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Comparing Multiple Stimulus Preference Assessments to the In-the-Moment Reinforcer Analysis

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by

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Abstract

The provision of reinforcement to increase desired behaviors is a crucial element of behavior analytic intervention for individuals diagnosed with Autism Spectrum Disorder. Formal preference assessments, like the multiple stimulus without replacement procedure (MSWO), are often used to determine reinforcers used during intervention. While these types of assessments have been widely investigated, there is no empirical evidence to support that these rigorous methods of reinforcement identification produce higher rates of responding compared to the in-the-moment reinforcer analysis. The present study compared the average number of chips sorted per session on a sorting task when participants were reinforced with items selected based on an MSWO preference assessment versus items provided using in-the-moment reinforcer analysis. The results showed no significant difference in the average number of chips sorted, however there were differences in terms of efficiency.

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Chapter I: Introduction and Literature Review

Catania (2013) stated that a stimulus is a positive reinforcer if "its presentation increases responding that produces it" (p. 460). For individuals diagnosed with autism spectrum disorder (ASD) to acquire new target behaviors, maintain the targeted behaviors overtime, and generalize the targeted behaviors; interventionists must use reinforcement within the context of behavior analytic intervention (Hanley, Iwata, & Roscoe, 2006; Pace, Ivancic, Edwards, Iwata, & Page, 1985). Thus, it would be important for interventionists to identify potential reinforcers prior to implementing behavior analytic intervention. While some individuals may be able to identify potential reinforcers when asked about their preferences, individuals with severe disabilities and/or ASD are less capable of relaying this information for a variety of reasons, including limited or no verbal language, interfering behaviors, and lack of comprehension or play skills (Pace et al., 1985). Given these challenges researchers have developed a variety of formal preference assessments to help identify preferences for individuals with ASD and that are highly predictive of having a reinforcer effect (Fisher et al., 1992; Piazza, Fisher, Hagopian, Bowman, & Toole, 1996). These formal preference assessments have included: the single stimulus approach (SS) (Pace et al., 1985), the paired-stimulus preference assessment (PS) (Fisher et al., 1992), multiple stimulus with or without replacement (MSW, MSWO) (DeLeon & Iwata, 1996), and the free operant procedure (FO) (Roane, Vollmer, Ringdahl, &Marcus, 1998).

Cihon et al. (2017, Submitted for publication) conducted a literature review of formal preference assessments as they are implemented for individuals diagnosed with ASD. In this review, the authors evaluated 69 studies from 2004 to 2016. The results of the study showed that within this time span, there was a total of nine studies that involved a single-stimulus approach,

47 studies that involved a paired stimulus preference assessment, five studies that involved an MSW, 20 studies that involved an MSWO, and seven studies that involved a free operant procedure. The authors concluded that the research on all formal preference assessments was robust but questioned their actual utility.

Formal preference assessments have not only been conducted in the research but are widely used within clinical practice. In 2012, Graff and Karsten published their survey of 406 professionals (e.g., Board Certified Behavior Analysts (BCBA), non-certified practitioners, individuals with a degree in behavior analysis, psychology or special education) working with individuals with developmental disabilities on their use of a range of formal preference assessment strategies. Of all respondents surveyed, 52% reported using at least one direct formal preference assessment procedure. Moreover, 33% reported having previously conducted either a multiple stimulus with or without replacement. Graff and Karsten (2012) also reported that 45% of BCBAs and 47% of individuals with a degree in behavior analysis used a full scale formal preference assessment ranging from several times a day to once a month.

One of the first formal preference assessments where interventionists compared multiple items was the paired stimulus (PS) preference assessment, conducted by Fisher et al. (1992). Stimuli were presented in pairs and presented once with every other stimulus in a randomized order. The participant was required to make a choice between the stimuli within 5 seconds. A choice response was defined as reaching toward or touching an item. After a choice was made, the participant was given about 5 seconds to engage with the item they chose, after which the item was withdrawn and the next pair of items was presented. Participant approach responses to both items concurrently were blocked. If a participant did not demonstrate any choice responses

within the 5 seconds allotted, the therapist prompted the participant to sample each item for 5 seconds; then the two items were re-introduced. If the participant did not approach either stimuli within the 5 seconds, both stimuli were withdrawn and the next pairing was presented. These selections were recorded and preference rankings determined by calculating the percentage of approach responses per stimulus.

In this study, the researchers utilized a concurrent operant paradigm to assess a single stimulus approach compared to a forced-choice, or paired stimulus presentation, in order to identify reinforcers for children diagnosed with a variety of physical, intellectual, and developmental disabilities. Results showed that while both assessment methods could accurately identify high preference stimuli, the paired stimulus assessment demonstrated a greater differentiation among stimuli; additionally, it better predicted which stimuli would produce higher levels of responding when issued contingently during work tasks or activities (i.e., predictive validity).

Researchers have replicated the findings from Fisher et al., 1992 (Vollmer, Marcus, & LeBlanc, 1994). Additionally, according to recent reviews of the literature as well as previously conducted surveys, the most commonly used method to determine reinforcement preference is the paired stimulus preference assessment (Tullis et al., 2011). In this review, paired stimulus preference assessments were conducted in 40% of all studies that have used a formal preference assessment.

Another formal preference assessment that can be conducted is the multiple stimulus without replacement (MSWO). This assessment procedure begins with all stimuli placed randomly and equidistant in a straight line on a table. All the stimuli are available simultaneously

for each trial for the duration of the assessment (i.e., predetermined number of trials). The participant is seated across from the table and is instructed by the researcher to choose one item. When an item is selected, the participant is given access to the item. The selected item is then removed from the array of stimuli and items are shifted by moving the item at the left end of the array to the right end; all items are moved so that there is an equal distance between them prior to the subsequent trial. The assessment continues until each item is selected by the participant or until the participant does not choose an item from the array within 30 seconds of the instruction to select an item. When this occurs, the assessment ends and the items that are not chosen are documented as, "not selected." Preferences are determined by calculating the percentage of approach behaviors per stimulus.

The first study that was conducted on the MSWO was a study that compared the paired stimulus preference assessment to the MSWO (DeLeon & Iwata, 1996). In this study, the authors compared the paired preference assessment to the MSWO and to the multiple stimulus with replacement (MSW) for seven adults with developmental disabilities. The MSWO procedure generated similar rankings and consistency of rankings amongst stimuli to the rankings produced by the same participants when using a paired preference assessment. Additionally, findings from this study showed that the MSWO procedure identified more reinforcers than the MS assessment method. Moreover, both multiple stimulus formats took less than half the time to complete compared to the paired preference assessment. Overall, the study concluded that the MSWO shares similar benefits to the paired preference assessment but is more time efficient; and therefore, may be preferred.

The MSWO procedure has been researched in a variety of subsequent studies. In 2000, Carr, Nicolson, and Higbee evaluated the MSWO procedure with three children diagnosed with ASD. Results of this study demonstrated that the high preference items chosen by all three participants yielded the most frequent level of accurate responses followed by moderate preference items and low preference items. Additionally, for two of the three participants, the preferences determined in their initial MSWO assessment remained stable over eight additional MSWO assessments throughout a four-week period. Similarly, these results suggested that fewer than five MSWO assessments were necessary in order to determine preference rankings, making it even more efficient than DeLeon and Iwata (1996) originally stated.

Higbee, Carr, and Harrison (2000) expanded the research of MSWO assessments with nine adults with intellectual disabilities. In this study, the brief MSWO conducted by Carr, Nicolson, and Higbee (2000) was utilized with the participants to determine their top four ranked items. These items were delivered as reinforcers upon accurate responding during a neutral task (i.e., pressing a button that activated a microswitch counting mechanism). For many participants, the item that was deemed highly preferred (i.e., ranked first) produced a higher reinforcer effect than those ranked lower in the MSWO assessment, as indicated by an increase in responding over baseline levels.

Another way to evaluate preference and potential reinforcers for individuals diagnosed with ASD is using the in-the-moment reinforcer analysis (IMRA) (Leaf, Leaf, Alcalay, et al., 2015; Leaf, Leaf, Leaf, et al., 2016). IMRA falls into a progressive framework of ABA (Leaf, Leaf, McEachin, et al., 2016). Instead of the teacher implementing formal preference assessments prior to teaching, the interventionist uses in the-moment decisions based upon

clinical judgment to determine which item will serve as a potential reinforcer on any given reinforcing opportunity.

When interventionists use IMRA there are a variety of factors to consider. The first factor is the child's affect (e.g., facial expression, body language). If the child is smiling, giggling, or seems "happy," the teacher may choose to use that item as a reinforcer more often; although, if the child seems disinterested, apathetic, or upset, the item is chosen less frequently. Another factor is how the child interacts with the item. If the child makes comments suggesting they like the item or they are having fun, the item may be chosen more often; however, if the child makes statements that indicate they are not having fun or do not like the item, the teacher is less likely to choose that item again. A third factor is how often the item has been used during previous trials or sessions in order to prevent satiation of the item (e.g., looking at data sheets from previous sessions). If the teacher calculates that the items has been chosen in more than 70% of trials across the previous three sessions or over 70% of trials within a session, they would choose a different item as a reinforcer. The teacher also factors in the child's improvement following the provision of a specific reinforcer. If the teacher assesses that trials following the delivery of a specific item yield better results, the teacher may choose to deliver that item more often. This helps the teacher determine the effect of the reinforcer on the child's responding and could be used intermittently throughout trials.

