 2003).

Post response error correction can be presented in several different ways through vocal, visual, and or physical demonstration (Barbetta et al., 1993; McGhan & Lerman, 2013; Rogers and Iwata, 1991; Worsdell et al., 2005). Previous literature suggested that the presentation of the correct response following an error increases the likelihood that correct response will occur in the future. These results have been extended across several skills targeted for increase in both individuals with disabilities and now in other areas as ABA expands to new realms.

Errorless learning has been shown to work across several skill domains and varying age levels. Jerome, Frantino, & Sturmey (2007) combined errorless teaching with backwards chaining to increase the independent completion of leisure skill tasks analysis in adult men diagnosed with developmental disorders. To further on the versatility of errorless teaching procedures, Ducharme and Drain (2004) utilized errorless learning in teaching children to complete household tasks. Results showed that not only did the intervention improve skills, it also increased compliance in young children diagnosed with ASD.

Tsiouri and Greer completed two studies (2003, 2007) utilizing rapid motor imitation antecedents in increasing functional communication in the form of tacts, echoics, and mands. In both studies, participants increased skills significantly on skill acquisition in those language areas.

Problem Statement

Utilization of rapid motor imitation antecedents is a procedure that has been researched lightly. Tsiouri and Greer have dominated the little research in this area by completing studies on increasing vocal verbal skills in children diagnosed with ASD. In 2003, Tsiouri and Greer completed a study utilizing the imitation sequences in children that were not finding success in increasing vocalizations using alternative treatments. Results of the study showed significant increases in vocalizations across mand, tact, and echoic domains. Again in 2007, Tsiouri and Greer utilized rapid motor imitation antecedents as an antecedent intervention to increase functional vocal behavior. Similar to their 2003 study, results yielded positive results and increase vocal skills significantly across participants.

With the success founded in the fore mentioned studies, more research needs to be completed to both strengthen the implications and to further the research. Extending the hypothesized success to additional deficit domains could lead to successful interventions for skill acquisition in children diagnosed with ASD. The field of Behavior Analysis continues to grow, expand, and adapt to the changing science. In doing so, comparison across common techniques is needed to identify methods that prove to be successful across different participants and domains.

While clinicians are trained in identifying successful interventions, does client selection play a role in the success of interventions? As clinicians, we vow to protect client autonomy and to advocate for the individuals we work with. The individuals receiving these behavior analytic services should be given a voice and some control over the interventions that are utilized in their therapy.

Purpose of the Study

The purpose of the current study was to determine if rapid motor imitation antecedents not only increase skills in language but in other domains as well. Three teaching procedures were

compared to determine if one method proves to be more successful that the others. ASD presents itself differently in all that are diagnosed. One method does not suit all. As Tsiouri and Greer (2003) founded, children will often not react to several treatments all put in place for the same goal. Finding successful, evidence-based interventions can aid in the behavior analytic treatment being implemented around the world.

Additionally, researchers will examine the effects of client preference on their performance on skill acquisition targets. Researchers sought to determine if more preferred teaching techniques led to more successful outcomes.

The current study was addressed to further the evidence of a method hypothesized to be under-utilized and one that could lead to improved successes in individuals' skill progress while also comparing three common teaching methods to determine if one proves to be more successful than the others. Data were collected on three different domains to analyze success in improving skill acquisition in children diagnosed with ASD individually and compared to other methods. This study also addressed whether client preference plays a role in increased skill acquisition. Data were collected on the clients preferred and unpreferred teaching interventions to determine if the most preferred is also the most successful intervention.

Research Questions/Research Questions and Hypotheses

Research Question 1: Does the implementation of rapid motor imitation antecedents increase skill acquisition in receptive language, expressive language, and matching in children diagnosed with ASD?

H11: Rapid motor imitation antecedents will increase skill acquisition across all three tested domains.

Research Question 2: How does rapid motor imitation antecedents compare to other common methods of increasing skill acquisition in children with ASD?

H12: Rapid motor imitation antecedents will yield similar, if not better, results as other common methods used to increase skill acquisition in children with ASD.

Research Questions 3: Is the participant's most preferred teaching procedure also the procedure that yields the most positive results for the participant?

H13: The participant's highest preferred teaching method will also be the method that yield the most positive results.

Definitions of Key Terms

Applied Behavior Analysis: The process of utilizing both antecedent and consequent strategies, as well as environmental manipulations, to improve development and behavioral deficits (Roberts, 2013).

Autism: A developmental disorder with common impairments effecting language, social, play, and behavioral development (Ducharme & Ng, 2012).

Rapid Motor Imitation Antecedent: The process of presenting imitation directives in rapid succession as an antecedent condition used to increase target skills (Tsiouri & Greer, 2003).

Errorless Teaching: A teaching method focused on the prevention of incorrect responding in individuals (Mueller, Palkovic & Maynard, 2007).

Error Correction: A method in which feedback is given to the learner after an incorrect response is emitted (McGhan & Lerman, 2013).

Preference: A method in which identifies potential reinforcers (Davis et al. 2010)

Concurrent Chain: An arrangement in which two or more selections are available and each selection can lead to reinforcement and a different result (Brower-Breitwieser et al., 2008).

Significance of the Study

Findings of the study will have significant implications for practitioners specializing in Early Intensive Behavior Interventions. Common methods used by these behavior analysts will be compared against each other and a prospective new and successful method could be developed. With the findings presented in the study, new interventions may be formulated for clients that are not responding to other common methods used to increase skill acquisition. Findings in this study will build upon the limited research on the area of rapid motor imitation antecedents and will encourage others to continue research in this area. The practical implications could improve functioning and skill acquisition in several domains for client around the world.

Summary

Autism is a developmental disorder commonly characterized by deficits in several areas including language, social, play, and behavior. It is now believed that one in every 150 children will be diagnosed with ASD (Roberts, 2013). ABA is the most prevalent treatment for ASD and sets out to improve skills across the deficit areas. One area that ABA targets is skill acquisition. Some common methods to improve skill acquisition are error correction and errorless learning procedures. A potential new method to be included in those common methods is rapid motor imitation antecedents.

Rapid motor imitation antecedents have few studies completed on the effects it can have on skill increase for children diagnosed with ASD. With the existing research, these imitation sequences have shown to increase functional language skills, but findings of this study could extend the reach if this procedure. Instead of only being used to increase functional language,

rapid motor imitation antecedents could be used to increase skill acquisition in several other skill domains.

Preference has been studied surrounding the potential items that are able to serve as reinforcing agents, but this paper identifies if preference also leads to a teaching method's success with a particular individual. If preference does not play a large role, the comparison between the three methods outlined in the study will lead researchers to answers regarding the most successful teaching method in increasing receptive and expressive language as well as matching to sample tasks.

This document proceeds to provide information pertaining to this research questions and hypotheses. Building upon this chapter, Chapter 2 presents the literature related to ASD, ABA, and those fore mentioned skill increase methods. Subsequently, Chapter 3 outlines the current study including information regarding participants, settings, materials, variables, procedures, and experimental design. Chapter 4 and 5 document the results and discussion of the results of the study. Additionally, Chapter 5 outlines implications, recommendations, and limitations that were derived from the results.

Chapter 2: Literature Review

According to the Center for Disease Control and Prevention (CDC) in 2018, the prevalence of ASD had increased from 1 in 68 individuals to 1 in 59. That's nearly a 15% increase in two years. With the rise in ASD, more families are seeking treatment for their children upon receiving their diagnosis. ABA is a common and most widely used treatment for ASD and is becoming more prevalent in clinics and schools around the nation. Within ABA, there are several protocols and procedures used to increase skill acquisition, social skills, and communication while also striving to decrease and replace negative behaviors that may impede learning. Identifying and addressing the deficits of each individual gives ABA a unique approach to teaching children with ASD. There are several tools used to identify those deficits, one common assessment specifically used for children diagnosed between the ages of 0-48 months is the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP).

The VB-MAPP is an assessment developed by Dr. Mark Sundberg and is based on Skinner's analysis of verbal behavior (1957). The VB-MAPP addresses several skills across several skills domains. These domains are the building blocks used to address and build skills in expressive and receptive communication, social skills, play skills, visual perceptual skills, imitation, group skills, and pre-academic skills.

There is a great importance placed on increasing skills across those domain areas. Those domains are the simple skills that will one day assist in building the more complex executive functioning. Increasing skill acquisition and developing procedures that can increase and optimize learning opportunities in children with ASD is critical given the increasing rates of the diagnosis (Soluaga et. al., 2008).

Increasing Skill Acquisition

As mentioned, there are several domains assessed and addressed that lead to skill acquisition and learning in children diagnosed with ASD. Echoics, listener responding, and matching are of those domains. Echoics address the child's ability to repeat a word or sound that is presented to them. For example, the technician presents the directive "say ah" and the child responds by saying "ah." Building this echoic repertoire can aid in shaping sounds into words and increasing communication in children diagnosed with ASD. Listener responding targets are those in which a directive is given, the child must listen to that directive, and provide a response. For example: the technician lays three cards out in front of the client and tells the child to "point to car"; the child then responds by pointing to the picture of the car. Skills in this area increase receptive language and following directions. Skills in this area can build up to following multi-step instructions which are common in daily routines and educational settings. Finally, matching targets in which a target is placed with its corresponding match. For example, a technician lays three cards in front of a child and hands the child a corresponding match of one of those cards. The technician then gives the directive "match"; the child lays the card on the corresponding match in the field of three cards. Skill acquisition in this simple matching area can lead to sorting laundry or silverware and can foster more independence in older years.

ABA is considered the most effective treatment in increasing these skill acquisition goals in children diagnosed with ASD (Wolfe & Neisworth, 2005). Within ABA, there are several teaching protocols that have been developed over time. A common procedure used to increase skill acquisition is Discrete Trail Training (DTT). DTT is a teaching procedure in which individualizes the way implementation is delivered to facilitate learning for the child. It has been shown to be useful in developing skills across several domains, including speech, motor movements, and making discriminations (Smith, 2001).

Within DTT, there are several error correction procedures utilized to improve skill acquisition in children diagnosed with ASD (Carroll et al., 2015). Post response error correction is of these strategies.

Post Response Error Correction

Post response error correction can be described as the act of providing feedback to a participant following an incorrect response. This feedback is given in attempt to increase the likelihood that the participant will engage in the correct response when presented with the same directive in the future. This error correction can be presented in different ways and typically depends on the skill being addressed at the time. Common ways include feedback delivered vocally, physical demonstration of the task, and requiring the participant to practice the response several times (McGhan & Lerman, 2013).

Previous literature has shown that the repetition of engaging in a correct response following an error increased the likelihood that the participant would engage in the correct response in the future (Barbetta et al, 1993; McGhan & Lerman, 2013). Barbetta, Heron, and Heward in 1993 utilized active student response (ASR) in improving sight word recognition in children with developmental disabilities. Each trial of their study involving a participant error was followed by a teacher model and a student independent response. Results showed that in same day and next day tests, participants' correct independent scores were higher in the ASR trials than in trials when no response was given following an incorrect response.

