A Comparison of Verbal and Standard Selection-Based Preferences Using the Multiple Stimulus Without Replacement Method for Children with Developmental Disabilities

by

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Abstract

A Comparison of Verbal and Standard Selection-Based Preferences Using the Multiple Stimulus Without Replacement Method for Children with Developmental Disabilities

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Since DeLeon and Iwata (1996) published their seminal study on multiple stimulus preference assessments, the research surrounding preference assessments utilizing multiple stimuli has grown immensely. This has led to many variations of DeLeon and Iwata's (1996) original preference assessment. Variations have included preference assessments conducted with videos, pictures, and activities. We compared the results of a standard tangible multiple stimulus without replacement preference assessment (MSWO) to a verbal multiple stimulus without replacement preference assessment with four individuals with developmental disabilities. A reinforcer assessment was conducted following each preference assessment to assess accuracy. Idiosyncratic results were found across participants. For two participants, the verbal MSWO predicted reinforcers more accurately than the tangible MSWO. For the remaining two participants, the tangible MSWO predicted highly preferred reinforcers more accurately than the verbal MSWO. The overall consistency of preference assessment was found to be strong and statistically significant through utilizing the Spearman rank-order correlation. Implications and directions for future research are discussed.

Key words: preference assessments, tangible, verbal, developmental disabilities, autism

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Dedication

I dedicate this thesis to my grandparents, John and Dorothy McMahon. Thank you for your constant love and support and for always pushing me to pursue my dreams.

A Comparison of Verbal and Standard Selection-Based Preferences Using the Multiple Stimulus Without Replacement Method for Children with Developmental Disabilities

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Identifying reinforcers for children with intellectual and developmental disabilities presents challenges for many behavior analysts. A reinforcer, by definition, is any stimulus that, provided contingent on a behavior, increases the future probability of that behavior occurring (Kuhn, DeLeon, Terlonge, & Goysovich, 2006). Thus, an important component of many skill-acquisition and behavior-reduction programs involves the identification of potential reinforcers to provide contingent upon desired behavior. Many behavior analysts utilize preference assessments to help determine reinforcers. Graff and Karsten (2012) reported in a survey of 406 behavior analysts that almost 90% used at least one form of preference assessment with clients. Since the mid-1980s, researchers have developed and refined methods of determining preferences and reinforcers using questionnaires, presenting stimuli either singly, in pairs, or larger arrays, or other variations based on the individual's abilities to select items or activities (DeLeon & Iwata, 1996; Fisher et al., 1992; Green et al., 1988; Pace, Ivancic, Edwards, Iwata, & Page, 1985; Windsor, Piche, & Locke, 1994). Preference assessments comprise a

key component of treatment for clients diagnosed with intellectual and developmental disabilities who are referred for behavior analytic services.

Several standard formats exist for identifying items or activities that function as potential reinforcers, based on simple operant responses. Although specific arrangements vary from study to study, experimenters typically offer an array of two or more items or activities and document a dimensional quantity of responding based on how the individual approaches, avoids, or interacts with items. Two of the most commonly used types of preference assessments in clinical and research applications focus on selection-based responding, or engagement-based responding to access preferences. Briefly, selection-based preference assessments involve offering one or more items and prompting the participant to select one (Pace et al., 1985; DeLeon & Iwata, 1996; Fisher et al., 1992). Free-operant, or duration-based presentation, involves offering items and observing the amount of time a participant interacts with each one (Roane, Vollmer, Ringdahl, & Marcus, 1998). Many of the empirical investigations regarding preference assessments involve comparisons between multiple formats, in an effort to determine the most efficient and effective methods of determining preferences.

For many learners who possess limited verbal repertoires, including vocal-verbal or sign language responses, simply asking the individual to state his or her preference provides important data on the relative efficacy of stimuli to function as reinforcers. Some previous research indicates that verbal preference assessments

identified reinforcers more accurately than other forms of preference (Northup, George, Jones, Broussard, & Vollmer, 1996), while other literature revealed mixed results regarding verbal presentation with or without tangible presentation of items (Cohen-Almeida, Graff, & Ahearn, 2000; Hanley, Iwata, & Lindberg, 1999; Higbee, Carr, & Harrison, 1999; Tessing, Napolitano, McAdam, DiCesare, & Axelrod, 2006; Kuhn et al., 2006; Northup, Jones, Broussard, & George, 1995). Differences in the types of participants studied and particular experimental arrangements likely contribute to variability in results. While previous research suggests the potential utility of verbal preference assessments, most research on preference incorporates the use of actual items or representations of items, such as pictures. One of the benefits of a verbal preference assessment may involve preference for stimuli not easily depicted in pictorial or tangible formats, e.g., activity-based preferences (Kuhn et al., 2006).

In this paper, I will provide an overview of current methods of conducting preference assessments, focusing on selection-based, duration-based, and other novel assessments. Next, I will discuss research that incorporated comparisons between preference assessment types that have been experimentally validated. Finally, I will propose a research project to compare a standard selection-based preference assessment, the Multiple Stimulus Without Replacement (MSWO) with target stimuli available, to a verbally-delivered MSWO for children with ASD (DeLeon & Iwata, 1996).

Overview of Selection-Based Preference Assessments

Over 30 years of research on preference assessment highlight the importance of selecting items that function as potential reinforcers quickly and efficiently. Although multiple methods of directly assessing preferences in individuals with disabilities exist, two commonly implemented types in the behavior analysis literature include paired-stimulus (PS, Fisher et al., 1992) and Multiple Stimulus without Replacement (MSWO; DeLeon & Iwata, 1996). The PS preference assessment consists of presenting two stimuli simultaneously to the individual, directing the individual to choose one, and providing access to the stimulus that the individual approaches first (Fisher et al., 1992). The implementer presents all potential permutations of the items in pairs and shifts side placement from left to right to control for potential selection bias. The PS consistently yields high-, moderate-, and low-preference rankings of items in research, and shows good predictive validity in terms of selecting items that later function as reinforcers; however, a commonly cited limitation of the PS assessment is the time required to complete the procedure (Hagopian, Long, & Rush, 2004).