A fifth factor that helps guide the teacher's decision-making process is incorporating items with similar reinforcement qualities as items that have previously been determined as preferred. The teacher may choose to select items similar to other highly preferred stimuli in order to condition those items and expand the child's repertoire of reinforcement. Finally, the

teacher factors in their ability to condition alternative item as reinforcers (Greer & Singer-Dudek, 2008; Greer, Singer-Dudek, & Gautreaux, 2006; Leaf et al., 2012; Leaf, Kassardjian, et al., 2015; Leaf, Oppenheim-Leaf, et al., 2016). If the child begins playing with the reinforcer in similar ways in which they play with other preferred items, the teacher is more likely to select that items as a reinforcer; if the child does not play with the item in novel ways or similar to how they play with other items, the teacher is less likely to choose that item.

Leaf, Leaf, Alcalay, et al. (2015) first investigated the use of in-the-moment reinforcer analysis as compared to a formal PS preference assessment (Fisher et al., 1992) to evaluate the rate of responding during a sorting task with three children diagnosed with ASD. Ten items were determined as highly preferred stimuli according to interviews with the members of each participant's clinical team. These 10 items were included in each of the two PS preference assessments that were conducted in order to determine the top three preferred items; teachers used these three items as reinforcers in the preference assessment condition. The same 10 items were also used in the IMRA condition, however, the teacher in this condition was allowed to use any of the highly preferred items, based on using in-the-moment evaluations to influence their decision-making process with respect to delivering reinforcers. Additionally, a control condition was implemented in which no reinforcers were delivered. All three conditions consisted of six one-minute trials in which participants were given the option of engaging in a simple sorting task (i.e., putting red poker chips in its designated box, green poker chips in its designated box, and white poker chips in its designated box). Reinforcement was delivered based on the participant sorting a pre-determined number of chips, established during baseline. The number of chips required in order to access reinforcement increased throughout the study.

Results of the study showed that there was little difference in the level of responding across both the PS preference assessment condition as well as in the IMRA condition; for two of the participants, responding decreased in the control condition when no reinforcement was available. The researchers also analyzed the distribution of reinforcers in terms of the percentage of the time the therapists in the IMRA condition chose each of the stimuli from the PS preference assessment as reinforcers throughout intervention. For two of the participants, the therapists in the IMRA condition selected more reinforcers outside the top three items ranked in the PS preference assessment. For one participant, the therapist selected items deemed most preferred from the PS preference assessment more often, however they selected the least preferred item from the preference assessment the majority of the time. Finally, the results indicated that the IMRA was far more efficient than the paired preference assessment. The PS preference assessments conducted prior to baseline added an average of 87 minutes to the preference assessment condition across all three participants. Additionally, the IMRA condition took less time to complete, eliminating approximately 87 minutes from intervention when compared to the PS preference assessment condition.

Leaf, Leaf, Leaf, et al. (2016) expanded upon this first study by comparing the PS preference assessment to the IMRA for teaching two pre-school aged children diagnosed with ASD a variety of expressive labels (i.e., comic book characters; associations). The study simulated the conditions developed by Leaf, Leaf, Alcalay, et al. (2015) with respect to identifying reinforcers for both the preference assessment condition and the in-the-moment reinforcer analysis condition. Reinforcement in both conditions was delivered upon accurate responding based on the target skills (e.g., “Who is it?” “What goes with a restaurant?”). This

study revealed findings similar to that of the original study; the results across the two teaching conditions were similar. While participants demonstrated skill acquisition during both conditions, the in-the-moment reinforcer analysis was more efficient for both participants. While one participant responded with a greater degree of accuracy on more trials in the in-the-moment reinforcer analysis condition, the other participant's level of responding was almost identical across both conditions. Overall, no significant difference was found with respect to skill acquisition, responding, or maintenance. The results also showed that the teachers in the in-the-moment reinforcer analysis condition selected items outside the top three ranked items more often for both participants. Finally, the IMRA condition was more efficient than the PS preference assessment condition in terms of total time, total number of sessions, and total number of trials across both participants. This follow-up study confirmed previous findings that conducting PS preference assessments provided no real benefit to the participants, and instead, carried the disadvantage of increasing the time required for participants to achieve mastery on skills.

These two studies (Leaf, Leaf, Alcalay, et al. 2015; Leaf, Leaf, Leaf, et al. 2016) mentioned above represent research that has compared two different forms of preference assessments in terms of their effectiveness and efficiency. There have been other studies that have compared two or more preference assessments in an attempt to find the most efficacious procedures. These include comparing the PS preference assessment to the single stimulus approach (Fisher et al., 1992; Paclawskyj & Vollmer, 1995); the free operant approach to the MSW preference assessment (Kodak, Fisher, Kelley, & Kisamore, 2009); and the PS to the MSWO (Call, Trosclair-Lasserre, Findley, Reavis, & Shillingsburg, 2012; Davies, Chand, Yu,

Martin, & Martin, 2013; Horrocks & Morgan, 2009; Lang, van der Werff, Verbeek, & Didden, 2014; Lanner, Nichols, Field, Hanson, & Zane, 2010).Given the need to find effective reinforcers for individuals diagnosed with ASD (Hanley et al., 2006; Pace et al., 1985), the need to find the most effective procedures (National Autism Center, 2015), and the need to maximize teaching time (Leaf, Leaf, Alcalay, et al., 2015; Leaf, Leaf, Leaf, et al., 2016), researchers should continue to compare various preference assessments to each other. Thus, the purpose of this study is to compare two forms of formal preference assessments (i.e., MSWO and IMRA) that have been shown to be effective in previous studies (Leaf, Leaf, Alcalay, et al. 2015; Leaf, Leaf, Leaf, et al., 2016) but have not yet been compared to each other empirically (Cihon et al., 2017), thereby extending the previous research on both MSWO and IMRA.

Chapter II: Method

Participants

Jeff was a three- and a half-year-old boy diagnosed with Autistic Disorder. Jeff had a Wechsler Preschool and Primary Scale of Intelligence-IV (WPPSI-IV) full scale IQ score of 105, a Vineland Adaptive Behavior Scales (VABS) composite score of 79, a Peabody Picture Vocabulary Test (PPVT-IV) standard score of 107 (68th percentile), and an Expressive One Word Picture Vocabulary Test (EOWPVT) standard score of 100. He had age-typical conversational skills (e.g., spoke in full sentences, used spontaneous language, demonstrated a wide range of vocabulary, used accurate grammar and syntax, could independently engage in reciprocal conversation commensurate with his same aged peers) and displayed intermediate play skills (e.g., imaginative play, parallel play, cooperative play). Jeff displayed a few stereotypic behaviors including body and mouth tensing during activities that elicited excitement (e.g., outdoor games, music) and making repetitive comments and asking repetitive questions. Prior to the study, Jeff had received 15 months of intensive early behavioral intervention.

Louis was a 7-year-old boy diagnosed with Autistic Disorder. Louis had a WPPSI-IV full scale IQ score of 72, a VABS composite score of 69, a Gilliam Autism Rating Scale-2 (GARS-2) Autism Quotient of 70 (probability of autism: possibly), a Social Skills Improvement System-Parent Version (SSIS-P) standard score of 84, a PPVT-IV standard score of 77 (6th percentile), and an EOWPVT standard score of 94. Louis showed intermediate conversational skills (e.g., spoke in full sentences, used spontaneous language, demonstrated a moderate range of vocabulary for his age, often used incorrect grammar and syntax, could engage in reciprocal conversation commensurate with his same aged peers with minimal prompts) and displayed

beginning play skills (e.g., imaginative play, parallel play, game play). Louis demonstrated a variety of stereotypic behavior, including perseveration on topics of special interest, making repetitive statements, talking in character voices, and an adherence to his schedule. Prior to the study, Louis had received 11 months of intensive early behavioral intervention.

Robert was a 9-year-old boy diagnosed with Autistic Disorder. Robert had a VABS composite score of 74, a PPVT-IV standard score of 109 (73rd percentile), and an EOWPVT standard score of 97. He displayed intermediate conversational skills (e.g., spoke in full sentences, used spontaneous language, demonstrated a moderate range of vocabulary for his age, often used incorrect grammar and syntax, could engage in reciprocal conversation commensurate with his same aged peers with minimal prompts) and displayed intermediate play skills (e.g., imaginative play, parallel play, cooperative play). Robert demonstrated several stereotypic behaviors, consisting of arm flapping, making perseverative statements and asking repetitive questions. Prior to the study, Robert had not received any intensive behavioral intervention.

Brandon was an 8-year-old boy diagnosed with Autistic Disorder. Brandon had a PPVT-IV standard score of 106 (66th percentile) and an EOWPVT standard score of 118. He had intermediate conversational skills (e.g., spoke in full sentences, used spontaneous language, demonstrated a wide range of vocabulary, used accurate grammar and syntax, could engage in reciprocal conversation commensurate with his peers with consistent prompts) and displayed intermediate play skills (e.g., imaginative play, parallel play, cooperative play). Brandon demonstrated a moderate level of stereotypic behavior, including perseverations and rigidities. Prior to the study, Brandon had not received any intensive early behavioral intervention.