Similarly, McGhan and Lerman in 2013 utilized not only ASR but also directed rehearsal (DR) conditions in their study. DR is when the participant is directed to rehearse the correct response several times following an incorrect response. Results of their study suggest that while ASR conditions showed high scores, the DR session scores yielded a bit better results across all

but one participant. In 2005, Worsdell et al. addressed similar DR conditions; however, they split the condition into single response (SR) repetition and multiple-response (MR) repetition. In the SR condition, the researcher followed an incorrect participant response by modeling a single correct response. In contrast, in the MR condition the researcher followed a participant response by modeling the correct response and prompting the participant to repeat the correct response five times. All participants scored higher in the MR condition when multiple correct responses were prompted following an incorrect response. Based on the positive results of Worsdell et al., the SR repetition was utilized in the current study. Researchers found the fast paced and quick delivery of the SR repetition favorable for the study due to other teaching procedures being utilized having increased duration during teaching sessions.

Rogers and Iwata (1991) also studied different error correction procedures. Their research differed in their practice condition in that they repeated the trial over and over until a correct response was independently given. Instead of practicing a correct response several times, participants reattempted the trial until they were able to produce a correct response. Findings of the study showed favorable results when 71% of participants' scores were higher in that condition than any other.

Errorless Teaching

Errorless teaching is a strategy that is used and designed to reduce and eliminate errors in student responding (Mueller, Palkovic, & Maynard, 2007). It is a procedure that is common in increasing skill acquisition goals in children and individuals diagnosed with developmental disabilities. Errorless learning procedures were primarily used early on to teach discrimination to non-human subjects such as pigeons. More recently, these procedures have been modified and improved to be used to teach a variety of tasks and behaviors to children with developmental

impairments (Braga-Kenyon et. al., 2017). Throughout research history on the topic, several different techniques have been identified in errorless learning.

The errorless learning procedure began with errorless learning through trial and error. In this method, the correct and incorrect responses were always presented together. Through teaching, the subject was not only learning the correct response but was also learning incorrect responses as well. That individual was learning the discrimination of outcomes for selecting correct and incorrect responses (Mueller, Palkovic, & Maynard, 2007).

Errorless learning through stimulus fading is an additional procedure in which a stimulus prompt is gradually faded over time. In Arantes and Machado's 2011 study, they had both an errorless group and a trial-and-error group when studying conditional temporal discrimination in pigeons. They wanted to examine whether a fading procedure alone could teach a conditional discrimination while pigeons also engage in few to no errors. Results confirmed that all pigeons learned the discrimination while having few to no errors throughout the study. Arantes and Machado's study (2011) showed that in pigeons, both trial and error and stimulus fading procedures worked to limit errors in conditional discriminations. However, in 1964, the stimulus fading procedures were used with human subjects. Moore and Goldiamond (1964) used stimulus fading to also teach matching to sample procedures. In their study, they gradually faded black triangles utilizing a computer program to reduce errors in typically developing nursery school children. Results indicated that the stimulus fading procedure was effective in reducing errors and improving matching to sample skills across participants.

Like stimulus fading, stimulus shaping is another errorless procedure in which the stimuli gradually and systematically become more difficult over participant trials and successes. Mosk & Bucher (1984) compare stimulus fading and another traditional prompting procedure when

teaching lower functioning children how to hang a toothbrush or washcloth after use. Results of their study showed that the shaping procedure yielded far more positive results and had less time to mastery than the other prompting procedure.

Delayed prompting is an errorless learning procedure in which introduces a time delay approach to prompting. This approach systematically reduces the time between the SD and the prompt as the individual's correct responding increases. The prompt delay may begin at a 1 second (1-s) or immediate prompt following the SD. Once mastery is reached for 1-s time delay, the prompt will be faded to occurring after 3 seconds if a correct response is not given first. This fading of the prompt is continued until the individual responses independently with no delay. O'Neil, McDowell, and Leslie (2018) suggested that delayed prompting may be the most effective procedure in reducing errors in responding in children diagnosed with ASD spectrum disorder. In their study, they compared 2 second and 5 second delays when teaching matching-to-sample tasks and had favorable outcomes when using the prompt delays.

Response prevention is yet another procedure that is used with errorless learning and will be the procedure focused on in the present study. In response prevention, the incorrect response is made difficult to engage in through the addition of a prompt. An example of response prevention is the introduction of an immediate prompt upon delivering the SD to an individual. Preventing the individual to respond before a correct prompt is given has been shown to increase correct responding in children diagnosed with developmental delays. When providing the SD "What is this," responding with "car" before the other individual can respond increases the likelihood that individual also responds with the correct answer, "car," rather than an incorrect response. Visual prompts can also be used similarly to that used in the 1973 article by Storm and Robinson. These researchers provided a visual prompt in the form of a line under the correct

response before presenting the SD to children with developmental delays. This response prevention technique increased skills in color discrimination. Response prevention was identified as the method to be utilized in the study based on the successes observed in previous literature and based on ease of training and delivery of the procedure.

Rapid Motor Imitation Antecedent

Rapid motor imitation antecedent (RMIA) consists of the rapid presentation of imitation directives followed by the presentation of a novel, target directive. In 2003, Tsiouri & Greer utilized the RMIA by presenting six motor responses with the directive "do this." Participants of the study were expected to comply with each directive by imitating each movement one by one. The imitation directive used were categorized as both large motor movements and small motor movements. The large motor movements were those using larger muscles and consisted of movements such as stomp feet, clap hands, and touch head while small motor movements were those using small muscles in the face such as touch eyes, touch nose, and open mouth.

In 1993, Williams & Greer implemented similar RMIA procedures; however, they utilized echoic responses as the antecedent procedures. Their interventions were referred to as "Teaching Operations for Verbal Behavior" or (TOVB). While like RMIA, TOVB required participants to engage in a set number of known echoic responses prior to being presented with an independent mand or tact.

There is limited research on the topic of RMIA procedures. These procedures are like behavior momentum in that there is a sequence of mastered tasks presented prior to the targeted SD. Behavior momentum is a common strategy used for gaining compliance in kiddos with developmental delays (Ducharme & Ng, 2012, p. 651). Kelly & Holloway (2015) identified behavior momentum as the act of a student frequently contacting reinforcement through the

modification of task presentation. Whether it is addressing compliance or building fluency, behavior momentum is a strategy consisting of presenting easy or high probability tasks to an individual to build momentum based on access to reinforcement before presenting a more difficult task. In behavior momentum, the tasks presented prior to the SD can be any tasks the child consistently responds correctly to. RMIA is similar in that it presents a sequence of easy or known tasks to the individual; however, with RMIA, those sequences consist only of imitation directives. Additionally, as stated by Mace et. al. (1998), "The greater the rate of reinforcement, the greater the behavioral momentum" (p. 123). In RMIA, the individual does not gain access to reinforcement during the imitation sequence but instead gains access to reinforcement once the novel target response is delivered and a correct response is given.

Preference Assessments

Several different methods can be used to assess an individual's preference. These methods can be broken down into three different aspects: presentation of stimuli, if access is granted immediately upon selection, and the nature od presented stimuli. The presentation of stimuli can be done though forced choice or unforced choice, single stimuli presentation vs multiple stimuli presentation, replacement vs. non-replacement, and can be conducted via parental interview (Davis et al., 2010). A common method for identifying preference in children with ASD is though conducting a multiple-stimulus-without-replacement (MSWO) assessment (Conine et al., 2021). MSWO preference assessments have been shown to be an effective method in identifying preferred items in individuals diagnosed with ASD and other developmental delays (Fritz et al., 2020).

Brodhead et al. (2015) conducted a MSWO preference assessment to children diagnosed with ASD. Their results showed that MSWO produced strong and statistically significant results

when assessing preference with video and tangible items. Additionally, Hoffman et al. (2019) was able to successfully identify a preference hierarchy for all participants in their study regarding preference in six adults with developmental disabilities. In their study, researchers utilized app icons to determine if they could identify preference of iPad content.

While individual preference leads to identification of potential reinforcing agents to increase desired behavior, less than 60% of practitioners reported having adequate knowledge in conducting preference assessments (Graff & Karsten, 2012). A MSWO assessment was utilized based on the previous literature, which, through analyzing 157 different MSWO preference assessments conducted, indicated that the MSWO reliably identified the highest preferred items (Conine et al., 2021). Additionally, as shown, MSWO is applicable across items (tangible, edible, video) in accurately identifying highly preferred items for children with ASD.

Concurrent Chains

Concurrent Chains is an arrangement in which two or more selections are available and each selection can lead to reinforcement and a different result (Brower-Breitwieser et al., 2008). The concurrent chains arrangement has two different links associated with the procedure: an initial and a terminal link. During the initial link trial, the participant is presented with a choice between two or more procedures or stimuli. The participant is asked to then make a choice between the presented choices. These choices or stimuli are associated with the terminal link. This terminal link represents what occurs once each stimuli or procedure is chosen (Catania & Sagvolden, 1980).

Providing opportunities for choice in tasks or learning opportunities has the potential to lead to decreased problem behavior and lower levels of task refusal or escape behaviors

(Romaniuk & Mittenberger, 2001). Decreasing problem behavior can lead to more successful trials being conducted in behavior analytic therapy leading to positive outcomes of therapy.

Brower-Breitwieser et al. (2008) utilized a concurrent operant preference assessment to identify preference between two teaching procedures used with children with ASD. The participants were asked to choose between two commonly used instructional procedures. However, results suggested that the three participants did not show a clear preference between instructional methods, even when the rate of reinforcement was higher with one intervention than in the other.

Similarly, Hanley et al. (1997) conducted a study on preference, also utilizing a concurrent chain procedure. Researchers in this study wanted to determine if children with developmental disabilities showed preference for two common procedures that were often put in treatment as a result of a functional analysis being conducted. Results of this study contrasted with those of Brower-Breitwieser et al. (2008) because in their study, Hanley et al. (1997) founded that the participants did show preference in intervention. Their results led to the idea that individuals receiving therapy for developmental delays could participate in selecting the interventions used in their treatment and through that choice, destructive behaviors could be decreased.

Previous literature in this area leads researchers to identify a potential link between preferred methods of instruction additionally being the most effective method in increasing skills. With this choice in intervention, results have the potential to not only lead to increased choice and autonomy but also lead to faster rates of acquisition and faster rates of decreasing problematic behavior (Cannella et al., 2005).

Summary

With ASD diagnosis number on the rise, new interventions and modifications to interventions are on the rise. Increasing skill acquisition and decreasing maladaptive behavior is becoming more important than ever. Increasing those building block skills in early learners provides the necessary pre-requisite skills for more complex executive functioning in the future.

The present study set out to increase skill acquisition in early learners across three different domains: expressive communication, receptive communication, and visual perceptual skills. Researchers compared three different skill acquisition techniques in a set alternating succession.

Post response error correction, errorless learning, and RMIA are all common methods used to decrease errors and increase skill acquisition. Both error correction and errorless learning have research outlining the procedures increasing skill acquisition across several domains. The current literature surrounding RMIA has not addressed whether the method generalizes to increasing skills in domains other than vocalizations (mands and echoic responses). Researchers in the present study tested similar interventions on visual perceptual, listener responding, and imitation domains.

Additionally, current literature has not compared the common methods of increasing skill acquisition in the three different domains. There have been several studies comparing the different errorless learning protocols; however, none of which have compared these three methods.