In an effort to reduce the time required to conduct systematic preference assessments, two other formats emerged whereby the authors offered multiple choices simultaneously in an array. First, Windsor, Piche, and Locke developed the multiple stimulus with replacement preference assessment (MSW, 1994). In the MSW procedure, the experimenter places all items in front of the client, and

instructs him or her to select one from the array. After the selection is made, the trial ends. The experimenter replaces the chosen item in the array. Although the MSW reduced the duration to produce preference hierarchies, some researchers noted problems with instability of preferences, and a tendency to produce false-positives, i.e., rejecting items that may function as reinforcers (DeLeon & Iwata, 1996; Hagopian et al., 2004).

In a similar format to the MSW, DeLeon and Iwata developed the multiple stimulus without replacement (MSWO) preference assessment (1996). The primary difference between the MSW and MSWO is that investigators offer the stimuli in an array, and once the client chooses an item, that item is removed from the array for the rest of the assessment (DeLeon & Iwata, 1996). In a study comparing the MSWO to the MSW approach, DeLeon and Iwata (1996) cited the advantages that the MSWO yielded more stable results in terms of ranking preferences as high, moderate, and low preferred, and reduced false-negative findings, meaning less displacement of items by top-ranked preferences when they were removed from an array.

Other Methods of Preference Assessment

Roane et al., (1998) described a free-operant (FO) preference assessment as a method of determining preferences without having to remove items from individuals, or disrupt their selections, since the items are made freely available without interaction with interventionists. In the FO preference assessment,

individuals access an array of items while observers score the percent of 10-s intervals the client spends with each item, in a 5-min session. The item that is approached the most frequently and for the longest duration is identified as the most preferred. Although the FO preference assessment results in findings rapidly, some researchers showed instability in preferences, especially for top-ranked items, which notably differed from the briefer 5-min exposure to extended periods up to 30 min (Rapp, Rojas, Colby-Dirksen, Swanson, & Marvin, 2010).

Another novel approach to conducting assessment of preference is the response-restriction method identified by Hanley, Iwata, Lindberg, and Connors (2003). In this study, the authors measured the response allocation for three adults with developmental disabilities, by offering several activities concurrently. The researchers then removed items that were most frequently approached after each trial, thereby responding is restricted to fewer and fewer options over time. Removal of items is based on specified rules and trends in the data indicating early preference. Results revealed accuracy of determining high- and low-ranked items. However, the authors note the procedure is notably time-consuming and potentially takes more time to implement.

Research on Comparing Preference Assessment Types

The majority of published research on preference assessment involves comparison studies between two or more approaches in an effort to evaluate the simplicity, efficacy, and time to complete the assessments, as well as the predictive

validity of determining reinforcers (Canella, O'Reilly, & Lancioni, 2005; Hagopian et al., 2004). In an effort to streamline the processes of identifying reinforcers, many researchers focus on methods that result in preferences that rank as high, moderate, and low preference items, as rapidly as possible. Multiple methods of determining preferences exist in the literature, and several published comparisons of their procedures reveal important differences between the approaches that benefit individuals in clinical and research settings.

In one of the earliest studies of preference assessment types, Pace and colleagues (1985) conducted a single-stimulus (SS) preference assessment for individuals with severe intellectual disabilities. The authors presented 16 items with interesting auditory, tactile, and other sensory properties, and scored whether nine individuals engaged in approach responses. In 1992, Fisher et al. (1992) conducted a study comparing the effects of the Pace et al. (1985) study on single-stimulus preference to a new format, the PS preference assessment. In this study, the authors found that four adults with intellectual disabilities selected a wider variety of items of high, moderate, and low preference items. When they used the same stimuli as in the Pace et al. (1985) study, they found that the SS method resulted in higher overall selections of items, and that many of the items selected later failed to function as reinforcers during a concurrent-operant arrangement. Fisher and colleagues therefore suggested that the PS preference assessment might yield a

higher rate of false-positive results, that is, selecting items that later do not function as reinforcers (1992).

Since the initial comparison study by Fisher and colleagues (1992), other researchers have developed novel approaches to conducting preference assessment by comparing results of items selected along ranks of preference, total duration to complete the assessment, and the effectiveness of determining reinforcers. DeLeon and Iwata (1996) compared an MSW preference assessment, an MSWO preference assessment, and a PS preference assessment. The researchers ran all three methods of preference assessment, and tested the reinforcing effects of the stimuli selected in the PS and MSWO procedures. Seven adults with profound developmental disabilities participated in the first study. If the participant did not select an item within 30-s, the trial ended. If the participant selected an item, he or she received 30-s access or the opportunity to consume the item. Before the first session, participants sampled each edible item, or had 30-s of access to all leisure items. Each participant completed five consecutive sessions of each procedure, resulting in a total of 15 sessions. A percentage score was calculated that indicated the number of times an item was selected across trials that included the item. Results concluded that the top three stimuli identified by the MSWO preference assessment matched the top three stimulus ranks identified by the PS preference assessment for four out of seven participants. For all participants, the MSW preference assessment

resulted in a more frequent selection of the higher preferred items compared to the low preferred items in comparison to the other two types of preference assessment.