Setting

All phases in this study took place in the research room at the agency's center located in Seal Beach, California. This room measured 25 ft. by 10 ft. and was separated into two areas. The front of the room had a long table and two chairs used for research sessions; the back of the room contained four desks and chairs and a sitting area with two small couches and a coffee table.

Teachers

The study was conducted by four behavior analysts, ranging in age from 23- to 28-years-old. All four behavior analysts were interns in a year-long training internship that was administered and managed by a private agency that provides intensive behavioral treatment for individuals with ASD. Although all four teachers had some level of experience with either ABA or ASD, they were all novice in the progressive model of ABA. Thus, the purpose of the internship program was to train them on the principles of applied behavior analysis and ASD through a progressive framework.

The first teacher, Sally, was 28-years-old and had a Master's degree in Science in Behavior Analysis and was a Board Certified Behavior Analyst (BCBA). She had five years of previous experience working in the field of Applied Behavior Analysis. The second teacher, Miranda, was 27-years-old and had a Master's degree in Special Education with an emphasis in Applied Behavior Analysis. She had six- and one-half years of prior experience working in the field of Applied Behavior Analysis. Isabelle, the third teacher, was also 27-years-old and had a Master's degree in Special Education with an emphasis in Applied Behavior Analysis. She had worked in the field of Applied Behavior Analysis for six years prior to the start of the study. The

fourth teacher, Ethan, was 23-years-old and had a Bachelor's degree in Psychology and Film. He had no formal previous experience working in the field of Applied Behavior Analysis.

The researchers ensured that each teacher would work with two participants with which they had no history and that they would alternate conditions for each of the participants (i.e., for one participant they would implement the IMRA and for the second participant they would implement the MSWO). Table 1 (see Appendix) provides information of who the teacher was randomly assigned to and what condition they were assigned to. The teachers utilized in the study were kept blind from each other's findings and were not allowed to discuss the results of any sessions or reinforcers used within each condition. As such, the teachers assigned to the in-the-moment reinforce analysis did not know the results of the MSWO preference assessment. Teachers were responsible for running the assessment, as well as the assessment condition sessions they were randomly assigned to. If the teacher was randomly assigned to the MSWO condition, he or she was expected to run the two MSWO preference assessments, as well as the MSWO assessment condition sessions. If a teacher was randomly assigned to the IMRA condition, he or she was responsible for running the in-the-moment reinforcer analysis. The control condition was run by teachers assigned to either condition.

Teacher Training

All teachers participated in a training that consisted of three parts. The first part of the training focused on the principles of ABA and information on ASD. This initial training provided a general didactic overview covering topics such as reinforcement (e.g., definition, reinforcement guidelines), preference assessments (e.g., types, utility), and the overall purpose of the study. Additionally, the training emphasized to the participants not to disclose any results

from their research sessions until the end of the study to keep them blind from each other's findings.

The second portion of the training focused on teaching participants how to conduct a multiple stimulus without replacement preference assessment as well as how to conduct baseline, and the control and MSWO conditions of intervention. First, the lead researcher modelled the preference assessment with an additional person acting as the "child," using 10 toys chosen at random by the lead researcher. Next, each participant had the opportunity to demonstrate the implementation of the assessment. The steps of the assessment were written out as a prompt for the participant. The lead researcher provided in-the-moment feedback, if necessary. The participant was required to meet mastery criterion (100% of the steps performed accurately on one role play of the complete simulation of the preference assessment) before moving on to the next step of the training. Training for baseline, control and the MSWO conditions were identical and taught to the teachers one condition at a time. All steps of each of procedure were modelled by the researcher. The teacher then had the opportunity to role play implementing the procedure, accurately responding to a variety of potential behaviors acted out by an additional person posing as the "child" participant (e.g., interfering behaviors during the task, not engaging in the task at all). A checklist of the steps of each procedure was available for the teacher to use as a prompt, if necessary. Mastery criterion was set at 100% of the steps performed accurately during one role play (i.e., six identical trials).

The third part of the training concentrated on the IMRA condition. Since the main difference in the implementation of the protocols of the MSWO and IMRA conditions is the way in which reinforcers are selected following the task (e.g., formal assessment vs. "in-the-

moment" evaluations), this is the area that was specifically targeted. First, the lead researcher provided a brief review of considerations related to these kinds of evaluations, including the child's affect; how the child interacts with the item; how often the item has been used throughout the session; the child's improvement following the provision of a specific reinforcer; incorporating items with similar reinforcement qualities as items that have previously been determined as preferred; and the teacher's ability to condition alternative items as reinforcers. Similar to previous training procedures, the lead researcher modelled the reinforcer selection component of the IMRA condition with the second researcher six times. However, in order to help increase comprehension of the procedure, the lead researcher added an extra component to the training protocol by asking the teachers why he/she selected the reinforcer following each trial. Then the teachers each role played the steps of the IMRA condition. Based on the considerations listed above, the teacher had to assess which reinforcers to select after each trial. Similar to the previous trainings, role plays consisted of six trials; mastery criterion for this portion was choosing a contingent reinforcer for 80% of the trials during one role play.

Materials

Materials in this study fell into three broad categories: (a) instructional materials, (b) reinforcer materials, and (c) research related materials. Instructional materials consisted of three rubber bins and 450 poker chips (i.e., 150 red poker chips, 150 green poker chips, and 150 white poker chips). Reinforcer materials included various toys that could be used as reinforcers for completing the task (see below). Research materials consisted of different colored mats designated to each condition (i.e., blue mat for in-the-moment reinforce analysis, red mat for multiple stimulus preference assessment, and yellow mat for the control condition), timers to

time the rate of responding and the length of the entire research session, data sheets to record each child's rate of responding per trial per condition, and a video camera to record research sessions.

Dependent Measures

Four dependent variables were evaluated in this study. The primary dependent variable was the average number of chips sorted per session in each condition (i.e., MSWO, in-the-moment reinforcer analysis, and control condition). At the end of each session, for each condition, the researcher determined the total number of chips the child sorted in each session divided by the total number of trials. The second dependent variable was efficiency. This was calculated by the total amount of time each child spent in each of the three conditions. For the MSWO condition, the total time included both the time the participants spent in the MSWO condition as well as time spent during the multiple stimulus preference assessment. For the IMRA condition the total time was just the total time spent during the IMRA condition.

The third measure was the stimuli selected by the teachers in the IMRA condition. In this condition; the teacher(s) could select amongst any of 10 different toys (see below). The researcher evaluated the percentage of times the teacher selected each of the 10 stimuli across all IMRA sessions. The final measure was the rationale for choosing the toy, provided by the teacher, in the IMRA condition. For each trial that reinforcement could be accessed, the teacher would indicate the reason(s) why they chose the reinforcer, based on the factors taken into account when conducting an in-the-moment reinforce analysis, as described by Leaf, Leaf, Alcalay et al. (2015) or a different reason identified by the teacher and written in on the data sheet. Reinforcer rationale was calculated by evaluating the percentage of the time each reason

was indicated. Definition for the various reinforcer rationales are displayed in Table 2 (see Appendix).

Procedure

Pre-Baseline-Reinforcer Identification

In order to determine which potential reinforcers to include in the multiple stimulus preference assessment and to use in the IMRA condition, the two teachers (i.e., one teacher assigned to IMRA and one teacher assigned to MSWO) were told to go shopping for 10 toys. The teachers were informed of the age of the participant, the gender of the participant, and that no single toy could exceed $20.00. Finally, the teachers were told that they had to work collaboratively to come up with 10 toys from a national toy shop. The researchers did not inform them who the participant was so that toy selection would be blind to potential preferences.

Pre-Baseline-Multiple Stimulus without Replacement Preference Assessment

Once 10 toys were identified and purchased for a participant, two separate MSWO assessments were conducted by the teacher assigned to that condition. Prior to starting the first MSWO assessment, the participants had the opportunity to play with each item for approximately 30 seconds. Next, the teacher assigned to the MSWO condition began the preference assessment. The MSWO consisted of the teacher placing all 10 items in a randomized array on a table in front of the participant and asking the participant to select an item to play with. After physically selecting an item to play with, the participant was given 30 seconds access to that item. During this time, the teacher could socially engage with the participant and the item. The item that was selected was then removed from the array, and the remaining items in the array were rotated to the left. This process was repeated until all items from the array were

selected by the participant. If the participant chose several items simultaneously, the teacher ended the trial and presented the trial again. If no items were selected within 10 seconds of the start of a trial, the teacher ended the trial and presented the trial again. If no items were selected after two consecutive trials, the teacher ended the preference assessment.

The second day of the preference assessment was identical to the first day with the exception that the participant did not engage with the items prior to the assessment. The three items chosen most frequently across both days were used as reinforcers during the MSWO condition, whereas all 10 items were used as reinforcers during the in-the-moment reinforcer analysis condition.

General Procedure

Research sessions were conducted five days per week for Jeff and Louis and two days per week for Robert and Brandon. A single research session was conducted per day, which consisted of the preference assessment condition, in-the-moment reinforcer analysis condition, and control condition. The order of each of these conditions was randomized and counterbalanced ahead of time. Participants received at least a -2 to 5-minute break in between each of the conditions.