The purpose of the current study is to determine the most effective teaching method in increasing skill acquisition in three areas for children diagnosed with ASD.

Chapter 3: Research Design and Method

The purpose of the proposed study was to compare three methods used to increase skill acquisition in children with ASD. This study also determined if rapid motor imitation antecedents were effective in increasing skills in receptive language, expressive language, and matching for those participants. Outlined in this chapter is the research questions and hypotheses, participants, materials, settings, variables, and study procedures.

Research Questions and/or Hypotheses

Researchers evaluated the effects of rapid motor imitation antecedents on skill acquisition in children diagnosed with ASD. Researchers also questioned whether rapid motor imitation antecedents could be effective in increasing skills in receptive language, expressive language, and matching. Also, researchers asked how the rapid motor imitation antecedent compared to other common methods used to increase skills in those domains? It was hypothesized that rapid motor imitation antecedents would increase skills in those areas and would have success similar or more significant than those other common procedures.

Research Design

An alternating treatment design was utilized in the study. This method was deemed appropriate based on the several treatments being assessed for each domain. The alternating treatment design allowed for rapid succession of treatments to be compared closely. For each of the dependent variables, baseline was taken to determine starting levels for each participant across each of the domains. Following baseline, three treatments were applied to the dependent variable in rapid succession. Mastered targets were graphed cumulatively for each treatment phase.

Participants

Participants were three children diagnosed with ASD ranging in age from 18 months to 5 years (see table 1). All participants were recruited via email (see appendix A) and attended an Early Intensive Behavioral Intervention (EIBI) clinic located in the Kansas City metro area. These participants were selected from a pool of clients from those EIBI clinics. There were four clinics included in the study and each clinic served approximately 20 children per day. All participants had an ASD diagnosis however some had additional diagnoses including Global Developmental Delay, Global Speech Delay, and/or Apraxia. All participants had a basic imitation repertoire consisting of at least three motor imitation targets mastered.

Participants in the study were appropriate for the study and applied interventions based on their age and current level of functioning. Each participant screened was performing within level one of the VBMAPP assessment at the onset of the study and were working to increase skills that were consistent with those being targeted in the study. Baseline skills and targets were based on administration of the VB-MAPP assessment. This assessment was conducted with each participant to identify current level of functioning, to identify targets that were already mastered, and to identify targets not yet mastered to be used in the study.

Mav's initial VBMAPP score was 10 over the three tested domains (see figure 1). During the initial assessment, he was able to correctly and independently tact four of 100 items assessed giving him an initial tact score of 2. Within the listener responding domain, Mav was able to select five different reinforcers (family members and highly preferred items) when presented in a field of two. He was unable to receptively identify 100 additional common items giving him a listener responding score of 4. Finally, Mav was unable to match any identical pictures or items that were assessed during the initial assessment but was able to complete short close ended tasks giving him a matching to sample score of 4.

Kurts' initial VBMAPP score was 12 over the three tested domains (see figure 2). During the initial assessment, he was able to correctly and independently tact six of 100 items assessed, giving him an initial tact score of 4.5. Within the listener responding domain, Kurts was able to select five different reinforcers (family members and highly preferred items) when presented in a field of two. He was unable to receptively identify 100 additional common items giving him a listener responding score of 4. Finally, Kurts was able to match five sets of identical color cards but was unable to match identical shapes, animals, or other common items giving him a matching to sample score of 4.5.

Kathy's initial VBMAPP score was 15.5 over the three tested domains (see Figure 3). During the initial assessment, she was able to correctly and independently tact 15 of 100 items assessed giving her an initial tact score of 5.5. Within the listener responding domain, Kathy was able to select correctly and independently 11 of 100 different common items when presented in a field of four, giving her a score of 4.5. Finally, Kathy was able to match 13 sets of identical sets of colors and shapes but was unable to match other identical common items, giving her a matching to sample score of 5.5.

Ethical Assurances

Ethical assurances were held at high regard for the duration of the study beginning with recruitment and consent. Recruitment documents were sent out to prospective clients through a HIPAA compliant data base in which protected information and identity of all clients within the company. Prospective participants contacted only the lead researcher regarding interest in the study. Once inclusion was determined, informed consent forms were provided to parents of the participants. Consent forms outlined how information was kept anonymous and how information was protected. No identifying information was used, except for code names with no link to actual

names, after the consent forms were signed. All consent forms were locked away in a filing cabinet which only the lead researcher had access to. All study data were protected in the filing cabinet and will be destroyed after seven years post study.

Pre-Screening. A pre-screening questionnaire (see appendix B) was sent to all interested parents. To be included in the study, participants had to be diagnosed with ASD, be between two-five years old, be receiving services through an EIBI Applied Behavior Analysis (ABA) clinic and must have had at least three mastered gross motor targets. Participants were excluded from the study if they were under the lead researcher's direct supervision, were younger than two years old or older than five years old, were not enrolled in an EIBI clinic, and/or did not have at least three mastered gross motor imitation targets in their repertoire. If participants passed the screening phase of the study, they were then moved to the informed consent phase.

Informed Consent. Written consent (see Appendix C) was obtained prior to the onset of the study. Once a participant passed the pre-screening process and was deemed able to be included in the study, written consent was presented to the parents of each prospective participant. The written consent document included a brief outline of the study, the purpose of the study, risks and benefits to participation, and how confidentiality was maintained throughout the study. After written consent was obtained, the participant entered the study. A schedule was developed by the lead researcher and was proposed to the participants' parents for approval. The schedule was followed for the duration of the study. All modifications in scheduling were made based on illness, tardiness, and absence. All changes and modifications were approved with parents.

Materials

During all sessions, target materials, reinforcers, and data collection (see Appendix D) materials were present. The targeted skills for each client differed across each teaching procedure. Each participant had three targets in acquisition per domain across each intervention (See Table 2 for example). Target lists and materials were identified based upon initial administration of the VBMAPP with each client. Following the administration of the VBMAPP, targets that each participant did not provide an independent correct response to were added to a cumulative list. This list acted as the ongoing target list for each participant.

For example: during the assessment of the participants' tacting of common items, it was identified that the participant could already independently tact dog, hat, and sock. It was also identified that the client could not correctly tact cat, shoe, bus, car, table, mouse, phone, pen (and several other common items). Those items the participant provided an incorrect response to were placed on the cumulative list of incorrect responses. Upon beginning baseline, the first nine targets were selected and used for that phase. Once entering the intervention phase, if a target was mastered the target that took its place was the next unused item on the list. Difficulty on these targets was not directly assessed; however, the target probe list was the same for each participant during the initial administration of the VBMAPP.

Target materials included common-object picture cards (animals, furniture, clothing, etc.), matching card sets (identical and/or non-identical), and various small objects (blocks, toy cars, etc.). Target materials were unique to each participant and were identified prior to the beginning of each session. Reinforcers included edible and leisure items. Data collection materials included paper data sheets, pencils, and clip boards.

Setting

Sessions were conducted in a 4 m x 4 m individual session room located in one of the four EIBI clinics that client attended. Sessions were conducted three times a day, three to five days a week. Each session room contained one table, two chairs, session materials, and client-specific reinforcers.

Dependent Variable and Measurement

The dependent variable in the study was acquired targets. Acquired or mastered targets were defined as a target with correct, independent responding at 80% or above over three consecutive data collection days. Once a target was mastered, it was added to a cumulative graph for that participant totaling all acquired targets throughout the duration of the study. That mastered target was then replaced with another target from the corresponding domain. For example: if a tacting target was mastered, the next tacting target on the list was put into acquisition. Tacting was defined as when an individual comments on something they hear, see, smell, taste, etc. For example, a child sees a dog and says “dog.” Acquired tact targets were measured on how many novel targets were mastered throughout the study. Receptive identification was defined as selecting a stimuli based on a verbal directive. For example: a researcher says, “find the dog” and the child points to the picture of a dog. Acquired receptive identification targets were measured on how many novel targets were mastered throughout the study. Matching was defined as a stimulus being presented to an individual and the individual selects a second stimulus to the identical or non-identical stimulus in the array. Acquired matching targets were measured on how many novel targets were mastered throughout the study. Targets in each of the three variables were considered mastered based on a percentage of correct responses divided by the total number of trials ran of that target.

Session data were taken on correct and incorrect target responses. A correct response was when a client responded with a correct answer within 1-5 seconds of the SD given without engaging in problem behavior. An incorrect response was any response in which was different than the target response, did not occur within 5 seconds of the SD being provided, or if the participant engaged in problem behavior. For example, during a treatment phase, if the target response was tacting a picture of a dog, the data collector would mark a "+" for a correct response (participant correctly tacts "dog" or a variation of dog "puppy," "doggie," etc.), the data collector would mark a "-" for an incorrect response (participant does not respond, engages in problem behavior, or responds with anything other than the tact for "dog"). Data were also taken on how many targets were acquired throughout each of the treatment phases. Targets were acquired if correct responses were given in three consecutive data collection sessions. Once targets were acquired, new targets were added.

Interobserver Agreement and Treatment Integrity

Interobserver agreement (IOA) was collected by a doctoral candidate from The Chicago School of Professional Psychology (TCSPP). This student was trained on all data collection procedures prior to observing any videotaped sessions. Training took place via GoToMeeting between the lead researcher and the IOA collector. This training consisted of a Behavior Skills Training (BST) approach through implementation of the following steps. The lead researcher first read through the procedures and modeled how to take data. The two researchers then role played through a few sessions so the IOA collector could take data and feedback could be provided. The IOA collector had time to ask any questions to the lead researcher prior to taking any IOA data.

IOA was collected in 40.4% (35.7%-46.4%) of randomly selected sessions across baseline and all interventions for all participants. The overall agreement between the researcher and IOA collector over all phases was 93.3%. The IOA for MV was 91.7% (83.3%-100%). The IOA for KS was 94.5% (88.9%-100%). The IOA for KH was 93.8% (87.5%-100%).

Prior to the onset of the study, a checklist was developed to ensure all procedures were executed as intended by the lead researcher (see appendix E). In doing so, the lead researcher created a task analysis based on going through the protocol for each of the dependent variables. This checklist was included in all portions of each dependent variable and encompassed the information needed to complete each phase of the study. These task analyses were performed with each assistant researcher to train on the protocols and continued to be performed throughout the study, ensuring the independent variable was implemented accurately. Scores on the treatment integrity checklist were determined by dividing the number of steps implemented correctly but the total number of steps. That number was multiplied by 100% and was recorded as a percentage.

Procedural integrity data was taken in 38.0% (32.1%-42.9%) of sessions across all three participants and was collected in 39.2% of sessions for MV, 32.1% of sessions for KS, and 42.9% sessions for KH. Overall treatment integrity was 94.8% (91.7%-100%). Integrity data for MV was 91.7%. Integrity data for KS was 100%. Integrity data for KH was 92.7%.