In a second study, the authors aimed to verify predictions about stimuli not selected during the MSW preference assessment. Four participants continued in this study. After establishing stable rates of responding in baseline, each participant received the selected item contingent upon one response (i.e., a fixed-ratio 1 schedule). For three out of four participants, items they never selected during the MSW preference assessment (but were selected during the other two preference assessment methods) produced increases in responding when delivered contingently. Thus, researchers posited that items not identified as reinforcers in the MSW assessment can function as reinforcers. This finding indicates that the MSWO preference assessment and the PS preference assessment more readily identify items as reinforcers. Researchers also found that the MSWO preference assessment produced similar results in terms of high, moderate, and low rank stimuli, and consistency of rank compared to the PS preference assessment (DeLeon & Iwata, 1996).

Two studies by Verriden and Roscoe (2016) compared four common formats for implementing preference assessments for children with ASD. This study included six participants with Autism Spectrum Disorder or a related disability, and the authors compared results for: (a) paired-stimulus preference assessment (Fisher et al., 1992); (b) multiple stimulus without replacement

preference assessment (DeLeon & Iwata, 1996); (c) free-operant preference assessment (Roane et al., 1998); (d) and response-restriction preference assessment (Hanley et al., 2003). The experimenters first conducted a survey with clinicians who worked with the participants to identify seven leisure items to utilize during the study. The results of the first study found stable preferences for most of the participants using the PS and MSWO preference assessments. The authors computed the Spearman rank-order correlation coefficient and the Kendall rank correlation coefficient to describe the extent of correspondence between consecutive replications of the various types of preference assessment analyzed in this study. They noted that the Kendall coefficient was most significant across participants for the PS method and the Spearman correlation was most significant during both the PS and MSWO assessments. Significance for the Kendall coefficient was determined based on significance in correspondence. Significance for the Spearman correlation was determined based of a coefficient being equal to or exceeding the critical *r* value of .60. Researchers noted that each participant's problem behavior occurred at lower levels during the free operant preference assessment compared to other methods.

In the second experiment, Verriden and Roscoe (2016) evaluated the implications of preference stability on the effectiveness of reinforcers for individuals who participated in study one and exhibited lower Spearman rank-order correlation coefficient and Kendall rank coefficient with a specific preference

assessment. The low statistical results meant that the specific type of preference assessment analyzed did not predict reinforcers as accurately. Three participants continued from the first study, using the same leisure items from study one. The results of the second study found that the PS preference assessment and MSWO preference assessment lead to higher correlation coefficients—that is, they showed better matching of high, moderate, and low-preferred items—than the free operant or response restriction preference assessments (Verriden & Roscoe, 2016).

Novel Approaches in Selection-Based Preference Assessment

One example of a novel approach to conducting preference assessment includes modifying the types of stimuli presented in the array. For instance, Brodhead et al. (2016) evaluated the results of a brief electronic pictorial MSWO preference assessment with contingent access to the selected stimuli compared to the results of a brief tangible MSWO preference assessment. This study included five participants with ASD. The authors identified a pre-study matching task to examine if matching skills functioned as a predictor of correspondence between the brief tangible MSWO preference assessment and the brief electronic pictorial MSWO preference assessment results. Prior to the beginning of the study, the researchers presented toys to each participant. Following this presentation, the investigators showed pictures of five different toys the children sampled, and conducted a brief electronic pictorial MSWO preference assessment. In the pictorial MSWO condition, the experimenter presented five pictures of different

toys on an iPad and asked the participant to, “touch the one you want.” Selection resulted in 30-s of access to the selected item. Following the pictorial MSWO, the authors conducted a brief tangible MSWO preference assessment. In this phase, the researchers presented toys in a linear array in front of the participant and asked them to select one. Selection resulted in 30-s access with the item. Toys were then ranked from highest to lowest preferred based on the number of trials each toy was selected divided by the number of times it was available for selection. A reinforcer assessment was also conducted in this study to evaluate whether the presentation of a highly preferred toy resulted in higher rates of responding compared to a lower preferred toy. Three of the five participants showed correspondence between the high and low preferred toys in both types of preference assessments. Thus, the study provided support for the results of a brief electronic pictorial MSWO preference assessment as a method of determining preference, with results that were similar to the tangible MSWO preference assessment (Brodhead et al., 2016).

Clark, Donaldson, and Kahng (2015) conducted a study comparing the results of a PS preference assessment with a video preference assessment without contingent access to reinforcers. Four individuals with multiple diagnoses, including ASD, were included in this study. The preference assessments conducted was similar to the standard PS preference assessment. The investigators conducted a concurrent-operant procedure. During the video preference assessment, the participant watched two 30-s videos. After the participant watched both videos, the

experimenter restarted each video and played both videos of the two available stimuli simultaneously while instructing the participant to "pick one." The tangible preference assessments consisted of presession exposure to each item utilized in the assessment. During the tangible preference assessment, the experimenter presented the participants with tangible items, instructed them to "pick one," and provided immediate access to the selected item. The reinforcer assessment results showed that the highly preferred activities from the video preference assessment served as reinforcers and were chosen more often than the tangible items in at least one comparison for each participant. Three out of four participants chose highly preferred items from the video assessment over moderately preferred items from the tangible assessment. For most of the individuals who participated in this study, the no-access video preference assessment was successful in determining reinforcers (Clark et al., 2015).