The general procedure for all three conditions was as follows. Prior to calling the participant into the research room, the teacher set up the work materials by placing one large bin containing 450 poker chips (i.e., 150 red chips, 150 green chips, and 150 white chips) on the table and placing three smaller bins next to the larger bin. The three smaller bins each contained a single-color poker chip placed at the bottom of the bin; one bin had a red poker chip, one bin had a green poker chip, and one bin had a white poker chip. The teacher then called the participant into the room and had the participant sit directly across from him/her. Next, the

teacher placed the colored mat that corresponded with one of the conditions on the table (i.e., a blue mat for the in-the-moment reinforcer analysis condition, a red mat for the preference assessment condition, and a yellow mat for the control condition). The teacher then provided the following instruction: "I want you to sort the chips (while pointing to the large bin), the red chips go in here (pointing to the bin with the red chip placed in it), the green chips go in here (pointing to the bin with the green chip placed in it), and the white chips go in here (pointing to the bin with the white chip placed in it). You can do as many as you want, but you do not have to do any if you do not want to. You will be working for toys this time (during the preference and in-the-moment reinforcer analysis conditions) or there will be no toys this time (during baseline or control condition). Ready, set, go!" Within one second of saying "go," the teacher started an electronic timer and gave the participant one-minute to sort as many chips as he chooses to sort. The teacher did not provide any prompts or reinforcement, redirect any off-task behavior, and did not socially interact with the participant during the one-minute period of time.

Once the designated time was up, the teacher told the participant to "stop" and/or blocked the participant from sorting any additional chips. The teacher counted the number of chips that were correctly sorted in each of the bins aloud (excluding the baseline condition in which the chips were not counted out loud). A consequence was provided, determined by the condition, as well as whether the participant met the targeted number of pieces (described below). There were a total of six trials per condition per session.

The number of chips that the participant had to sort in order to access reinforcement in both the preference assessment condition and the in-the-moment reinforce analysis condition varied; this number was told to the teacher each day that a research session was implemented,

but was not communicated to the participant. During the first session of intervention, in order to earn reinforcement, participants were required to sort 20% more chips than their average calculated across three baseline sessions. After every two consecutive sessions in which the participant met the targeted number of chips, in either the preference assessment condition or the in-the-moment reinforcer analysis condition, the targeted number of chips increased by 20%. If, after three consecutive sessions, the participant was unable to meet the targeted number in any of the conditions, the researcher decreased the targeted number by 20%.

MSWO Condition

The MSWO condition session was made up of six total trials where the teachers could only use the top three most preferred toys as identified from the MSWO assessment. The teachers who were randomly assigned to this condition conducted every session in the MSWO condition. Each trial was implemented using the general procedure mentioned above. If the participant sorted enough chips to meet or surpass the target number, the teacher provided him with one-minute access to one of the three items or activities. The three top items selected in the MSWO assessment were evenly distributed across the six trials; the participant had a chance to earn each item two times per session. The order of delivery of the reinforcers was predetermined prior to each session. The participant was given only one item per trial. If the participant sorted enough chips, the teacher said, “You got enough, we can play with . . .” However, if the participant did not sort enough chips to meet or surpass the target number, the teacher said, “You did not sort enough chips and there will be no toy this time.”

In-the-Moment Reinforcer Analysis Condition

Similarly, each IMRA condition session also included six trials, however the teachers could use any of the 10 toys that were purchased from the toy store for the participant. The teachers who were randomly assigned to this condition conducted every IMRA session. Each trial was implemented using the same procedure described above. If the participant did not sort enough chips to meet or surpass the target number, the teacher said, "You did not sort enough chips and there will be no toy this time." However, if the participant did sort enough chips to meet or surpass the target number, the teacher said, "You got enough, we can play with . . . " and provided him with one-minute access to any of the 10 items that were assessed in the MSWO preference assessment. The teacher had the flexibility to choose any of the items at his or her own discretion. The same item could be chosen throughout the research session or different items could be selected after each trial; only one item, however, could be selected per trial. The selections made by the teacher in this condition were based upon a number of variables. While the teacher was directed by guidelines, albeit flexible ones, and their evaluations of the participant's preferences could change moment to moment. On each opportunity for reinforcement, the teacher would consider a variety of factors, mentioned previously. These included the participant's affect (i.e., facial expression, body language); the way in which the participant interacted with the stimuli, including comments or statements that indicated whether they liked or disliked the item; the frequency with which the reinforcing item had been provided during previous trials or sessions; the participant's skill improvement (i.e., the extent to which the child's performance yields better results following the provision of a specific reinforcer; the teacher's own ability to expand upon the child's repertoire of reinforcing stimuli by choosing an

item of similar quality to an item previously determined as preferred; and the teacher's ability to condition an item as more reinforcing to the participant.

Control Condition

Control sessions were implemented by both teachers assigned to the MSWO and IMRA condition based upon teacher and participant availability on a given day. Control sessions were also comprised of six trials as described above. Participants were told that that they would not be working for items during this condition (described above). At the end of each trial, the teacher provided neutral or no feedback to the participant, regardless of the amount of chips he accurately sorted and began the subsequent trial. No further reinforcement was provided during control condition sessions.

Baseline

During the baseline condition, only the control condition was implemented (see above). Baseline was conducted until stable responding was demonstrated.

Intervention

During the intervention condition, the researchers implemented the control condition, MSWO condition, and the IMRA condition (all described above). The order of these three conditions was randomized and counterbalanced to help minimize the potential for carryover. Each of the three conditions was separated by a short 2- to 5-minute break.

Experimental Design

An alternating treatments design was used to assess the effects of the three conditions (MSWO, IMRA, and control) on chips sorted per session. The order in which each condition was

presented during research sessions was randomly determined prior to beginning the session and was counterbalanced to control for sequence effects.

Interobserver Reliability

The teacher running the session scored the participant's responses during every session. A second observer (first author or research assistant) simultaneously and independently recorded participant responses during 100% of the MSWO preference assessments, 100% of baseline sessions, 100% of MSWO condition sessions, 100% of IMRA condition sessions, and 96.5% of control condition sessions. Inter-observer agreement was calculated by totaling the number of agreements (i.e., number of trials in which both observers scored the same amount of chips sorted) divided by the number of agreements plus disagreements and converting this ratio to a percentage. IOA was 100%, 99.4%, 99.7%, 99.8%, and 99.7%, for each of the above-mentioned conditions, respectively.

Treatment Integrity

In order to assess treatment integrity, a second observer (first author or research assistant) independently scored (according to a checklist) whether the teacher assigned to the preference assessment condition implemented correct instructor behaviors during the MSWO preference assessment as well as during MSWO sessions. Integrity was also scored during the IMRA condition, as well as during the control condition and baseline. Treatment integrity was scored for 33% of sessions for each phase of the study. Performance results were calculated by dividing the total number of correct checklist items by the total number of checklist items. Treatment integrity for the MSWO preference assessment, baseline, the control condition the MSWO condition, and the IMRA condition was 98.1%, 100%, 99.7%, 99.7%, and 99%, respectively.

Correct instructor behaviors per trial of intervention consisted of: (a) placing the colored mat that corresponded to the condition on the work table; (b) placing all 4 bins on the table; (c) reading the script (described above) correctly; (d) setting a timer for one minute and providing the participants with the opportunity to sort the counting manipulatives for the allotted time; (d) withholding any feedback (e.g., prompts, reinforcement) throughout the one minute interval; (e) preventing the child from sorting additional pieces when the timer stopped; (f) counting the number of chips sorted; (g) recording the chips on the data sheet; (h) offering the correct reinforcer based on participant's rate of responding during the task or providing no reinforcer in the control condition; and (i) providing one minute of reinforcement, as applicable. For the MSWO condition, the teacher must select only one of the three reinforcing items, established in the MSWO preference assessment conducted prior to intervention. For the IMRA, the teacher would choose to deliver the reinforcing stimulus determined by several factors, including the participant's affect, verbal statements, not providing the item over 70% of sessions, and/or the teacher conditioning the stimuli as preferred items similar to procedures identified by Leaf et al. (2012).

Chapter III: Results

Average Number of Chips Sorted

The primary dependent variable was each participant's average number of chips sorted per session during the three conditions. The results of this measure are depicted in Figure 1 (see Appendix). Each panel depicts a different participant's average amount of chips sorted per trial per session. Across the x-axis is the number of sessions and across the y-axis is the average number of chips sorted per trial within a given session, across the three conditions. It must be noted that the range along the y-axis and x-axis varies from panel to panel, due to the various range of chips that each participant sorted per sessions and the number of sessions each participant received.

Jeff's data is depicted in the upper left panel. During baseline sessions, Jeff sorted an average of 6.38 chips per trial across three sessions. Following baseline, Jeff participated in 10 research sessions; his average rate of responding was 37.46, 37.5, and 25.4 chips sorted for the MSWO, IMRA, and control condition, respectively. In three out of 10 sessions, Jeff sorted more chips in the MSWO condition; in six out of 10 sessions Jeff sorted more chips in the IMRA condition; and in one out of 10 sessions, Jeff sorted more in the control condition. A one-tailed t-test showed that there was no significant difference in responding in the MSWO and IMRA condition ($p = 0.494$), that there was a significant difference in responding between the MSWO and control condition during intervention ($p = 0.0326$), and that there was a significant difference in responding between the IMRA condition and control condition during intervention ($p = 0.0455$). Although, there were significant differences between the two reinforcement conditions and the control condition, we did see an increase in responding during the control condition in

the final sessions of intervention. The researchers hypothesized that this could have been due to carry over and, therefore, returned Jeff to baseline, where an immediate drop in responding occurred. In total, the results indicated no real differences between the two reinforcement conditions (i.e., IMRA and MSWO) but that both reinforcement conditions resulted in more responding than a no-reinforcement condition.