Experimental Design

The comparison of different teaching procedures on skill acquisition was evaluated utilizing an alternating treatment design. The goal of the alternating treatment design is to determine the most effective intervention by implementing two or more procedures in rapid alternation. Once a steady state of responding was reached in baseline, three procedures were

administered to each participant in each session throughout the duration of the study. Each treatment session consisted of a RMIA intervention, Errorless Learning, and an Error Correction Procedure. Each treatment session consisted of nine targets during each intervention, totaling 27 total targets ran before ending the session. These treatment sessions occurred three times each day for each participant. The order in which the interventions were delivered was based on a concurrent-chain procedure. This procedure was utilized to determine if the participants demonstrated preference for one treatment condition over another. In this procedure, colors were paired with the treatment conditions for each participant. The participants were then presented with a choice between the different colored boxes and were able to choose which treatment conditions they completed first, second, and last during the given session.

Procedures

A probe session was completed prior to the onset of any treatment phases. During the session probes, all current targets were presented, and data were taken on correct and incorrect responding. Scores from the pre-session probes were those that were used in determining if targets met mastery criteria to be added to the cumulative mastered targets graph. Pre-session probes were presented in random rotation. Each probe session included all 27 of the targets that were in acquisition for each participant. These probes were not correlated with the colored boxes utilized during the concurrent chain procedure outlined below.

Preference. Prior to the onset of the study, multiple stimulus without replacement (MSWO) preference assessment was conducted with each participant to identify highly preferred colors. Each participant was presented with seven boxes of varying colors (teal, green, orange, pink, dark blue, purple, and yellow). The participant was sat at a table across from the researcher, the researcher then placed all seven colored boxes in front of the participant and instructed the

participant to “pick one.” The participant selected a box and that color was recorded and the colored box was removed. The researcher would then remove the boxes and represent the remaining six colored boxes and repeat the procedure until no colored boxes remained. The boxes were then ranked from most preferred (1) to less preferred (7) based on the order the participant selected the box. This procedure was completed three times with each participant to determine the participants’ highest preferred colors (see Table 3 for participants results of MSWO preference assessments).

Concurrent-Chains Procedure. Prior to the onset on intervention, each of the interventions for the participants was assigned a color (see Table 4 for assigned colors). At the beginning of each study session, a concurrent-chains procedure containing two parts, the initial and terminal link was utilized. The initial link in the study was the participants’ choice between colored boxes that were assign to each treatment condition, while the terminal link was the implementation of the condition selected. During this procedure, the participant was presented with each of the three colored boxes they selected during the preference activity. The participant selected a colored box, and the corresponding intervention was then presented. Following the first intervention, the participant was then presented with the choice of the two remaining-colored boxes. After selection, the participant was then presented with the corresponding selected intervention. Finally, the participant was presented with the last remaining intervention. For example: if error correction was assigned as the orange box, errorless learning was assigned the pink box, and RMIA was assigned the yellow box the participant would be presented with the orange, yellow, and pink boxes. If the participant selected the yellow box, then the researcher would implement the RMIA intervention. The researcher would then re-present the remaining pink and orange box. If the client then selected the pink box, the researcher would implement the

errorless learning intervention. Finally, the researcher would present the last intervention remaining: the orange box or the error correction intervention.

During each condition, the participant was sat down and oriented towards the researcher. Once the colored box was selected the researcher removed the necessary stimuli from the box and presented the corresponding SD. During each treatment condition, three different targets were always in acquisition, each directive was placed once per session. All correct responses were reinforced in all treatment conditions.

Baseline. Baseline sessions consisted of the presentation of three targets to each participant one time. Baseline was assigned to a clear box for the study. No teaching or intervention took place during this phase. Each participant was seated and presented with a discriminative stimulus for the corresponding domain. The researcher presented a receptive identification target and directive, a tacting target and directive and a matching target and directive in randomized order. No programmed reinforcers were delivered for correct responses. Participants moved to intervention once they had three days with a steady state of responding across all targets.

Error Correction. During error correction sessions, the SD was presented in the same manner as baseline. However, if an incorrect response was given, the researcher immediately performed the error correction procedure. Error correction consisted of re-presenting the SD followed by an immediate prompt and reinforcing the participant's correct prompted response. All responses were reinforced via social praise and access to an edible item. If the participant engaged in an incorrect response, error correction was ran once more. If the participant responded correctly, they were provided with a preferred item; if they respond incorrectly, the trial ended and no preferred item was given.

During error correction sessions, the targets identified for that domain were presented in randomized order to the participant. Each of the nine targets were ran during each intervention session.

Errorless Learning. During errorless learning sessions, the researcher immediately presented the errorless teaching procedure. The errorless procedure consisted of simultaneous prompting of the correct response. The SD was presented while the correct response was prompted. Following the prompted response, the child was given the opportunity to engage in an independent response following the delivery of the SD. Following the correct response, the researcher delivered one distracter trial consisting of skills in the participant's repertoire. The procedure ended with a final opportunity for the participant to engage in a correct response. A correct response was reinforced via social praise and an edible reinforcer. An incorrect response was followed with one more presentation of the errorless procedure. If another incorrect response was given, the trial was ended.

During errorless learning sessions, the targets identified for that domain were presented in randomized order to the participant. Each of the nine targets were ran during each intervention session.

Rapid Imitation Antecedent. In rapid imitation antecedent phase, the child was presented with three imitation directives from their repertoire presented in rapid succession followed by the target SD. For example, if the target response was tacting dog, and three imitation directives in the child's repertoire were clap, stomp, and wave, the presentation would be as follows: "do this…" (clap), "do this…" (stomp), "do this…" (wave), "what is it?" (while holding a picture of a dog). A correct target response was reinforced via social praise and an edible reinforcer. An incorrect response ended the trial.

During RMIA sessions, the targets identified for that domain were presented in randomized order to the participant. Each of the nine targets were ran during each intervention session.

Post-Session Assessment. During the final phase of the experiment, the VB-MAPP was administered again to note progress across the domains. Scores between the pre- and post-session probes were compared and progress was analyzed and reported via number of points added to VBMAPP scoring grid between onset and conclusion of the study.

Social Validity

A social validity questionnaire was presented to parents at the conclusion of the study to perceive any positive effects the parents observed in their child. The parents watched session videos of all treatment conditions administered throughout the study. The survey addressed questions pertaining to how satisfied the parents were with each of the interventions administered to their children during the study. They were also asked questions regarding whether they thought their child gained skills in each domain and if they were satisfied with the overall effects of the study. This survey also asked if parents recommended the procedures used in the study to other families with children diagnosed with ASD. All additional feedback was recorded at this time. The social validity questionnaire was administered via zoom to all parents of the participants following the post-session probes.

Results of the social validity questionnaire (see Table 5) showed that regarding satisfaction parents indicated they were all highly satisfied with the errorless learning intervention. Two parents indicated they were highly satisfied with post response error correction, and only one parent indicated they were highly satisfied with the RMIA intervention. However, when asked which intervention their child most enjoyed, 66% of parents indicated that

they felt their child's most enjoyed intervention was RMIA. Additionally, 66% of parents indicated that post response error correction was both their favorite intervention and the intervention that they felt the child learned best during.

Debriefing

The lead researcher debriefed the participants' parents after their child completed the post-session probes. In doing so, the lead researcher developed a summary of the information and data collected throughout the study. This debriefing also contained information on how the role the participant played in the study and how the study could benefit the field of ABA. Any questions the parents had regarding the study were also be addressed at this time.

Chapter 4: Results

The trends observed across participants are similar across procedure and target domain. Participants' cumulative mastered targets and mastered targets by domain are depicted in Figures 1-3, and each participants' preference data are presented in Figure 4. No participant acquired any targets during baseline and no participant acquired any tact targets during the RMIA intervention. However, all participants showed upward trends in data for all procedures cumulatively.

Figure 4 depicts the cumulative number of mastered tacts, receptive identification, and matching targets as well as the cumulative number of mastered targets within all domains for Mav. During baseline, Mav acquired no new skills. Within the tacting domain, Mav acquired no new targets during the RMIA intervention, six targets during the errorless learning intervention, and nine targets during the error correction intervention. Within the receptive identification domain, Mav acquired six targets during the RMIA intervention, 11 targets during the errorless learning intervention, and 10 targets during the error correction intervention. Finally, within the matching domain, Mav acquired eight targets during the RMIA intervention, 13 during the errorless learning intervention, and 13 during the post-response error correction intervention. Overall, Mav acquired 14 targets during the RMIA intervention, 30 targets during the errorless learning intervention, and 32 targets during the error correction intervention for a total of 76 mastered targets throughout the study. Mav chose RMIA first 54 times (72%), RMIA second 15 times (20%), and RMIA last six times (8%). He chose errorless learning first 16 times (21%), errorless learning second 49 times (65%), and errorless learning last 10 times (13%). Mav selected post response error correction first five times (7%), error correction second 11 times (15%), and selected error correction last 59 times (79%).

Figure 5 depicts the cumulative number of mastered tacts, receptive identification, and matching targets as well as the cumulative number of mastered targets within all domains for Kurts. During baseline, Kurts acquired no new skills. Within the tacting domain, Kurts acquired no new targets during the RMIA intervention, nine targets during the errorless learning intervention, and nine targets during the error correction intervention. Within the receptive identification domain, Kurts acquired four targets during the RMIA intervention, ten targets during the errorless learning intervention, and nine targets during the error correction intervention. Finally, during the within the matching domain, Kurts acquired nine targets during the RMIA intervention, 13 during the errorless learning intervention, and 13 during the post-response error correction intervention. Overall, Kurts acquired 13 targets during the RMIA intervention, 32 targets during the errorless learning intervention, and 31 targets during the error correction intervention for a total of 76 mastered targets throughout the study. Kathy chose RMIA first 60 times (80%), RMIA second 13 times (17%), and RMIA last two times (2%). She chose errorless learning first 15 times (20%), errorless learning second 43 times (57%), and errorless learning last 17 times (23%). Kathy selected post response error correction first zero times (0%), error correction second 19 times (25%), and selected error correction last 56 times (75%).

Figure 6 depicts the cumulative number of mastered tacts, receptive identification, and matching targets as well as the cumulative number of mastered targets within all domains for Kathy. During baseline, Kathy acquired no new skills. Within the tacting domain, Kathy acquired no new targets during the RMIA intervention, 11 targets during the errorless learning intervention, and 10 targets during the error correction intervention. Within the receptive identification domain, Kathy acquired four targets during the RMIA intervention, 10 targets

during the errorless learning intervention, and 10 targets during the error correction intervention. Finally, during the within the matching domain, Kathy acquired eight targets during the RMIA intervention, 14 during the errorless learning intervention, and 13 during the post-response error correction intervention. Overall, Kathy acquired 13 targets during the RMIA intervention, 36 targets during the errorless learning intervention, and 33 targets during the error correction intervention for a total of 82 mastered targets throughout the study. Kurts chose RMIA first 16 times (21%), RMIA second 51 times (68%), and RMIA last eight times (11%). He chose errorless learning first 55 times (73%), errorless learning second 12 times (16%), and errorless learning last eight times (11%). Kurts selected post response error correction first four times (5%), error correction second 12 times (16%), and selected error correction last 59 times (79%).