Brodhead, Abston, Mates, and Abel (2017) also conducted research on preference assessments using a video format, however, this study focused on MSWO preference assessments. Researchers compared two types of brief MSWO preference assessments using a video format for four participants with ASD. In one phase, the participants had no access to the chosen activities; whereas in the second, the participants had access to the chosen activity following the video. Researchers measured the duration of both preference assessments and asked instructors to rank the participants' most to least preferred activities. First, the

researchers conducted a pre-study matching assessment with video-to-activity matching. This activity consisted of showing the participant a video of one of their activities and then instructing them to go to that activity. All participants scored 100% on the pre-study. Following both types of preference assessments, the researchers ranked activities from highest to least preferred. Researchers then compared results from the participant's MSWO preference assessments with access to activities based on the instructor rankings. The investigators found a positive correlation between the instructors' surveys and participants' preference assessment across highly to least preferred categories. The authors also noted that the MSWO preference assessments without access to the chosen activity took less time to administer (i.e., 4.3 min), compared to the MSWO preference assessments with access to activities (i.e., 42.6 min). Overall, the results showed that the MSWO preference assessments without access to activities either strongly or moderately correlated with the results of the MSWO preference assessments with access to activities for children with ASD. These findings represent an important contribution to the literature on preference assessments, because the MSWO preference assessment without access to activities was more efficient in terms of duration, while yielding robust results (Brodhead et al., 2017).

In two studies by Heinicke, et al. (2016), researchers assessed the feasibility of pictorial stimulus preference assessments with children with developmental disabilities. This study included eight participants who completed three prerequisite

skill assessments (i.e., picture-to-object matching assessment, object-to-picture matching assessment, and a pictorial mand assessment). Researchers conducted a pictorial stimulus preference assessment without contingent access to reinforcers. This study also included a reinforcer assessment to evaluate whether the items from the pictorial stimulus preference assessment without contingent access later functioned as reinforcers. During the reinforcer assessment, the investigators tested a single-operant progressive ratio reinforcer assessment (Roane, Lerman, & Vorndran, 2001) and a concurrent-operants reinforcer assessment (Piazza, Fisher, Hagopian, Bowman, & Toole, 1996). The single-operant reinforcer assessment consisted of informing participants that they would earn either a high preferred, low preferred, or control item (depending on the condition) if they completed the task. In the concurrent-operants reinforcer assessment, the experimenters provided three colored containers and a box of paper clips. Each time the participant placed a paperclip into a colored container, the experimenter delivered the item associated with that container on a continuous schedule. The results showed that some participants with differing prerequisite assessment results had low correspondence between the stimulus preference assessment without contingent access and the reinforcer assessment. Thus, the authors concluded that prerequisite skills (i.e., picture-to-object matching, object-to-picture matching, and a pictorial manding) may be correlated with the success of pictorial modality when contingent access to reinforcers is not provided.

In the second experiment conducted by Heinicke, et al. (2016), the authors evaluated the role of contingent access to the reinforcers for those participants who did not demonstrate accurate results from the pictorial stimulus preference assessment without contingent access when compared to the successive reinforcer assessment. The researchers conducted three pictorial stimulus preference assessments with contingent access to reinforcers on a variable-ratio (VR) schedule. The pictorial stimulus preference assessment with contingent access allowed the participant to consume an edible after each selection. The initial VR schedule value was VR3, whereby the authors presented an item on average of every 3 responses. Schedule thinning continued (i.e., VR3, VR 5, extinction) until no access to reinforcers was provided during a stimulus preference assessment session. The results showed that the duration of the pictorial stimulus preference assessment session without contingent access to reinforcers was shorter than sessions conducted with contingent access to reinforcers. The authors also noted that when schedule thinning began, high correspondence continued for four of the participants and remained stable as the schedule was thinned to extinction. Overall, from the second experiment, the authors found that schedule thinning represented an effective method to establish conditioned reinforcement properties for pictorial stimuli for participants who did not show correspondence between pictorial stimulus preference assessment without contingent reinforcers during successive

reinforcer assessments. One of the main limitations of this study was that it only utilized edible reinforcers (Heinicke et al., 2016).

Higbee and colleagues (1999) conducted additional research on pictorial preference assessments. This study consisted of comparing an MSWO preference assessment using pictorial verses tangible stimuli. The participants in this study included two adult males with developmental disabilities. Each preference assessment consisted of seven stimuli per participant. Stimuli were chosen based on a clinician's interview with an adult who worked closely with the participant. When a participant chose a stimulus, the experimenter provided 20-s of access to the selected stimulus. Participants partook in 10 assessment sessions each. Researchers also conducted a reinforcer assessment using a reversal design with a multielement component to compare the reinforcing effects of the stimuli selected in the first phase. Before the first session, each participant received verbal instructions and a model of how to perform the target response. Following the final reinforcer assessment, the experimenter conducted two to three 15-min reversal sessions. Conditions during reversal phases were identical to baseline phases. The two preference assessment methods produced significantly different stimulus rankings and magnitude of preference gradient. The tangible preference assessment produced a much larger preference gradient for both participants. The results of the reinforcer assessment indicated that the tangible preference assessment more accurately predicted reinforcers. However, these results could be due to the

participants' lack of experience with using pictures to mand for tangible stimuli (Higbee et al., 1999).

Previous research on preference assessments has also examined preference for activities that are not usually provided as immediate consequences of choice due to their lengthy nature. In a study by Hanley, et al. (1999), four participants with developmental disabilities that engaged in problem behavior completed assessments of preference for leisure activities and chores that staff described as typical in their routines. Each participant completed three preference assessments. Preference assessments for activities were analyzed using a concurrent-schedules arrangement, whereby preference for one group of activities was evaluated during each session. The preference assessments utilized two photos of the activities for which preference was evaluated (i.e., riding a bicycle and playing basketball) and a third photo of a control (i.e., a photograph of the participant in a hallway). Prior to each preference assessment, the experimenter prompted the participant to touch each of three pictures, and then continued to the activity area that corresponded with the picture.