Louis' data is depicted in the upper right panel. Louis sorted an average of 32.6 chips per trial across three baseline sessions. Louis participated in seven research sessions; his average rate of responding was 67.57, 70.61, and 69.23 chips sorted for the MSWO, IMRA, and control condition, respectively. In two out of seven sessions, Louis sorted more chips in the MSWO condition; in four out of seven sessions, Louis sorted more chips in the IMRA condition; and in one out of seven sessions, Louis sorted more chips in the control condition. A one-tailed t-test showed that there was no significant difference in responding in the MSWO and IMRA condition ($p = 0.227$), that there were no significant differences in responding between the MSWO and control condition during intervention ($p = 0.287$), and that there was no significant difference in responding between the IMRA condition and control condition during intervention ($p = 0.368$). In total, the results indicate no real differences between the two reinforcement conditions (i.e., IMRA and MSWO) or the control condition.

Robert's data is depicted in the lower left-hand panel. Robert sorted an average of 33.22 chips per trial across three baseline sessions. Robert participated in five research sessions; his average rate of responding was 93.46, 91.6, and 79.4 chips sorted for the MSWO, the IMRA, and control condition, respectively. In three out of five sessions, Robert sorted more chips in the MSWO condition and, in two out of five sessions, Robert sorted more chips in the IMRA

condition. A one-tailed t-test showed that there were no significant differences in responding in the MSWO and IMRA condition ($p = 0.383$), that there was a significant difference in responding between the MSWO and control condition during intervention ($p = 0.0228$), and that there was a significant difference in responding between the IMRA condition and control condition during intervention ($p = 0.0472$). In total, the results indicated no real differences between the two reinforcement conditions (i.e., IMRA and MSWO) but significant differences as compared to a no reinforcement control.

Brandon's data is depicted in the lower right-hand panel. Throughout baseline, Brandon sorted an average of 33.27 chips per trial across three sessions. Brandon participated in seven research sessions; his average rate of responding was 85.71, 89.85, and 80.09 chips sorted for the MSWO, IMRA, and control condition, respectively. In three out of seven sessions, Brandon sorted more chips in the MSWO condition; in three out of seven sessions, Brandon sorted more chips in the IMRA condition; and, in one session, Brandon sorted more chips in the control condition. A one-tailed t-test showed that there was no significant difference in responding in the MSWO and IMRA condition ($p = 0.258$), that there was not a significant difference in responding between the MSWO and control condition during intervention ($p = 0.104$), and that there was not a significant difference in responding between the IMRA condition and control condition during intervention ($p = 0.052$). In total, the results indicated no real differences between the two reinforcement conditions (i.e., IMRA and MSWO) and no significant differences between the two reinforcement conditions and the control condition. Thus, the results showed no significant differences between the three conditions.

Efficiency Measure

Table 3 (see Appendix) displays the efficiency results across the three participants. For the MSWO condition, we measured the total time conducting the MSWO assessments, the total session time, and then a total time (i.e., total assessment time plus total session time). For the IMRA condition we measured just the total session time since there were no assessments conducted in this condition.

Across the four participants, the average amount of time spent on the MSWO assessment was 27:59 (range 26:48 to 29:43 minutes). Across the four participants, the average amount of time spent on the MSWO sessions was 122:19 minutes (range 91:12 to 166:13 minutes). Across the four participants, the average total amount of time spent in MSWO was 150:18 (range 120:55 to 193:01 minutes). Across the four participants, the average amount of total time spent in IMRA Session was 129:08 minutes (range 95:00 min to 170:21 min).

All four participants spent a longer amount of time in sessions during intervention in the IMRA condition then in the MSWO condition; this is a result of having more trials that resulted in reinforcement, thus, increasing the amount of time within each session. When you factor in the MSWO assessment that occurred prior to the intervention condition, the total amount of time is greater for the MSWO condition then the IMRA condition for all four participants (see Appendix Table 3). Jeff spent approximately 23 minutes longer in the MSWO condition to achieve similar results as the IMRA (see Appendix, Table 3). Louis spent approximately 15 minutes longer in the MSWO condition to achieve similar results as IMRA (see Appendix, Table 3). Robert spent approximately 26 minutes longer in the MSWO condition to achieve similar results as IMRA

(see Appendix, Table 3). Brandon spent approximately 22 minutes longer in the MSWO condition to achieve similar results as IMRA (see Appendix, Table 3).

Distribution of Stimulus Selection

Figure 2 (see Appendix) depicts the percentage of aggregate trials that the IMRA therapist selected each of the 10 reinforcers that could be used within the condition. Each panel represents one of the four participants. On the x-axis are the 10 different toys that could have been selected and on the y-axis are the percentage of opportunities each of these toys were selected. The toys are listed in order of their preference as determined by the MSWO preference assessment; the most preferred item is closer to the y-axis and the least preferred item is furthest from the y-axis.

For Jeff (see Appendix, Figure 2, upper left-hand panel), the two items that were delivered most frequently were the toy shark (18.4%) and the rocket balloon (15.7%). Rocket balloons were deemed the least preferred in the preference assessment while the shark was the 5th most preferred. The top three items that were determined most preferred and used as reinforcers in the MSWO condition were the Thomas the Train, toy car (Monster Hot Wheels) and a Woody doll; the teachers in the in-the-moment reinforcer analysis condition selected these items during 13.1%, 7.8%, and 7.8% of opportunities, respectively. For Jeff, the teacher in the IMRA condition selected items that were not used in the MSWO condition more frequently than items that were used in the MSWO condition.

For Louis (see Appendix, Figure 2, upper right-hand panel), the three items that the teacher chose to deliver most frequently were the air hockey game (28.5%) and the Batman toy and the flyer spinner, the latter two chosen an equal percentage of the time (23.8%). The hockey

game was deemed the fifth most preferred item and the batman toy the most preferred item by the MSWO assessment. The top three items that were determined most preferred and used as reinforcers in the MSWO condition were the Batman toy, a remote-control car, and a flyer spinner; the teachers in the IMRA selected these items during 23.8%, 9.5%, and 23.8% of opportunities, respectively. For Louis, the teacher in the IMRA condition selected items that were used in the MSWO condition more frequently than items that were not used in the MSWO condition.

For Robert (see Appendix, Figure 2, lower left-panel), there were three items that were chosen most frequently an equal amount of the time, the sock'em boppers, the Pokémon, and Nerf gun (25%). During the assessment, the Pokémon was deemed the most preferred, the sock em boppers the second most preferred, while the Nerf gun was the seventh most preferred. The top three items that were determined most preferred in the MSWO assessment were the Pokémon, the sock em boppers, and the floam; the teacher in the IMRA condition selected these items during 25%, 25%, and 0% of opportunities, respectively. Across all IMRA sessions for Robert, the teacher selected toys that were used in the MSWO condition during 50% of opportunities and toys that were not used in the MSWO condition also in 50% of opportunities.

For Brandon (see Appendix, Figure 2, lower righthand panel), the items that were delivered most frequently were the Lego Batman book (25%), the centipede (15%), and a street Shots Racer (15%). The Lego Batman book was the second most preferred item as determined by the MSWO assessment, the centipede was the most preferred, and Street Shot Racers was the third most preferred. Thus, the IMRA teachers most commonly selected toys were the top toys identified in the MSWO assessment.

Thus, the overall results show that most of the teachers were able to identify items as reinforcers in the IMRA condition that were also deemed highly preferred in the MSWO preference assessment. Three out of the four teachers blindly selected items during the IMRA condition that were ranked within the top three most highly preferred items from the MSWO preference assessment. Two teachers selected two of the three most highly preferred items a majority of the time during the IMRA condition while one teacher selected the same three items that were chosen as the most preferred items from the preference assessment. Finally, one teacher selected items outside the top three items a majority of the time; however, using these items as reinforcers did not negatively impact his rate of responding throughout intervention.

Reinforcer Rationale

Figure 3 (see Appendix) depicts the percentage of reinforcer rationales selected by the therapist during all IMRA sessions. Each panel represents one of the four participants. On the x-axis are the 10 different reasons why a teacher selected a toy as well as a category if a therapist provided their own rationale. Along the y-axis is the overall percentage of each category selected per trial that a reinforcer was attained. Affect, interaction, frequency, skill improvement, similar quality, and conditioning were included as reasons for the teachers. Novelty and child request were rationales that were written in by the teachers themselves throughout the study. Two factors and three factors refer to the teachers identifying either two or three variables that impacted their reinforcer selection on a given trial when reinforcement was accessible.

For Jeff (see Appendix, Figure 3, upper left-hand panel), the teacher assigned to the IMRA condition used a variety of in-the-moment decisions to select reinforcers. The majority of the time, the teacher reported that novelty was a factor that impacted which reinforcer he/she

selected (26.3%), followed by a two-factor rationale (i.e., two factors, impacted the teacher's decision to deliver a specific reinforcer per trial) (23.6%), the way in which the child interacted with the item (13.1%), and a three-factor rationale (i.e., three factors impacted the teacher's decision to deliver a specific reinforcer per trial) (7.8%). Jeff's teacher selected reinforcers based on the child's affect, the frequency with which he/she provided an item, providing an item that had similar qualities to a preferred item, and his/her ability to condition the item 5.2% of the time and because of skill improvement 2.6% of the time. The teacher never chose child request as the single reason for the delivery of a reinforcer.