Each client also added between 5 and 10 points to their VBMAPP score from pre to post intervention administration (see figures 1, 2, & 3). Mav added 10 points to his VBMAPP score over the duration of the study. Post intervention he was able to tact over 20 common items, receptively identify nearly 40 common items, and was able to match non-identical sets of cards in an array of 10. Kurts added 5.5 points to his VBMAPP score from pre to post intervention administration. Kurts added 1.5 point to his tacting score and was able to tact over 25 items. He added 1.5 points to his listener responding score and was able to receptively identify over 20 common items in an array of 6 cards. Kurts added 2.5 points to his matching to sample score and was able to match any novel identical picture set in an array of 8. Finally, Kathy added 6 points to her VBMAPP score throughout the duration of the study. She added point to her tacting score and was able to correctly and independently tact over 30 items. She added 1.5 points to her listener responding score and was able to select the correct picture in an array of 6 for over 40

items. Kathy added 3.5 points to her matching to sample score and was able to match non identical picture sets in an array of 10.

Chapter 5: Summary, Conclusions, and Recommendations

The purpose of the current study was to compare three teaching methods utilized in increasing skill acquisition in children diagnosed with ASD. Overall, each client showed an upward trend in data across all interventions and all domains with the exception the RMIA and tacting acquisition pairing. All three participants acquired the lowest number of skills in the RMIA intervention, while all three participants responded similarly to both the errorless learning and post response error correction interventions. However, when it came to preference of intervention, participants selected the errorless learning last 77% of the time and selected RMIA first 58% of the time.

Researchers asked three questions at the onset of the study. Does the implementation of rapid motor imitation antecedents increase skill acquisition in receptive language, expressive language, and matching in children diagnosed with ASD? How does rapid motor imitation antecedents compare to other common methods of increasing skill acquisition in children with ASD? Is the participant's most preferred teaching procedure also the procedure that yields the most positive results for the participant? Results of the study suggest that RMIA is not effective in skill acquisition across the three tested domains, nor does it perform comparably with errorless learning and post response error correction procedures. Additionally, the most preferred intervention does not yield the most positive results in participants.

Interpretation of Findings

The results of the study showed steady upward trends in nearly all domain-intervention pairings, which is consistent with much of the previous literature. Both errorless learning and post-response error correction maintained significant upward trends in mastered targets across all three studied domains. During the errorless learning intervention, participants mastered a

collective 98 targets throughout the study. Similarly to the work of Braga-Kenyon et al. (2017), errorless learning produced consistent positive results in skill acquisition. The repeated exposure of the correct response and systematic reduction of exposure to incorrect responses eliminated error in all participants; consistent with the findings of Mueller, Palkovic & Maynard 2007). While the errorless learning intervention yielded the most significant, positive overall results during the study, it was the least preferred intervention according to participants. Participants selected errorless learning first in only 38% of the time. Errorless learning can be a broad term regarding what all can fall under the errorless learning umbrella. Research suggests that all forms of errorless learning produces positive results in skill acquisition.

Comparably, during the post response error correction phase, participants collectively mastered 96 targets in the duration of the study. Again, these findings are consistent with previous literature surrounding the effects of post-response error correction on skill acquisition of children diagnosed with ASD and other developmental delays. Consistent with findings of McGhan and Lerman (2013), accessing the correct response and having the correct response followed by a preferred item lead to steady skill acquisition across participants. The post response error correction phase was globally the least preferred intervention being selected last 77% of the time across participants.

Results of the current study showed that both errorless learning and post response error correct procedures increased skills across the domains for each participant at similar rates. Within both methods, the participant was provided with the correct response following each delivery of the directive if an incorrect response was given. In both error correction and errorless learning procedures, the participant was offered the correct response and upon repeating the correct response that participant gained access to those items identified as possible reinforcers. In

contrast, during the RMIA intervention, the correct response was never provided to the participant following an incorrect response.

During the RMIA intervention, acquisition rates were slower and upward trends were not as steep for all participants. During this intervention, no participants acquired any tact targets. Researchers hypothesize that the lack of skill acquisition was due to not accessing the correct response during an error correction procedure. Additionally, researchers hypothesize the slight upward trends in receptive identification and matching skills being likely due to gaining access to preferred items by selecting the correct response by chance due to the low field size utilized with the targeted skills. Acquisition rates were inconsistent with previous literature outlining success among teaching tacts utilizing RMIA (Tsiouri & Greer. 2013). However, in the current study, participants did not engage in any form of error correction during the RMIA intervention, which is inconsistent with RMIA procedures utilized in previous literature. Nevertheless, RMIA was the most preferred intervention across participants being selected first 58% of the time and being selected last only 7% of the time.

Recommendations

A limitation of the study which formed inconsistencies with previous literature was the fact that in the current study there was no error correction procedure paired with the RMIA intervention. If the client did not provide a correct response during the study, there was no access to the correct response or preferred items or activities. This pairing was omitted due to error correction being selected as one of the methods compared with RMIA during the study. Future research in teaching procedure pairing and comparing different pairings has the potential to strengthen teaching procedures and increase acquisition rates in children with developmental delays.

In previous literature, RMIA procedures were utilized to increase several operants of verbal behavior. Often, the operants would build upon one another to increase more complex vocal verbal language (Tsiouri & Greer, 2003). Future studies could set out to address how to chain the teaching and building of verbal operants together through utilizing RMIA and other procedures to increase skill acquisition and speed up the functional communication process.

In previous literature surround errorless learning, there are several variations that have been explored including trial and error, stimulus fading, stimulus fading, and delayed prompting. Future research could identify each variation, compare the procedures, and test different procedure pairings on skills acquisition rates of children with developmental delays.

A limitation surrounding the target selection for each participant was that difficult of targets was not directly assessed. Targets were selected based on what came next on a list of predetermined targets selected during the pre-session administration of the VBMAPP. The order of the list was random and consistent across participants. Thus, the level of difficulty of targets could have varied across domain for each participant as well as varying across participant.

During the initial phase of the study, baseline was only taken on three targets and not on all targets introduced throughout the study. This had to potential to lead to possible skewed data based on not ruling out whether the skill was not already learned between the original assessment and the target being introduced during the intervention phase.

A concurrent chains arrangement was utilized in the study to determine the order in which interventions were delivered during teach treatment session. Due to this, client preference played a large role in the order of delivery. Once clients began showing a preference towards a particular design, that design was often selected first and the order in which the interventions were delivered became consistent across study days. This consistency of order could have led to

sequencing effects and results of study could be a reflection of this sequencing effect rather than the interventions delivered.

An additional limitation of the study involved the repercussions of Covid-19. Due to Covid-19 exposures, positive results, and perceived complications of the virus, the research site experienced consistent absences of both staff and participants. These absences caused inconsistencies in schedules for all participants involved. These inconsistencies had the potential to slow acquisition rates across participants. Future research in this area has the potential to identify higher rates of acquisition with the successful implementation of most consistent scheduling procedures.

Finally, the current study utilized these teaching procedures on early levels of the VBMAPP assessment. Future research could be extended to other demographics and other skills. For example, studying the effect of these common teaching procedures on teaching higher level functional skills such as safety skills or utilizing these procedures with populations other than with individuals with developmental delays.

Implications

The findings of the current study further the existing research supporting errorless learning and post response error correction as successful teaching methods to be utilized when working with children diagnosed with ASD. This data supports the use and extends the research on the domain areas that can be affected by utilizing those two procedures. While the current data did not support utilizing RMIA on increasing tacting skills in children diagnosed with ASD, it did provide areas and gaps that can be filled with future research.

Based on the findings, it is suggested that pairing procedures could yield faster acquisition rates and improve the participants' experience. The most effective procedures in the

study were not the most preferred by participants. However, it is unknown what he preference and overall positive experience would be if those procedures were paired and utilized together.

The study concluded that while RMIA did increase skills in both receptive identification and matching domains, it did so at a slower rate than the other interventions studied. It was also found that the RMIA in isolation did not increase tacting skills in the three participants in the study. However, these findings both supported existing literature and lead to further research in these areas.

Participant preference is an important piece of a clinician's obligation to protect the individual's autonomy. When able, applying preference of intervention to the individual receiving the therapy allows the individual to be their own advocate. There is, however, the potential that the most effective strategy in increasing skills is not the most preferred strategy, such as what researchers founded in the current study. Making modifications to construct both an effective and preferred teaching method could yield the most positive results for the individuals engaged in therapy.

Conclusion

The results of the study extended literature surrounding both errorless learning and post response error correction being procedures utilized to increase skill acquisition in children diagnosed with ASD. Results showed that while RMIA increased skills in both matching and receptive identification domains, RMIA is most successful in increasing acquisition with echoic directives per previous literature. However, with the addition of an error correction method, previous literature suggests that RMIA is successful in increasing verbal behavior in children with developmental delays. With additional research combining teaching procedures, there is the

potential to decrease acquisition time and increase rates in acquisition for children diagnosed with ASD.

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Table 1

Participant Demographics

Demographic Variable	No	Percentage
Gender		
Male	2	66
Female	1	33
Total	3	100
Age		
18 mo-2 years	1	33
3 years-5 years	2	66
Total	3	100
VBMAPP pre score		
0-10	1	33
10-20	2	66
Total	3	100
VBMAPP post score		
10-20	1	33
20-30	2	66
Total	3	100

Table 2

Sample Target List

Intervention	Receptive Identification	Expressive Identification (Tact)	Matching
Errorless Learning	*Cat*	*Bus*	*Identical: Square*
	Dog	*Pig*	*Identical: Red*
	Ball	*Door*	*Identical: Socks*
Intervention	**Receptive Identification**	**Expressive Identification (Tact)**	**Matching**
Error Correction	*Table*	*Gum*	*Identical: Blue*
	Rabbit	*Potty*	*Identical: Circle*
	Pencil	*Car*	*Identical: Watch*
Intervention	**Receptive Identification**	**Expressive Identification (Tact)**	**Matching**
RMIA	*Cup*	*Shirt*	*Identical: Triangle*
	Phone	*Duck*	*Identical: Yellow*
	Keys	*Mouse*	*Identical: Computer*

Table 3

MSWO color preference results by participant

Item				Total
MV	Session 1	Session 2	Session 3	
Teal	1	1	1	3
Green	4	4	4	12
Orange	5	3	3	11
Pink	7	7	7	21
Dark Blue	2	2	2	6
Purple	6	6	6	18
Yellow	3	5	5	13

Item				Total
KS	Session 1	Session 2	Session 3	
Teal	3	1	4	8
Green	7	7	1	15
Orange	4	2	7	13
Pink	2	3	6	11
Dark Blue	6	6	5	17
Purple	4	4	2	10
Yellow	1	5	3	9

Item				Total
KH	Session 1	Session 2	Session 3	
Teal	6	6	7	19
Green	5	5	5	15
Orange	3	7	2	12
Pink	7	4	6	17
Dark Blue	1	3	4	8
Purple	2	2	3	7
Yellow	4	1	1	6

Table 4

Color Assignments per Condition Across Participants

	MV	KS	KH
Error Correction	Teal	Teal	Yellow
Errorless Learning	Dark Blue	Yellow	Purple
RMIA	Orange	Purple	Dark Blue

Table 5

Social Validity Survey Results

	Mav's Parent	Kurts' Parent	Kathy's Parents
Error Correction Satisfaction	3	2	3
Errorless Learning Satisfaction	3	3	3
RMIA Satisfaction	2	1	3
Child Learned Best	EC	EC	EL
Child Enjoyed Most	RMIA	EL	RMIA
Parent Favorite	EC	EC	EL

Note. Social validity survey results, completed by the participants' parents.