Activity assessments were compared under two conditions–no access to activities versus access to activities. The design of this study included a nonconcurrent multiple baseline design across activities. Results showed that the preference assessments involving no access to activities typically lasted 3 to 10 min. The preference assessments including access to activities typically lasted 23 to

40 min. The results revealed idiosyncratic and undifferentiated responding in 11 of 12 activity comparisons for all participants. The authors posited that differential consequences, in the form of access to an activity contingent upon selecting its photograph, were necessary to achieve response differentiation. Additionally, researchers concluded that unique reinforcement (i.e., verbal praise or brief access to an activity) for a given choice affected the outcome of a preference assessment (Hanley et al., 1999).

The majority of research on preference assessment involves the use of some form of tangible item, whether the actual items or pictures of the items. Another novel method of testing preferences involves the use of verbal prompts regarding items to be selected. Tessing et al., (2006) analyzed the outcomes of vocal-verbal stimulus preference assessments when providing access or no access to stimuli following choice. This study included seven participants with various developmental disabilities. A preference assessment consisted of a PS vocal preference assessment with nine or 10 activities using a concurrent-operants arrangement. The no-access condition consisted of asking the participant, "Do you want X or Y?" The participant's response was then followed by the next question and did not include access to the preferred item. The access condition included the previously mentioned procedure, except selection of an item resulted in 2-min of access to the activity following selection. The study also included a reinforcer assessment, using a reversal design to analyze the reinforcer efficacy of the selected

activities, which were offered contingent upon completion of single-digit addition worksheets. Six out of seven participants showed differences in stimulus rankings between the access and no-access conditions for several activities (i.e., preference to complete worksheets, watch television, cook, or vacuum). But for other activities (i.e., playing basketball, puzzles, or playing video games), preference corresponded between the two conditions. Additionally, six out of seven participants demonstrated clear differences in preference assessment results when access to the activity was provided contingent on selection. These results suggest that access to activities contingent on selection predicted reinforcers more accurately in a vocal preference assessment than when activities were not provided. Additionally, the results suggested that vocal preference assessment without access to items showed poor identification of effective reinforcers (Tessing et al., 2006).

Previous research compared reinforcer assessment methods for children with Attention Deficit Hyperactivity Disorder (ADHD; Northup et al., 1995). The purpose of this study was to evaluate the utility of treatment of a verbal forced-choice questionnaire, child nomination, and direct observation in identifying the most effective reinforcers for children with ADHD. The verbal forced-choice questionnaire consisted of verbally presenting (i.e., “would you rather play with Y or Z?”) five toys in pairs. After the questionnaire, researchers observed the child during a 10-min period of free play. 10 children participated in the study. The forced-choice questionnaire included verbal presentations of all combinations of

five toys in pairs. This study included a simultaneous treatment design to determine the relative reinforcement value of the toys identified as preferred by each form of preference assessment. The reinforcer assessment included telling each child that he or she could earn play time with different toys based on the table where they worked. Experimenters placed one to three toys on different tables, and academic tasks on another table to serve as a control table. Each session lasted 10 min. Researchers found variability for toy preferences across reinforcer assessment methods. They also concluded that reinforcer assessment methods resulted in low correspondence between verbal and actual presentation of items. Researchers concluded that asking children with ADHD to identify their own reinforcers was insufficient at predicting actual responding in the presence of the items. Additionally, the authors recommended a forced-choice reinforcer assessment to enhance the verbal reinforcer assessment (Northup et al., 1995).

Northup and colleagues (1996) later conducted additional research on children with ADHD and reinforcer assessments. This study focused on evaluating the utility of verbal stimulus-choice reinforcer assessment for four children with ADHD. The dependent variable in this study was the number of coded squares on a coding task. The assessment consisted of 15 stimuli, organized into five categories. The stimuli that were selected for each participant were determined based on survey results and successive random selection. Control items were selected from five categories that were not selected on the survey. Six coupons of different colors

represented five categories of reinforcers and a control stimulus. The stimulus preference assessments consisted of: (a) a verbally administered modified child reinforcement survey; (b) a questionnaire that assessed each child's preference for the five categories of stimuli; (c) and a pictorial stimuli choice, similar to the verbal stimulus choice, except that tokens for each category of reinforcers were presented in pairs and children were prompted to select one instead of responding verbally. Following a reinforcer assessment, each of the four stimulus preference assessments were completed. This was done to evaluate the stability of preference across short time periods and to evaluate the influence of repeated exposure to the various stimuli and familiarity with assessment procedures. The results found that the verbal and pictorial stimulus preference assessments were more likely to identify high and low preferred items compared to the survey. Clear reinforcement effects were found for three out of four of the participants for at least one of the token types. Additionally, clear high and low preferred items were identified for three out four participants. Total accuracy was calculated for each preference assessment type. The results found total accuracy to be 55% for the survey, 70% for the verbal stimulus choice, and 80% for the pictorial stimulus choice. Based on these results, researchers suggested that surveys alone may not accurately predict reinforcer preferences. Additionally, asking children with ADHD to name their preference may not be sufficient for identifying effective reinforcers. However, accuracy of verbal preference assessments can be improved if attention is paid to

the response format and the structure of the questions (i.e., “which of these activities do you prefer?” or “which of these activities would you do a lot of work to earn?”). Physical representation may be more salient than a verbal statement alone. Suggestions for future research included conducting verbal preference assessments that include items selected on a basis that is independent of self-report (Northup et al., 1996).