For Louis (see Appendix, Figure 3, upper right-hand panel), the teacher reported that two factors impacted her clinical judgement for the selection of a specific reinforcer 38% of the time, followed by novelty (19%), child affect and a three-factor rationale, both at 14.2% of the time, and the way the child interacts with the item and a child's request of an item at 4.7%. Louis's teacher did not identify frequency, skill improvement, selecting an item of similar quality, or conditioning an item as the only reason that he/she selected particular reinforcers.

For Robert (see Appendix Figure 3, lower left-panel), the teacher conducting the IMRA condition selected multiple factors for choosing certain items as reinforcers; he/she chose two factors 75% of the time. The teacher reported three factors, the child's affect and the child's interaction with the item as the rationale for choosing an item 8.3% of the time. Frequency, skill improvement, choosing an item of similar quality, conditioning an item, novelty, and child request were never identified as the sole reason an item was provided as a reinforcer.

For Brandon (see Appendix, Figure 3, lower right-panel), the teacher doing the in-the-moment reinforcer analysis identified two factors that impacted his/her decision to deliver a

specific reinforcer 40% of the time. Novelty, three factors, and the child's interaction with the item were provided as reasons for choosing items as reinforcers 35%, 15%, and 10% of the time, respectively. The teacher did not indicate that affect, frequency, skill improvement, similar quality, conditioning, and child request were the sole reason for selecting a particular item for reinforcement.

Overall, three of the four teachers (teacher for Louis, Robert, and Brandon) identified that the majority of the time, more than one variable impacted their in-the-moment decisions to provide reinforcers. While they commonly indicated that two factors influenced their selection of a specific reinforcer (e.g., child affect and the way the child interacts with the item), either two factors or three factors were chosen over 50% of the time. Another variable that impacted the teachers' reinforcer selection was novelty. This was a reason that was not provided to the teachers as one of the six in-the-moment reinforcer analysis factors, but one that the teachers could fill in independently. Three out of four teachers (teacher for Jeff, Louis, and Brandon) reported the novelty was the singular reason they chose an item as a reinforcer either the majority of the time or as the second most common reason for choosing a particular item. While it is not reflected on the graph, Robert's teacher also used novelty as a reason for selecting an item as a reinforcer, but always in combination with another factor. Additionally, the teachers only chose novelty as the rationale for the first several sessions; as sessions continued, novelty was no longer reported and the other factors were reported as contributing to the teachers' reinforcer selections. Finally, there were several variables that were not indicated or indicated at low percentages as the single element that influenced the teachers' in-the-moment reinforcer analysis. Three of the four teachers (teacher for Louis, Robert, and Brandon) did not report that frequency,

skill improvement, similar quality, and conditioning was the main reason for choosing a reinforcer while one teacher (teacher for Jeff) only identified those as sole reasons at low rates (5.2% and below). For the majority of teachers, those factors were only one of multiple that contributed to reinforcer selection.

Chapter IV: Discussion

The purpose of this study was to evaluate if there would be a differential rate of responding for four children diagnosed with ASD when a teacher used the top three toys determined by an MSWO as compared to a teacher using IMRA to select amongst 10 items. Overall, the results showed that there were only slight differences in the average number of chips sorted per session among the four participants across both the MSWO and IMRA condition, and none that were at significant levels. Additionally, two of the participants (i.e., Louis and Brandon) showed no real differences in responding from either of the reinforcement conditions to the control condition. The efficiency results indicated that conducting MSWO preference assessments added a considerable amount of time to the learning process as compared to not conducting a formal preference assessment and instead using IMRA. We also observed some patterns amongst all the teachers with respect to the reasons why they chose certain toys in the IMRA condition. First, we saw that the teachers' results showed that the majority of the time, there wasn't only one rationale guiding them to decide which reinforcer to provide contingently, and instead, there were a variety of factors that should be considered when delivering reinforcers. Additionally, novelty was a factor that teachers indicated frequently for the rationale of choosing items as reinforcers, but more so in the beginning of intervention. Finally, there were several variables that were not identified as the singular reason for selecting an item as a reinforcer (i.e., frequency, skill improvement, similar quality, and conditioning), but more commonly as one of several factors for choosing a reinforcer. Finally, the results from the distribution of stimulus selection indicated a substantial degree of overlap of the selection of reinforcer selection between teachers assigned to the IMRA condition to teachers assigned to the MSWO condition. This

overlap occurred with teachers being blind to the results of the MSWO assessment. Thus, the results for this study showed that conducting the multiple stimulus without replacement preference assessment provided no real advantage in performance level for these participants, and instead had the disadvantage of taking more time.

The results of this study have several clinical implications, especially for those working with individuals with ASD. Graff and Karsten's (2012) survey found that 45% of BCBAs and/or BCaBAs were conducting formal preference assessments on a regular basis, ranging from several times a day to once a month. More specifically, 33% reported having previously conducted either a MSW or a MSWO. Furthermore, the most recent literature review on preference assessments for individuals diagnosed with ASD (Cihon et al., 2017) found that out of 69 studies, almost 1/3 (28.9%) involved the MSWO. These data demonstrate the widespread use of formal assessments to determine preferences and identify reinforcers. Despite the prevalence of these direct preference assessments, our study shows that there are alternative strategies to choosing reinforcers, thus decreasing the utility of these ubiquitous formal assessments. Conducting formal assessments with our participants to determine reinforcers, as well as using those reinforcers to reinforce high rates of responding did not produce significant differences in the rate of responding among our participants compared to choosing items based on making in-the-moment decisions regarding the delivery of reinforcers. These results show that children with ASD can perform just as effectively when teachers are guided by their clinical judgement and in-the-moment decisions without wasting time on formal preference assessments.

Second, the efficiency results demonstrate that implementing the MSWO adds a substantial amount of time the child spent in the preference assessment condition in order to

accomplish similar rates of responding to those in the IMRA condition. According to Graff and Karsten (2012), 3.8% of all BCBAs or BCaBAs reported that they implemented formal preference assessments on a daily basis. Previous research comparing the PS preference assessment to the IMRA significantly highlighted the disparity in efficiency between the two procedures. In 2015, Leaf, Leaf, Alcalay et al. estimated that conducting a PS preference assessment on a daily basis would take 11,440 min per year (based on a 44-min assessment); in 2016, they found that a daily PS preference assessment would require 10,660 minutes per year (based on a 41-min assessment). Even though the MSWO preference assessment is more time efficient than the PS preference assessment, based upon our average amount of time spent conducting a MSWO (18 min), if these assessments were conducted on a daily basis (260 clinical days), this would result in approximately 4,680 min (78 hr) per year of time spent in conducting formal preference assessments alone. While some clinicians may not conduct formal assessments this frequently, Graff and Karsten's survey results showed that some in fact do. Individuals diagnosed with ASD face extensive challenges that warrant intensive intervention; the time it takes to conduct formal assessments, albeit less time-consuming ones, does not seem to be more productive or justified than implementing direct teaching.

Finally, taking into consideration the protocol-driven nature of the multiple stimulus without replacement as compared to the protocol for the in-the-moment reinforcer analysis, an essential question is how well-trained professionals must be in order to conduct the latter assessment. The teachers in this study had varying degrees of experience ranging from no prior work with individuals with ASD or the implementation of ABA to multiple years of experience (5-6 years) and hands-on familiarity with individual with ASD and the field of ABA, as well as a

Masters level degree or BCBA certification. Regardless of prior experience, however, all of the teachers were novice in the progressive model of ABA and had no previous experience in-the-moment reinforce analysis prior to their training. Thus, this study showed that with minimal training that IMRA could be equally as effective as MSWO. While it may be easier and perhaps more efficient to train a novice teacher how to follow a simple protocol such as MSWO; the training for IMRA may have other benefits that could positively impact a child's overall quality of treatment (e.g., learning how to condition reinforcement or learning how to conduct in-the-moment assessments in other areas).

Not only does this study have clinical implications for those who work with individuals diagnosed with ASD but it also expands upon previous research. In 2015, Leaf, Leaf, Alcalay, et al. first investigated the IMRA, comparing it to the paired stimulus preference assessment (Fisher et al., 1992) for the same rate of responding task in the current study. The results showed that there was there little difference in participants' rate of responding across both the IMRA and paired preference, even though the teachers in the IMRA condition chose more items as reinforcers outside the top three ranked items identified in the formal preference assessments. More significantly, the IMRA condition was much more efficient than the PS condition, saving 87 minutes from intervention. A follow-up study by Leaf, Leaf, Leaf, et al. in 2016 comparing the IMRA to the PS preference assessment to teach a variety of expressive labels replicated the results of the initial study; participants learned the target skills in both conditions, despite teachers selecting items that were not identified as highly preferred in the formal preference assessment. Furthermore, the IMRA condition was more efficient, requiring less overall time and fewer teaching trials. One limitation and subsequent area of future research in both the

aforementioned studies was that the IMRA had only been compared to one type of formal preference assessment (i.e., PS). The current study replicated the findings demonstrated in previous literature and extends the research by showing that the IMRA is just as effective as the more commonly used MSWO preference assessments, but has the advantage of being much more efficient.