Figure 1

MV VBMAPP Scoring Grid

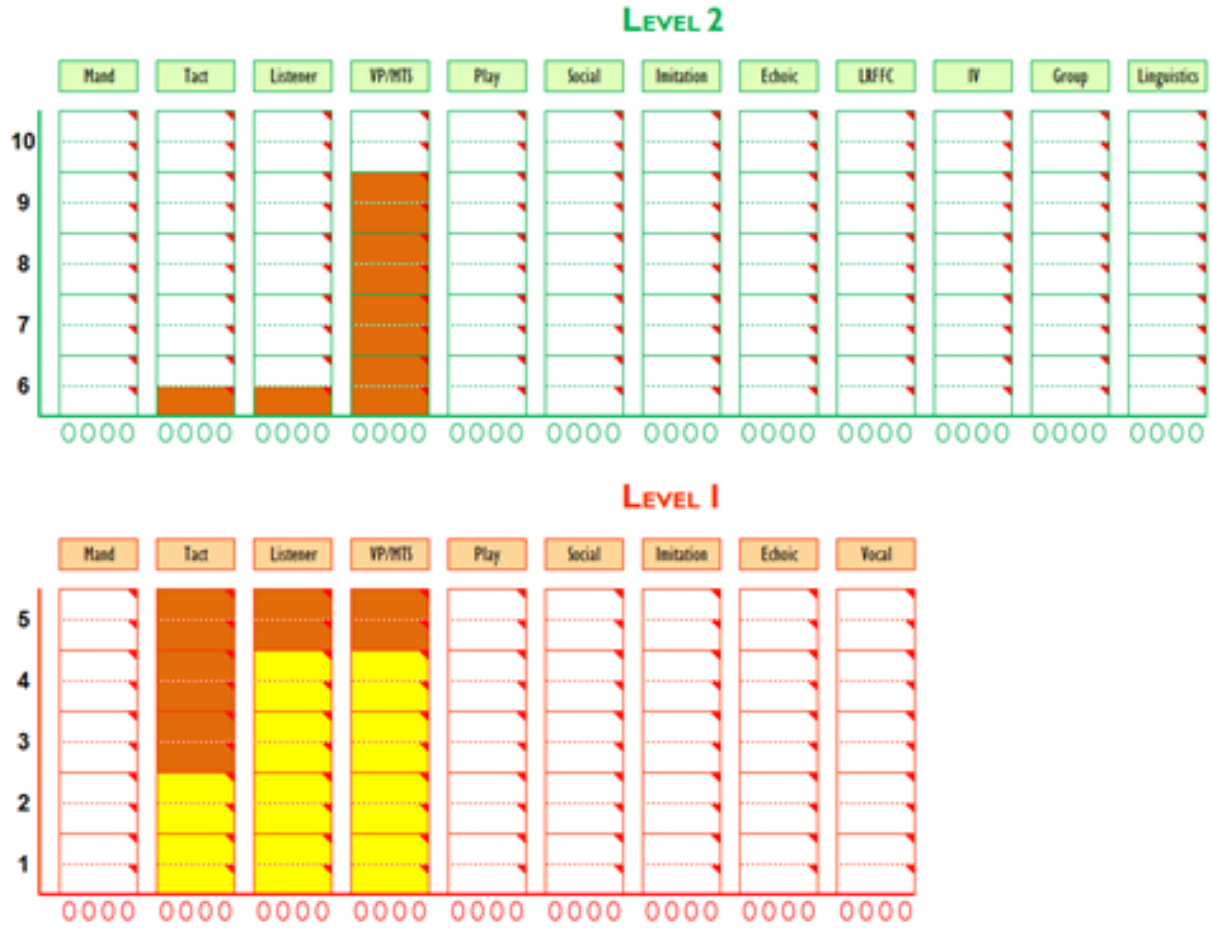


Figure 2

KS VBMAPP Scoring Grd

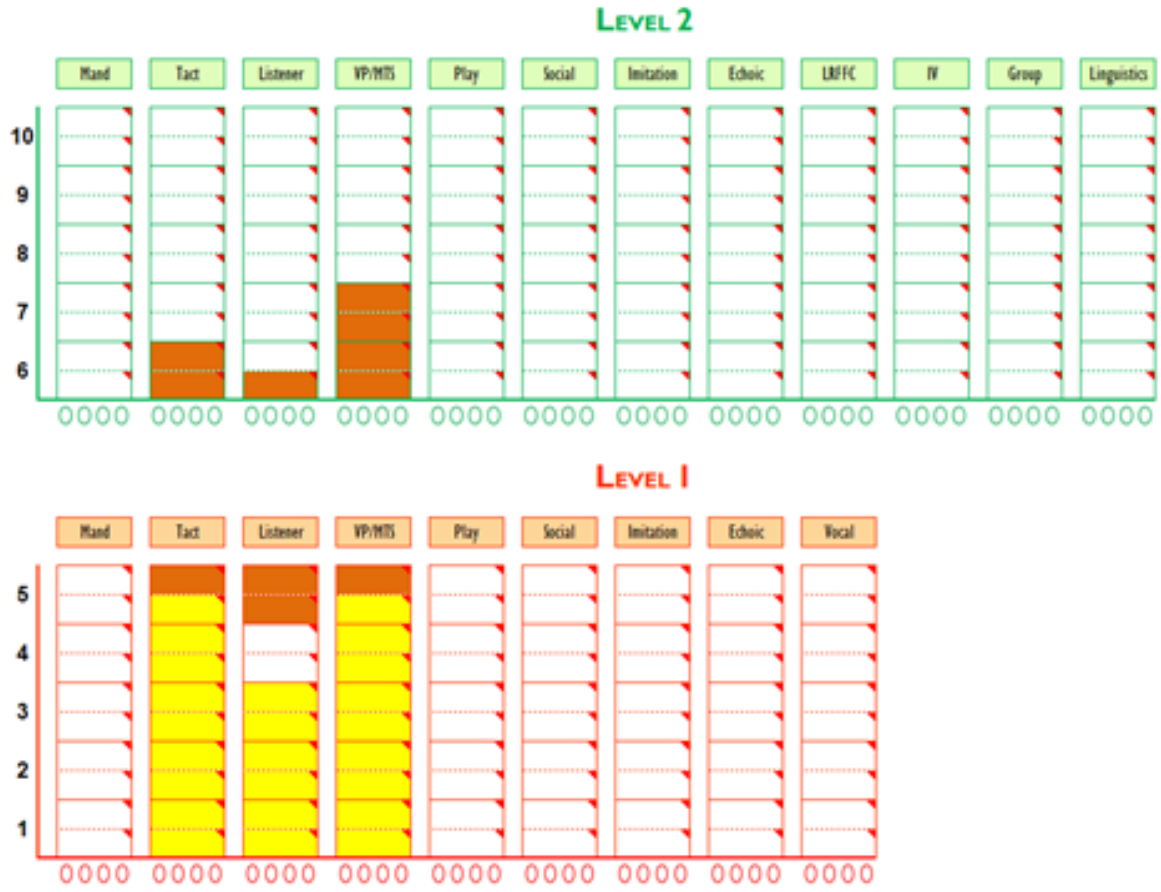


Figure 3

KH VBMAPP Scoring Grid

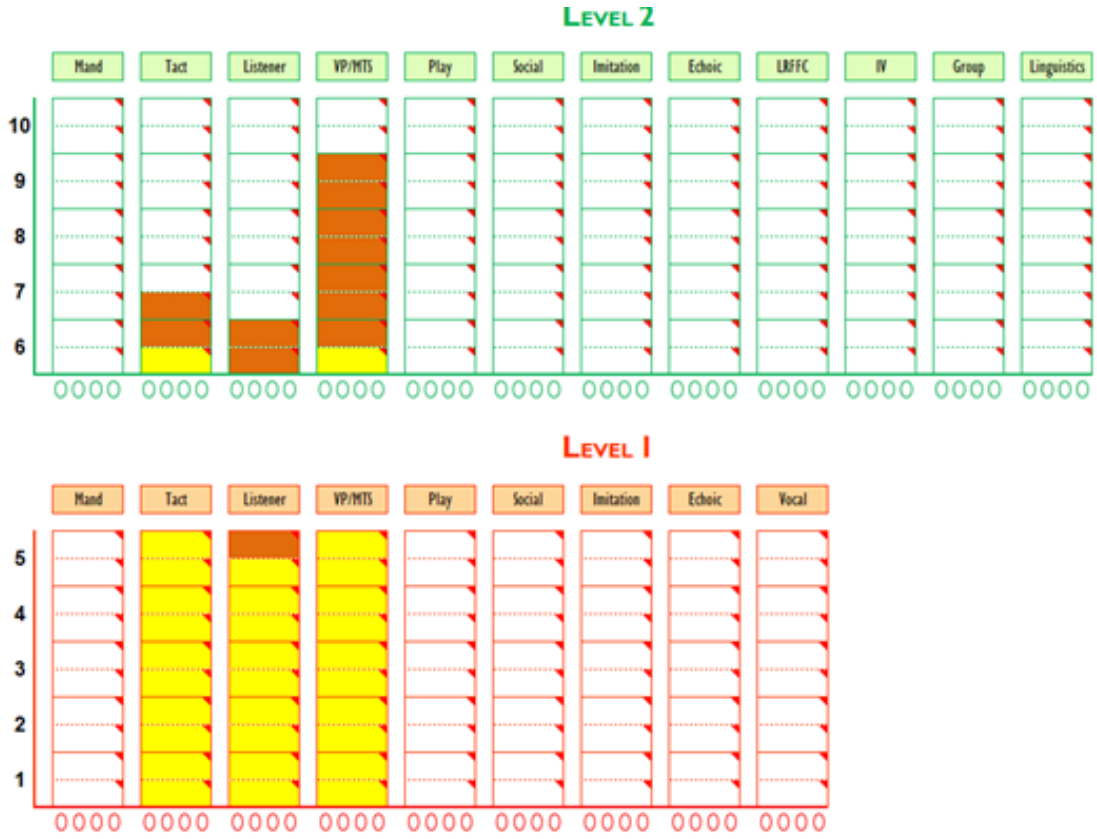


Figure 4

MV Study Graphs

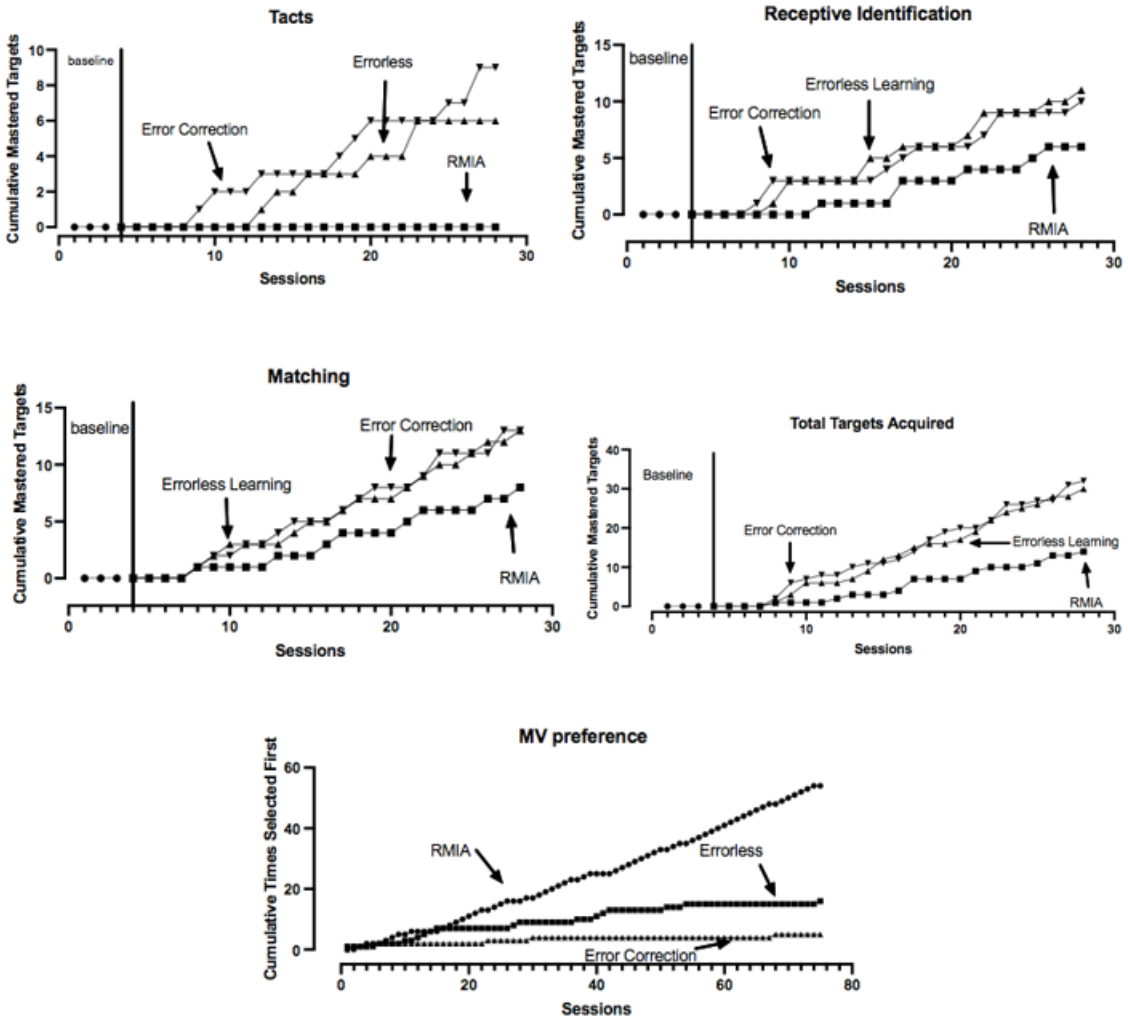


Figure 5

KS Study Graphs

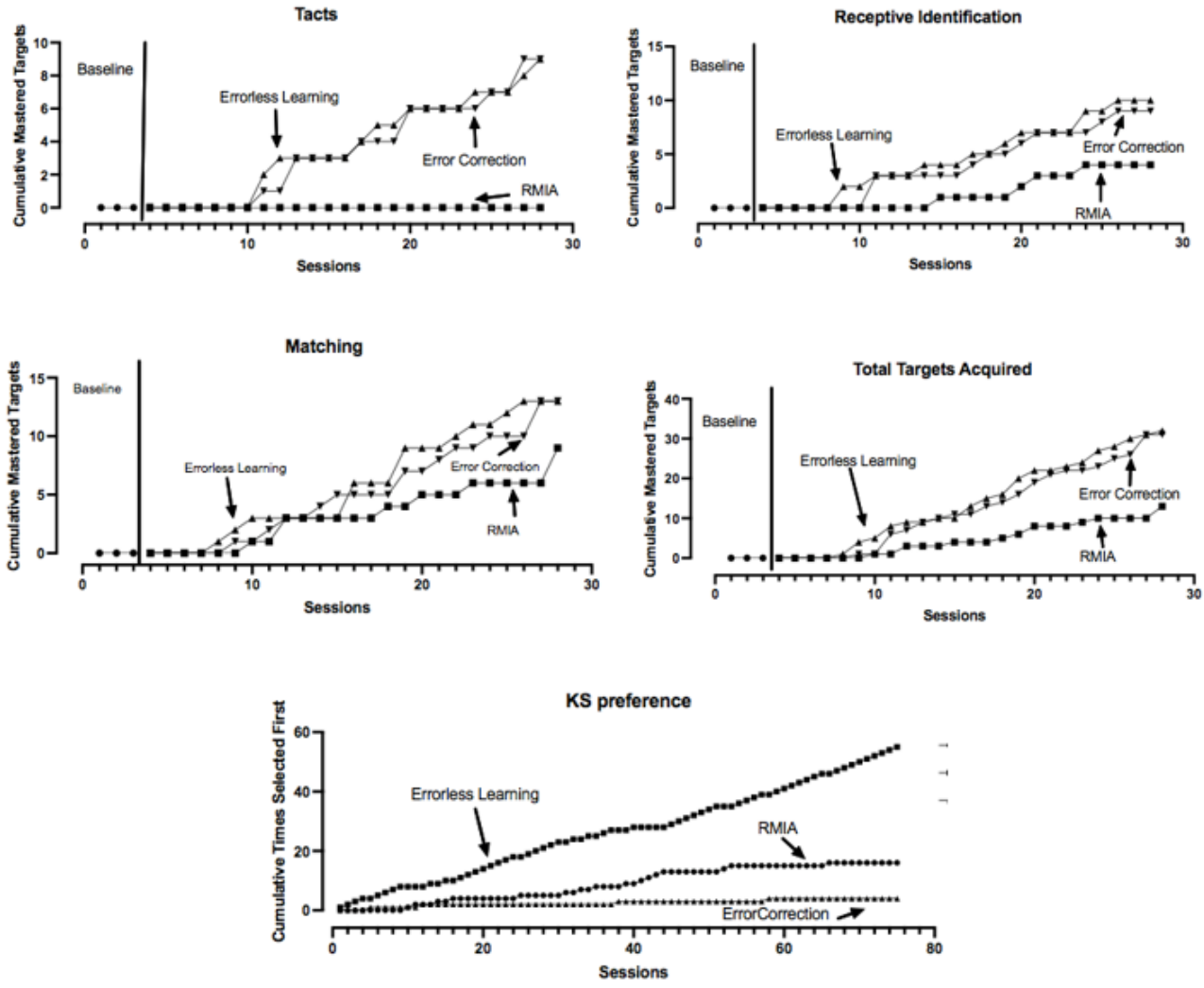
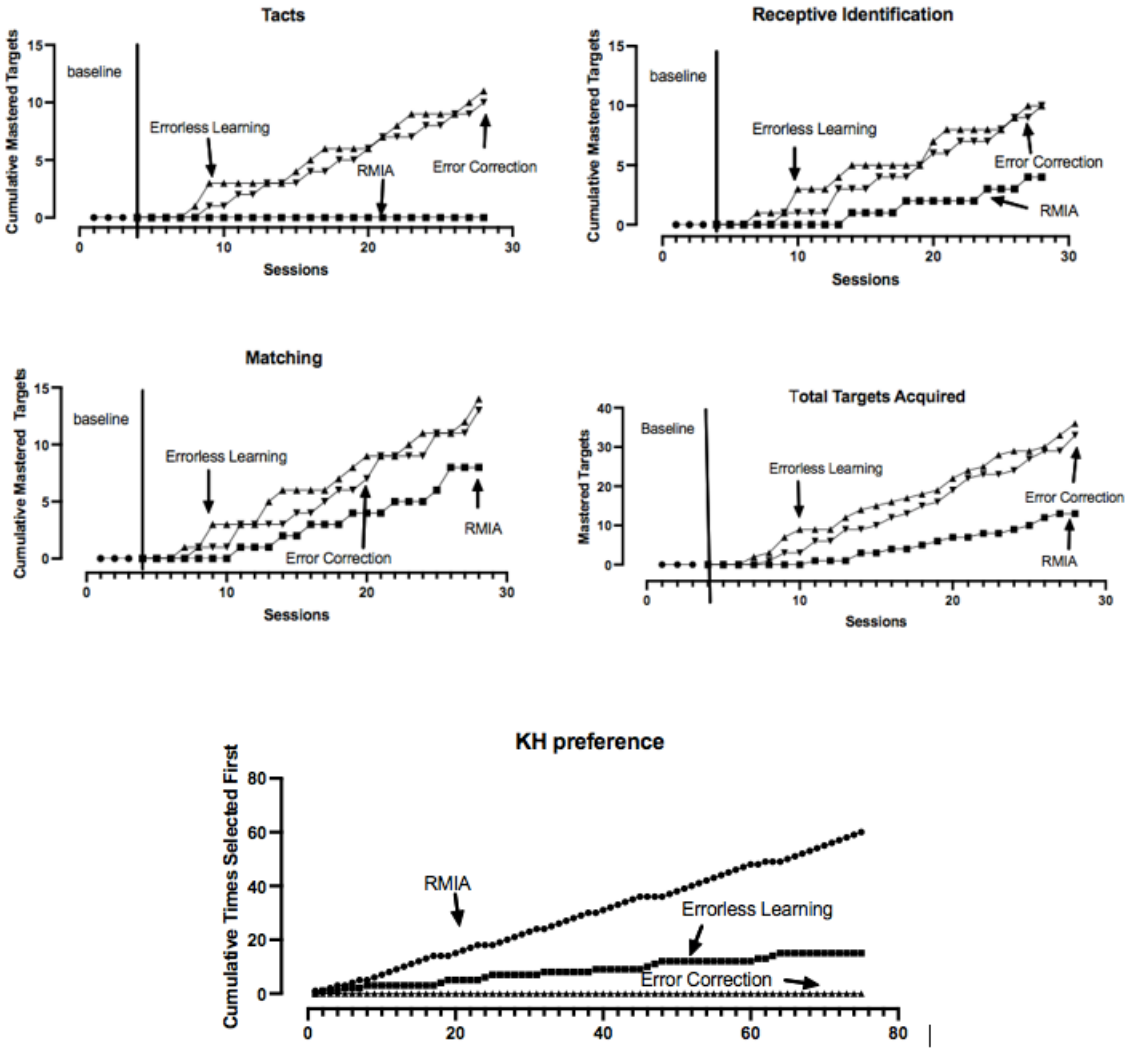


Figure 6

KH Study Graphs



Appendix A

Mr. & Mr. Client,

As part of Kailee Sherer Price's doctoral program, she is conducting a research study to examine the effectiveness of Rapid Imitation Antecedents or the presentation of 3-4 imitation directives ("do this" while clapping hands, "do this" while patting head, etc.) on the child's ability to acquire new /S (naming or labeling an item or object), receptive identification (selecting the correct item when asked "where is the *item?")*, and matching targets (placing an identical or non-identical picture on its corresponding match). I am writing you today to ask for your participation in her study. All participation is completely voluntary, but your child could potentially gain an increase in these skill areas. This study will take place at one of the Autism Support Now offices in your child's individual treatment room and the study will last approximately two months. Your child will have between two to three sessions per day and sessions will last one to three minutes. All sessions will occur during normal session hours unless otherwise approved.