A study by Kuhn and colleagues (2006) compared verbal preference assessments in the presence and absence of stimuli. This study also included a reinforcer assessment to test the accuracy of the two preference assessments. Three males with severe behavior disorders participated in this study. Between 12 and 20 stimuli were included in each preference assessment. Before each preference assessment, every participant interacted with the items for 30-s. In addition to the verbal-only and verbal-plus-tangible preference assessments, this study included token training. Participants received training to exchange tokens for specific stimuli. Different colored tokens were paired with worksheets of the same color and various activities. Results found that the verbal-plus-tangible preference assessment predicted more accurately predicted reinforcer efficacy than the verbal-only preference assessment. Researchers noted that participants may have allocated responding to the tangible stimuli as a function of immediacy to reinforcement rather than preference. Thus, verbal-only preference assessments may be favorable over verbal-plus-tangible preference assessments due to efficiency, providing

similar representations of all stimuli, may more accurately assess preference rather than immediacy to reinforcement (Kuhn et al., 2006).

Lastly, previous research has also compared the hierarchies of preferred stimuli produced by tangible preference assessments with hierarchies generated by verbal assessments (Cohen-Almeida et al., 2000). In a study by Cohen-Almeida and colleagues, the authors conducted tangible and verbal preference assessments with six participants, all of whom used vocal speech as their main method of communication and scored at least a three-year age-equivalent score on the Peabody Picture Vocabulary Test or a similar type of assessment. The tangible preference assessment included eight edible items identified by staff and presented two at a time. The verbal preference assessment utilized the same eight edible items from the tangible preference assessment but consisted of researchers simply asking, "do you want X or Y?". Edibles were not visible to the participant during the verbal preference assessment. For four of the six participants, both preference assessments resulted in selection of the same two highest preferred items with high correspondence for the most and least preferred items. Both assessments also revealed the same two least preferred items for five out of six participants. The results additionally demonstrated that the verbal preference assessment took less time to complete. Researchers suggested that verbal preference assessment could potentially be an efficient method for identifying putative reinforcers for some

individuals; however, a reinforcer assessment was not conducted to verify their initial findings.

Based on the previous research, stimulus preference assessments are used frequently by behavior analysts to identify effective reinforcers. Many studies note that a MSWO preference assessment takes less time than other types of preference assessments, and still identifies effective reinforcers. A potential solution to this issue might be to conduct verbal preference assessments, which previous studies have found take significantly less time compared to other preference assessment methods, while still resulting in preferences that function as reinforcers (Cohen-Almeida et al., 2000; Northup et al., 1996). Previous research shows that verbal preference assessments may be efficient in identifying reinforcers for some individuals, but more research is needed (Cohen-Almeida et al., 2000). Additionally, research has yet to be conducted on a verbal MSWO preference assessment compared to a standard MSWO preference assessment. Thus, the purpose of this study is to compare the accuracy of a no-access verbal MSWO preference assessment to a standard tangible MSWO preference assessment by utilizing a reinforcer assessment.

Method

Participants, Setting, and Materials

Four high-functioning individuals with developmental disabilities participated in this study. All four participants were male. Three participants had a

diagnosis of Autism Spectrum Disorder (ASD) and one participant had a diagnosis of Fragile X Syndrome. All participants were students at a school for children with intellectual, developmental, and physical disabilities. Participants ranged from five to 17 years old. All sessions were conducted in one of several therapy rooms at the school. Each room contained one table, two chairs, and relevant materials, such as tangible items, a laptop, data sheets, handwriting worksheets, writing utensils, and tablets. Before each session began, the participant was instructed to sit in one of the chairs; the experimenter sat in the other.

The experimenter presented four items per participant during each assessment. Three preferred items were selected and the fourth item served as the control stimuli. The items were presented in an array for the standard MSWO and verbally for the verbal MSWO. Preferred and control items were selected using the Reinforcer Assessment for Individuals with Severe Disabilities (RAISD, Fisher, Piazza., Bowman, & Amari, 1996).

After the MSWO was completed, a reinforcer assessment was conducted to verify the reinforcing effects of the stimuli utilized in the different preference assessment formats. The reinforcer assessment took place 5 min after the MSWO ended. Reinforcement effects were examined utilizing handwriting worksheets. Each worksheet was associated with an item from the previous preference assessment.

Response Measurement and Reliability

For all assessments, a selection response was recorded when the participant made physical contact with a stimulus or verbally selected the stimulus. The participants had 30 s to select an item. During the tangible MSWO, if the participant selected more than one item, the first item the participant selected was recorded. If the participant did not select an item during the 30 s trial, the trial ended. Once the participant made a selection, the participant received 30 s of access to that item. Total session duration was recorded during each session. Duration was recorded from the moment the participant was instructed to select an item during the first trial until the final selection.

Observers recorded data on data sheets customized for each preference assessment. For all sessions, the experimenter served as the primary observer. During 75% of sessions, interobserver agreement data was collected. The second observer collected data by viewing a video recording of the session. Agreements were defined if both observers recorded the same response, i.e., selection or no selection, for each trial. IOA data was then be calculated by dividing agreements by agreements plus disagreements and then multiplying by 100%. The average score across participants for all sessions was 94% (range, 83% to 100%).

Treatment integrity was collected for 75% of sessions. A second observer scored the proper implementation of the protocol for each preference assessment, and reinforcer assessment. The second observer collected data while viewing a

video recording of the session. The experimenter scored the presence of materials, compliance with the procedures regarding presentation and delivery of stimuli, and appropriate responding with the participants. Items were scored as dichotomous yes-no variables and calculated using trial-by-trial agreement. The average score calculated across all participants for treatment integrity was 95% (range, 89% to 100%).

Procedures

Before the beginning of each assessment, participants were given 30 s of access to each leisure item. The purpose of this exposure was to familiarize the participants with any items that may be novel. The experimenter will ensure items are in proper working order, and demonstrate how to turn on the power, or manipulate the items appropriately.