Another limitation from both Leaf, Leaf, Alcalay, et al. (2015) and Leaf, Leaf, Leaf, et al. (2016) that was addressed in the current study was the implementation of intervention by novice teachers. The teachers used in the initial study had been employed by the private agency providing behavioral intervention for at least seven months; those used in the follow-up study were employed by the private agency for at least one year and had over five years of experience in the field of ABA. In both studies, the teachers had a previous history with the participants. The results of the current study show that the effects of the IMRA demonstrated in previous studies can be replicated by novice teachers. This provides additional information regarding both the amount and type of training that may be effective in teaching practitioners how to conduct an IMRA. Similarly, these findings highlight that familiarity with the participants is not a prerequisite in order to evaluate their reinforcement preferences. While three of the teachers participating in this study did have previous experience in the field of ABA, they had not had any training in the IMRA procedure prior to their internship and the teaching they received as a result of the study.

Finally, the current study expanded the line of research by being the first to include the teachers' in-the-moment evaluations when choosing reinforcers. Training in the IMRA procedure includes teaching the practitioner how to analyze their present circumstances and use

their clinical judgement with respect to the factors that may influence their decision-making process. Including the teacher's in-the-moment rationale is an initial step in assessing clinical judgement.

This study is not without its limitations that can be addressed in future research. First, only high functioning individuals diagnosed with ASD participated in this study; therefore, it is unknown if the same procedures would yield the same results for individuals who would be considered lower functioning. Second, this study only examined the use of preference assessments as it applies to a simple rate response measure. While previous research has evaluated the use of preference assessments with more complex skills like expressive labelling, that study evaluated the use of the PS preference assessment compared to the IMRA (Leaf, Leaf, Leaf, et al. 2016). Future research is necessary in order to determine if similar results would be generated comparing the IMRA to the MSWO with a wider range of teaching targets (e.g., receptive labeling, expressive labeling). Along these lines, research on the IMRA includes only two types of formal preference assessments (i.e., PS preference assessment, MSWO preference assessment). It is still unknown, empirically, how effective and efficient the IMRA is when compared to other formal assessments like the MS preference assessment and the FO preference assessment; future research is warranted to investigate these procedures.

Fourth, for two participants (Louis and Brandon) there were no real differences between the reinforcement conditions and the control condition. Having no clear separation from treatment from control conditions could weaken function control and could indicate that a functional reinforcer was not identified. For Louis, there are several potential explanations. First, it could be that none of the items were reinforcing; which could have occurred since the items

were selected arbitrarily. Second, it could be that activity itself had some reinforcing value which was unknown to the teachers. Third, it could be that instructional control (i.e., doing what a teacher tells you to do) was the reason why sorting was high in all three conditions. Fourth, it could be that the researchers did not discriminate the conditions clearly enough. For Brandon, it is hypothesized that during the initial sessions during the intervention condition that there was a sequencing effect which increased the sorting that occurred during the control condition. As Brandon progressed along with the study the sequencing effect appeared to not occur anymore. Therefore, if you were to look at the entire intervention condition you would not see much of a difference in terms of responding; however, if you looked at the last four sessions you would start to see a difference between the reinforcement conditions and the control conditions.

Finally, the study included a majority of teachers that had previous experience in ABA with individuals with ASD. While they had not previously conducted in-the-moment reinforce analyses prior to their training, it is unclear whether a significant amount of familiarity in the field impacted their proficiency with the assessment. Although there was one teacher who did not have prior experience in any area of the field, future research should consider using all novice teachers in order to evaluate training procedures, as well as the amount of time necessary to sufficiently train teachers to use the IMRA. Similarly, future researchers may want to investigate these components (i.e., training procedures; training time) in order to compare the length of time it takes to train practitioners in IMRA to other types of formal assessments.

Despite these limitations and need for future research, this study showed that for our four participants, there was no significant difference in the rate of responding between a formal preference assessment and the in-the-moment reinforce analysis. Additionally, the study showed

that the in-the-moment reinforcer analysis was a more efficient procedure, requiring less time to achieve similar results as the multiple stimulus without replacement. Finally, this study extended previous research that demonstrated similar results with other types of formal assessments (Leaf, Leaf, Alcalay, et al., 2015; Leaf, Leaf, Leaf, et al., 2016). Given these results, the use of the MSWO was not warranted for our four participants. Taken collectively with other studies that have compared IMRA to formal preference assessments (Leaf, Leaf, Alcalay, et al., 2015; Leaf, Leaf, Leaf, et al., 2016) and the research on conditioning reinforcers it further brings into question the utility of formal preference assessments.

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Appendix: Tables and Figures

Table 1

Teacher and Child Pairings

Child Name	MSWO Condition	IMRA Condition
Jeff	Ethan	Miranda
Louis	Sally	Isabelle
Robert	Miranda	Ethan
Brandon	Isabelle	Sally

Table 2

Reinforcer Rationale during In-the-Moment Reinforcer Analysis

Rationale	Definition
Affect	The child's facial expressions and body language.
Interaction	The way in which the child interacts with the stimuli by making comments indicating they like/dislike the stimuli or are/are not having fun with the stimuli.
Frequency	The frequency with which the reinforcing stimuli has been used during previous trials or sessions. The teacher should not use the same stimuli as a reinforcer in more than 70% of trials across the previous 3 sessions or over 70% of trials within a session.
Skill Improvement	The extent to which the child's performance yields better results following the provision of a specific reinforcer.
Similar Quality	Incorporating stimuli with similar reinforcement qualities to stimuli that have been previously determined as preferred.
Conditioning	The ability of the teacher to increase the reinforcement value or condition less preferred items as reinforcers.
Novelty	The provision of a reinforcer based on its unfamiliarity to the child.
Child Request	The child makes a verbal request for a specific reinforcer.
Two Factors	Identifying two rationales for selecting a specific reinforcer.
Three Factors	Identifying three rationales for selecting a specific reinforcer

Table 3

Efficiency Data

Participant	Condition	MSWO Assessment Time	Session Time	Total Time
Jeff	MSWO	26 Min 48 Sec	166 Min 13 Sec	193 Min 1 Sec
	IMRA	0 Min 0 Sec	170 Min 21 Sec	170 Min 21 Sec
Louis	MSWO	27 Min 10 Sec	113 Min 11 Sec	140 Min 21 Sec
	IMRA	0 Min 0 Sec	125 Min 37 Sec	125 Min 37 Sec
Robert	MSWO	29 Min 43 Sec	91 Min 12 Sec	120 Min 55 Sec
	IMRA	0 Min 0 Sec	95 Min 0 Sec	95 Min 0 Sec
Brandon	MSWO	28 Min 15 Sec	118 Min 40 Sec	146 Min 55 Sec
	IMRA	0 Min 0 Sec	125 Min 43 Sec	125 Min 43 Sec