The study will have six phases (pre-session probes, baseline, treatment I, treatment II, treatment III, and post-session probes). All sessions will be video recorded. Pre-session probes will consist of the lead researcher conducting the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP). This will determine your child's current level of functioning across the tacting, receptive language, and visual perceptual matching-to-sample domains. This will also allow the researcher to best pick target responses to address in the study. During baseline, one target from each domain will be presented to your child. Your child will be presented with three directives "what is it" (when shown a picture of an object), "where is the *item*" when in an array of other cards, and "match" while an identical or non-identical match is in the array in front of them. The first treatment phase will consist of post-response error correction for each target. In other words, if an incorrect response is given your child will be re-presented with the directive followed by an immediate prompt. The second treatment phase will consist of an errorless procedure. In other words, if an incorrect response is given your child will be presented with a prompted trial, an independent attempt, a distractor trial, and a final independent attempt. The final treatment phase will consist of the rapid imitation antecedent. In other words, your child will be presented with three imitation directives ("do this" 'clap', "do this" 'wave', "do this" slide block) followed by the target. These treatment phases will determine how your child learns best and what treatment yielding the best results for your child. The final phase is the post-session probes. In this phase, the researcher will complete the VB-MAPP again to determine progress made in the study.

If you would like to volunteer to participate in this research study, please contact Kailee Sherer Price, BCBA and doctoral student at The Chicago School of Professional Psychology via phone or email.

Thank you for your time and consideration for participation. Again, please feel free to contact Kailee Sherer Price, BCBA, doctoral student or Dr. Julie Ackerlund Brandt, BCBA-D, dissertation chair with any questions concerning the study.

Kailee Sherer, BCBA, doctoral candidate

Phone: (660) 342-0193

Email: ksherer@ego.thechicagoschool.edu

Julie Ackerlund Brandt, BCBA-D

Email: jbrandt@thechicagoschool.edu

Appendix B

Pre session probes

Participant: _____ Researcher: _____ Time: _____ Date:

_____ Phase: _____

Tacting	1	2	3	4	5	6	7	8	9	10	Score
"Target Directive" ("What is it?" ***DOG)***											
Receptive ID	1	2	3	4	5	6	7	8	9	10	Score
"Target Directive" ("Where is the ***DOG****")*											
Matching	1	2	3	4	5	6	7	8	9	10	Score
"Target Directive" ("Match" ***INDETICAL DOG)***											

Appendix C

Informed Consent

Investigators: Kailee Sherer

Study Title: Effects of Three Teaching Procedures on Skill Acquisition in Tacting, Receptive Identification, and Matching in Young Children with ASD

I am a student at The Chicago School of Professional Psychology. This study is being conducted as the dissertation requirement for the Applied Behavior Analysis Doctoral Program.

I am asking your child to participate in a research study about increasing skill acquisition in the areas of tacting (naming or labeling an item or object), receptive identification (selecting the correct item when asked "where is the item?"), and matching (placing an identical or non-identical picture on its corresponding match). In the study, your child will be presented with three different common methods used to increase skill acquisition in the three targeted domains. The three methods used are post-response error correction, errorless teaching, and rapid imitation antecedent. The post-response error correction will consist of providing a prompted response immediately following an incorrect response from the child. The errorless teaching procedure will consist of a prompted response, an independent attempt from the child, a distractor trial (an easy directive the child already knows), and ending with an independent attempt of the original directive. The rapid imitation antecedent will consist of the experimenter presenting three imitation directives ("do this" clap, "do this" wave, "do this" jump) followed by the targeted

domain directive. It is hypothesized that the imitation sequence being presented prior to the directive will increase correct responses and increase your child's skills in the three domains. You will be asked to complete a pre-screening questionnaire regarding your child and be asked to give consent for your child to participate in the study. This study may cause increase problem behavior due to increase in demands placed on your child during daily therapy. There is also a possibility of a breach in confidentiality, however this risk is minimized through procedures put in place by researchers. Although you and your child may not benefit, it will help to understand ways in which we can increase skill acquisition in children diagnosed with Autism Spectrum Disorder.

Please take your time to read the information below and feel free to ask any questions before signing this document.

Purpose: I will be conducting this study in hopes of finding an intervention effective in increasing skill acquisition in children diagnosed with Autism Spectrum Disorder. I hope that the results from the study will be helpful in providing therapy to young children with ASD.

Procedures: In this study, your child will participate in three different interventions (post-response error correction, errorless teaching, rapid motor imitation antecedents). There will be three treatment phases, or parts, to this study.

Treatment Phase 1. In the first treatment phase, your child will be presented with a directive from one of the three domains. All correct responses will be reinforced. All incorrect responses will be immediately followed by a prompted correct response to the original directive.

Treatment Phase 2. In the second treatment phase, your child will be presented with a directive from one of the three domains. All correct responses will be reinforced. All incorrect responses will be immediately followed by prompted trial, an independent attempt by your child, a distractor trial (distractor will be a mastered target your child can already compete), followed by a final independent attempt.

Treatment Phase 3. In the third treatment phase, your child will be presented with three imitation directives (“do this” clap, “do this” wave, “do this” jump) followed by a directive from one of the target domains. All correct responses will be reinforced.

Each session will last approximately 1-3 minutes and your child will have 2-3 sessions per day for approximately 2-3 months depending on responding.

All sessions will be video recorded via a tri-pod camera set up in the corner of the room. All videos will be stored for 5 years after the conclusion of the study in a password protected folder.

A debriefing session will be offered at the conclusion of the study. During this meeting, you can request results of your child and ask questions regarding the study. A summary of findings and how they will benefit the field of Applied Behavior Analysis will be provided to you.

Risks to Participation: Perceived risks include possible increase in problem behaviors due to increased demands. Problem behavior will be minimized by providing breaks between study sessions and regular work sessions. If an increase in problem behavior presents itself to be at a higher than normal level, the study will be terminated with your child. These risks are perceived to be no more than what would be experienced in a regular therapy session. There is also opportunity for loss of confidentiality in the study. Confidentiality will be protected by assigning each participant with a numeric code so no identifying names or initials are used in the study.

Benefits to Participants: Possible benefits for your child's participation can include increasing skill acquisition in the three domain areas. There is also a potential benefit to the field of Applied Behavior Analysis. Findings could further research in the field and assist in constructing behavior analytic programming.

Alternatives to Participation: Participation in this study is voluntary. You may withdraw your child from study participation at any time without any penalty.

Confidentiality: During this study, information will be collected about your child for the purpose of this research. This includes age, diagnosis, and where your child receives ABA services.

Your child's confidentiality will be taken seriously throughout the study. Consent forms, which will have your child's name will be kept in a locked file for 5 years. They will only be accessible to researcher and individuals on her comps team. After a consent form is signed, a numeric code

will be assigned to your child to protect his/her confidentiality and will be used for any presentations or publications of the study results.

Videotapes which will contain images, voices, and possibly have your child's name, these will be kept in a secure electronic cloud drive for a minimum of 5 years. During the course of this study, this researcher, faculty research advisor, and another student selected as second observer will have access to the electronic files via secure password.

Possible limitations to the confidentiality of the study is the fact that your child is a client of Autism Support Now (ASN). Your child's scores will be seen by myself and all other data collectors. Once scores are inserted into the data system, all will be anonymous. It is possible that your child's data may be used for future research or distributed to another researcher without your consent. However, information that could identify you will be removed.
Your research records may be reviewed by federal agencies whose responsibility is to protect human subjects participating in research, including the Office of Human Research Protections (OHRP) and by representatives from The Chicago School of Professional Psychology Institutional Review Board, a committee that oversees research.

Questions/Concerns: If you have questions related to the procedures described in this document please contact:

Kailee Sherer, BCBA, Doctoral Student
(660) 342-0193

Dr. Julie Ackerlund Brandt, BCBA-D, LBA
715-456-1707

ksherer@ego.thechicagoschool.edu jbrandt@thechicagoschool.edu

If you have questions concerning your rights in this research study you may contact the Institutional Review Board (IRB), which is concerned with the protection of subjects in research project. You may reach the IRB office Monday-Friday by calling 312.467.2343 or writing: Institutional Review Board, The Chicago School of Professional Psychology, 325 N. Wells, Chicago, Illinois, 60654.

Consent to Participate in Research

Parents of Participant:

I have read the above information and have received satisfactory answers to my questions. I understand the research project and the procedures involved have been explained to me. I agree to allow my child to participate in this study. My child's participation is voluntary and I do not have to sign this form if I do not want my child to be part of this research project. I will receive a copy of this consent form for my records.

_____

Name of Participant (print)

_____

Name of Parent (print)

_____

Signature of Participant

Date: _____

_____

Name of the Person Obtaining Consent (print)

_____

Signature of the Person Obtaining Consent

Date: _____

Appendix D

Participant: _____ Researcher: _____ Time: _____ Date:

_____ Phase: _____

Tacting	1	2	3	4	5	6	7	8	9	10	Score
"Target Directive" ("What is it?" ***DOG)***											
Receptive ID	1	2	3	4	5	6	7	8	9	10	Score
"Target Directive" ("Where is the ***DOG****")*											
Matching	1	2	3	4	5	6	7	8	9	10	Score
"Target Directive" ("Match" ***INDETICAL DOG)***											

Participant: _____ Researcher: _____ Time: _____ Date:

_____ Phase: _____

Tacting	1	2	3	4	5	6	7	8	9	10	Score
"Target Directive" ("What is it?" ***DOG)***											
Receptive ID	1	2	3	4	5	6	7	8	9	10	Score
"Target Directive" ("Where is the ***DOG****")*											
Matching	1	2	3	4	5	6	7	8	9	10	Score
"Target Directive" ("Match" ***INDETICAL DOG)***											

Appendix E

Treatment Phase 1: Errorless Learning

Implementation Step	Completed? Y/N	Initials
Gather materials (reinforcers, writing utensil, data sheet, mastered skill list)		
Room Set Up		
Gain Child's Attention		
Present Target Directive		
If incorrect response given, present immediate prompted trial		
If incorrect response given, present SD allow independent response		
If incorrect response given, present distractor trial		
If incorrect response given, present target SD allow independent response		
Reinforce Correct Response		
Record Data		

Treatment Phase 2: Post-Response Error Correction

Implementation Step	Completed? Y/N	Initials
Gather materials (reinforcers, writing utensil, data sheet)		
Room Set Up		
Gain Child's Attention		
Present Target Directive		
If incorrect response given		
Reinforce Correct Response		
Record data		

Treatment Phase 3: Rapid Motor Imitation Antecedent

Implementation Step	Completed? Y/N	Initials
Gather materials (reinforcers, writing utensil, data sheet)		
Room Set Up		
Gain Child's Attention		
Present rapid imitation sequence (3 imitation directives)		
Present Target Directive		
Reinforce Correct Response		
Record data		