Tangible MSWO. During the assessment procedure, each session began with the experimenter arranging four items in a straight line on the table, about 2 cm apart. The participant was seated within arm's reach of the stimulus array. The experimenter then instructed the participant to pick one item. After the participant selected an item, the participant had access to the item for 30 s. The item was removed from the table and was not replaced. Before the next trial, the sequencing of the remaining items was rotated by taking the item at the left end of the line and placing it on the right end, thus shifting the items so they were once again equally spaced on the table. The second trial occurred immediately following the first. This

procedure continued until all items were selected or until the participant did not make a selection within 30-s of the presentation during the trial. If a trial ended due to the participant's failure to select an item, all remaining items were recorded as "not selected".

Verbal MSWO. For this assessment, the session began with the participant and experimenter sitting at the table. The experimenter asked the participant "which do you want: W, X, Y, or Z?" No actual items were present, only the question. Once the participant verbally selected a stimulus (e.g., "I want X" or "Y"), the experimenter recorded the selection, and gave the participant 30 s of access to the selected item. After the 30 s of access to the stimuli ended, the researcher presented the next verbal array. However, in the next array, the item that was said last was now said first (i.e., "which do you want: Z, X, or Y?"). This procedure continued until all the items were verbally selected or until the participant did not make a verbal selection within 30-s of the beginning of the trial. If the trial ended due to the participant's failure to select an item, all remaining items were recorded as "not selected." The order in which the experimenter listed the items remained the same across verbal MSWOs, with the stimuli previously stated last always listed first in the subsequent trial.

Reinforcer Assessment. The task selected for all participants was a handwriting worksheet. The experimenter placed five identical worksheets on the table in front of the participant. Four worksheets had one of the stimuli from the

preference assessment placed on top of it. The fifth worksheet did not have any stimuli on top of it, thus serving as the control. The reinforcement contingencies were then explained to the participant. The worksheets were placed approximately 2 cm apart from each other on the table in front of the participant, and the participant was instructed to, "work for what you want." Following the completion of the worksheet, the experimenter provided 30 s of access to the activity. Following the reinforcement interval, the experimenter rotated the stimuli and corresponding worksheets by moving one item from the far left and placing it on the far right. The participant was then prompted by the experimenter in the manner described previously. The participant completed up to five worksheets. The experimenter scored the duration of each session.

Experimental Design

The experimental design of this study was an alternating treatment design. Each participant participated in three sessions of each type of MSWO procedure, for a total of six sessions per participant. Implementation of the MSWO formats alternated between verbal and tangible MSWO procedures. To determine which type of MSWO the experimenter would conduct with each participant, the experimenter rolled a die. Even numbers were assigned to the verbal MSWO, and odd numbers were assigned to the tangible MSWO. The order of the presentation of verbal versus actual item analyses will be counterbalanced across participants. Five min after each MSWO, the experimenter conducted a reinforcer assessment

with the participant. Data were computed on the percentage of selections of worksheets completed, and the corresponding item.

Statistical Testing

The Spearman rank-order correlation was calculated to measure the ordinal association between the two types of MSWO conducted. The formula for the Spearman rank-order correlation is $R_s = 1 - (6\Sigma d^2/n^3\text{-}n)$. This statistic indicated the degree of correspondence across all preference assessments conducted, and yielded a single measure of correspondence. Stability for the Spearman rank-order correlation was defined as a coefficient equal to or exceeding the critical *r* value of 0.503 based on the criterion used by Zar (1972).

Results

The results of this study found idiosyncratic results across all four participants. For participants one and two, the verbal MSWO more accurately predicted reinforcers than the tangible MSWO. For participant three, the tangible MSWO was slightly more accurate than the verbal MSWO at identifying reinforcers. Lastly, the results for participant four found that the tangible MSWO more accurately identified lesser preferred items but that both types of MSWO accurately identified highly preferred reinforcers.

Figures 1 and 2 show the rank order of each stimulus during the tangible and verbal MSWOs and their succeeding reinforcer assessments for participant one, Caleb. Table 1 shows Caleb's mean approach responses to each stimulus during the

tangible and verbal MSWOs. Overall, this study found the verbal MSWO identified reinforcers more accurately than the tangible MSWO for this participant. However, it should be noted that Caleb chose items during the reinforcer assessments for session two and three randomly by playing a chanting game to select stimuli. During session four, the experimenter implemented a rule to prevent the participant from choosing reinforcers randomly. The therapist said at the beginning of the session, "Do not play any games to choose items. Select the one you want. If you follow the rule, we will play a game together after the session." The control stimulus for this participant was the baby doll. The baby doll was not selected until session five. Table 2 shows the mean Spearman correlation coefficient between all tangible and verbal MSWOs, across all verbal MSWOs and across all tangible MSWOs. The mean Spearman correlation coefficient between all trials of the verbal and tangible MSWO was 0.926. The statistical analysis of all trials of the verbal MSWO resulted in a Spearman correlation coefficient of 0.937. Lastly, the Spearman correlation coefficient of all the tangible MSWO trials was found to be 0.986. All three of these values indicate significant, strong positive results demonstrating high correspondence between the tangible and verbal MSWOs, across the verbal MSWOs and across the tangible MSWOs. Table 3 depicts the average duration of the verbal and tangible MSWOs for Caleb. The average duration of the three verbal MSWOs was 2 min and 32 s. The average duration of the reinforcer assessment immediately following the verbal MSWO was 12 min

and 6 s. In comparison, the average duration of the tangible MSWO was 2 min and 24 s. The average duration of the reinforcer assessment that succeeded the tangible MSWO was 11 min and 9 s.