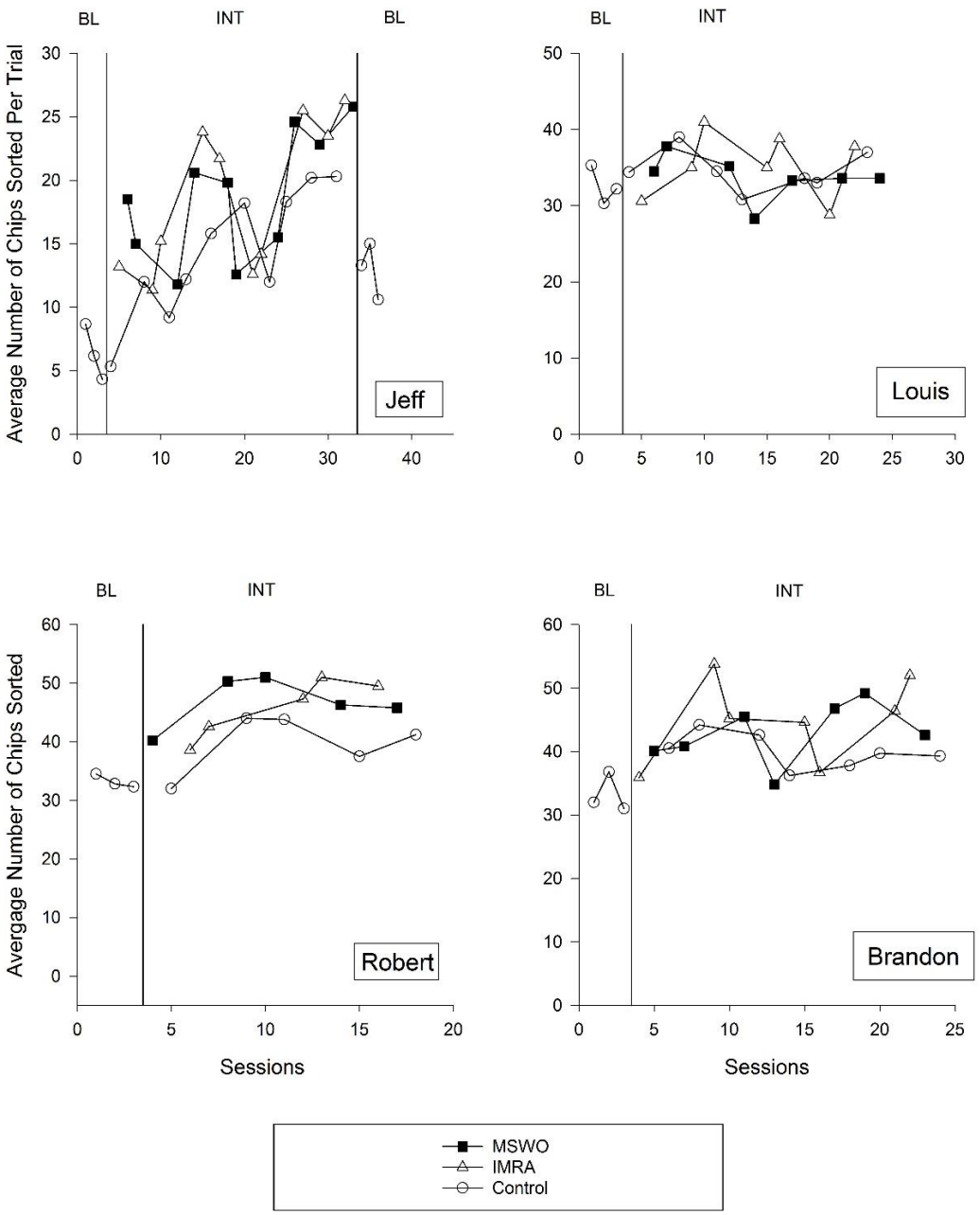

Figure 1. Average Number of Chips Sorted Per Session

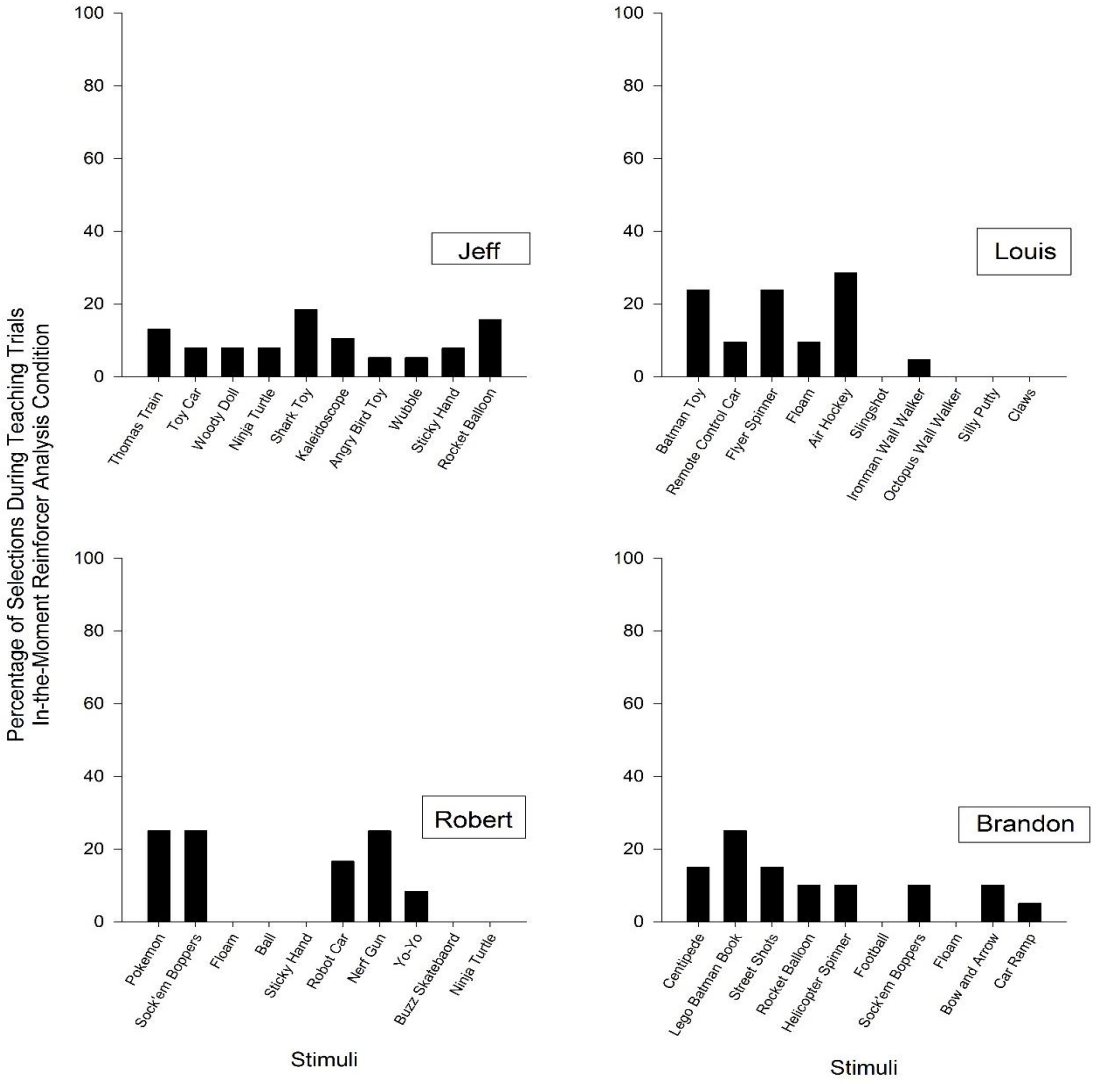

Figure 2. IMRA Reinforcement Selection

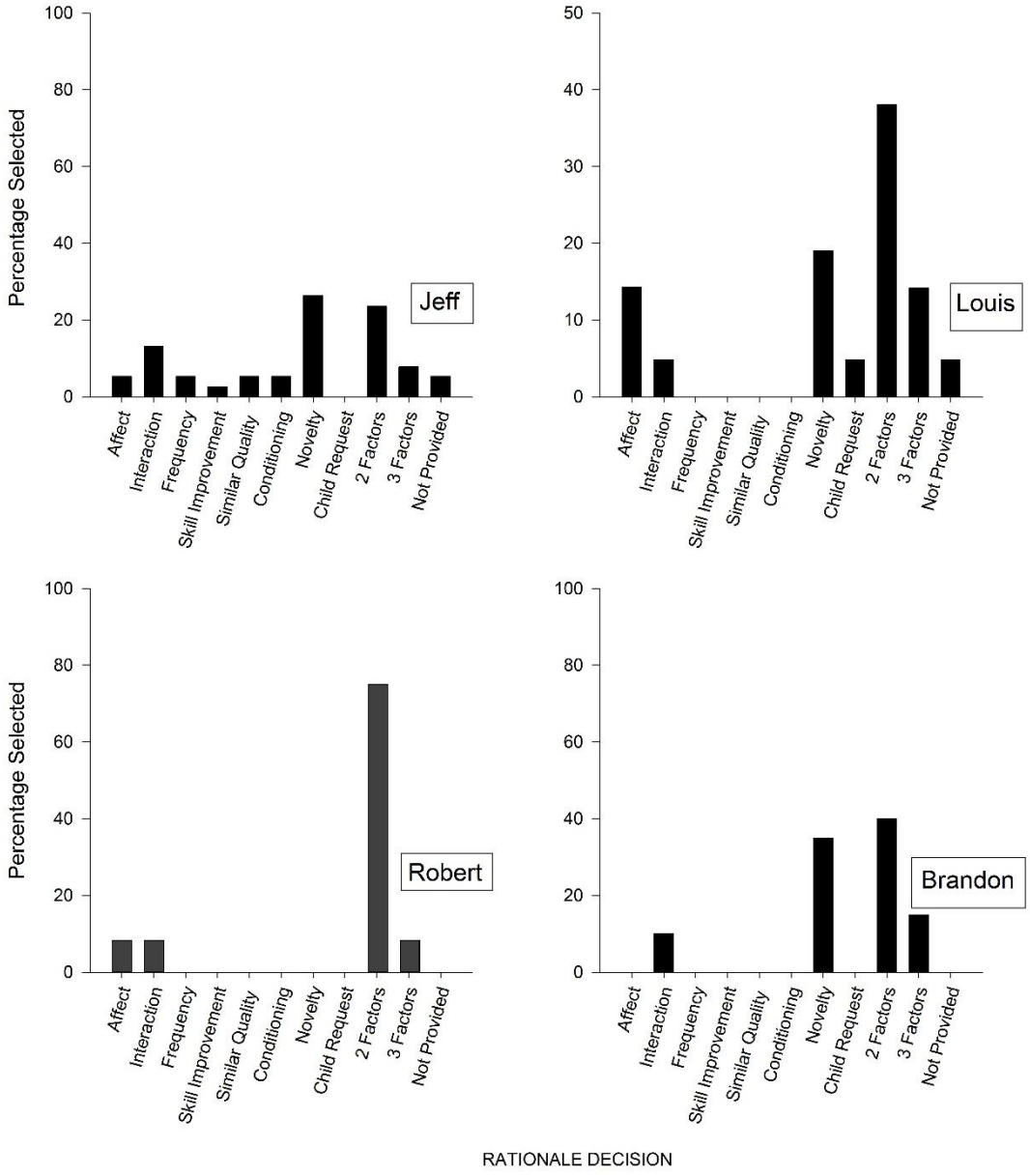

Figure 3. IMRA Reinforcement Rationale