Table 1 depicts the average percentage of opportunities each stimulus was selected during the verbal or tangible MSWO compared to the reinforcer assessment that immediately followed for participant two, Mark. Figures 3 and 4 show the rank order of each stimulus during the verbal and tangible MSWOs and the reinforcer assessment that immediately followed. For this participant, the verbal MSWO was slightly more accurate than the tangible MSWO. The control stimulus for Mark was a book with no pictures. Table 2 shows the mean Spearman correlation coefficient between the two types of MSWO, across verbal MSWOs, and across tangible MSWOs. The mean Spearman correlation coefficient between verbal and tangible MSWOs was found to be 0.930. In comparison, the mean Spearman correlation coefficient across verbal MSWOs was found to be 0.916. Lastly, the statistical analysis found the correlation coefficient across tangible MSWOs to be 0.986. All three of these values are significant, strong positive values indicating high correspondence between the verbal and tangible MSWOs, across the verbal MSWOs, and across the tangible MSWOs. Table 3 lists the average duration of the verbal and tangible MSWO for this participant. The average duration of the tangible MSWOs for this participant was 2 min and 5 s. The average duration for the reinforcer assessment following the tangible MSWO was 4

min and 6 s. Comparatively, the average duration of the verbal MSWO was 3 min. The average duration for the reinforcer assessment succeeding the verbal MSWO was 7 min and 4 s.

Table 1 shows the average percentage of opportunities each item was selected during the verbal and tangible MSWO compared to the succeeding reinforcer assessment for participant three, Daniel. Figures 5 and 6 show the rank order of each stimulus during each session of the verbal and tangible MSWO and the succeeding reinforcer assessment. The control stimulus for this participant was the ball. However, when Daniel selected the ball during the first session he noticed that the ball made a noise contingent upon movement. For sessions two through six, the ball was chosen more frequently. Thus, it is possible that the control stimulus for this participant became more preferred item during this study. The tangible MSWO appeared to be slightly more accurate in identifying potential reinforcers compared to the verbal MSWO for this participant. Table 2 lists the mean Spearman correlation coefficient between the two MSWOs, across the verbal MSWOs, and across the tangible MSWOs. The mean Spearman correlation coefficient between tangible MSWO and verbal MSWO trials was calculated to be 0.944. The correlation coefficient calculated for across the tangible MSWOs was found to be 0.923. The statistical analysis found the results for across the verbal MSWOs to be 0.951. All three of these values represent significant, strong positive results. Table 3 lists the average duration of the verbal MSWO and tangible

MSWO for this participant. The average duration of the verbal MSWOs conducted was 2 min and 54 s. The average duration of the reinforcer assessments following the verbal MSWOs was 11 min and 8 s. In comparison, the average duration of the tangible MSWO for this participant was 2 min and 55 s. Lastly, the average duration for the reinforcer assessments following the tangible MSWOs was 12 min and 9 s.

Lastly, table 1 depicts the average percentage of opportunities each item was selected during the tangible and verbal MSWO compared to the reinforcer assessment that immediately followed for participant four, Connor. Figures 7 and 8 list the rank of each stimulus selected during the verbal and tangible MSWO and the succeeding reinforcer assessment. The results for this participant showed that both MSWOs accurately identified the two most highly preferred items. However, the tangible MSWO was slightly more accurate when identifying lesser preferred items for this participant. The control stimulus for this subject was the barbie doll. Table 2 lists the mean Spearman correlation coefficient for between the two types of MSWOs, across the verbal MSWOs, and across the tangible MSWOs. The mean Spearman correlation coefficient between the verbal MSWO and tangible MSWO trials was calculated to be 0.986. Additionally, the mean Spearman correlation coefficient calculated for across tangible MSWOs was 0.993. Lastly, the statistical analysis resulted in a value of 0.993 for across verbal MSWOs. All three of these values are strong, positive significant values. Lastly, table 3 lists the average

duration of the verbal and tangible MSWOs for this participant. The average duration of the three verbal MSWOs conducted was 3 min and 19 s. The average duration of the reinforcer assessments immediately following the verbal MSWOs was 17 min and 6 s. Comparatively, the average duration for the tangible MSWO was 2 min and 39 s. Whereas the average duration for the reinforcer assessment following the tangible MSWO was 17 min and 5 s.

Discussion

The results of this study contribute to existing literature on preference assessments in several ways. First, the results suggest that verbal preference assessments may be idiosyncratic across individuals. Clinicians should conduct both types of preference assessments with a reinforcer assessment and compare the results to determine which is more accurate for the specific individual. Second, the tangible MSWO had a shorter average duration for three out of four participants compared to the verbal MSWO. This is important because previous studies suggested that verbal preference assessments would have a shorter duration than preference assessments utilizing tangibles (Cohen-Almeida et al., 2000). As mentioned previously, many clinicians have a limited amount of time to conduct preference assessments (Graff & Karsten, 2012). Thus, based on the results of this study those clinicians with limited time should consider using the tangible MSWO before utilizing a verbal MSWO. Overall, results showed that some individuals

with developmental disabilities may be able to identify their reinforcers accurately through a verbal MSWO.

There were a few limitations for this study that warrant further consideration regarding the results. First, Caleb showed random responding during the first tangible MSWO and its succeeding reinforcer assessment. This led the experimenter to discover he was using his own selection system based on a chanting game, not based on actual preference. After the use of a game to select items became apparent to the experimenter, the implementation of a rule resulted in better differentiation of results. This finding suggests the importance of observing participants closely to rule out reasons for idiosyncratic or highly variable responding. This finding also demonstrates that the tangible MSWO may be more susceptible to participants using random methods to select preferred stimuli than the verbal MSWO. This may be because it could be more difficult for the participant to select stimuli randomly during the verbal MSWO because the stimuli are not physically present.

A second potential limitation was that the experimenter did not limit access to specific items used in the preference assessments. For instance, it was possible that the participants had access to the same items during breaks between classes, provided by other therapists, and therefore, showed satiation over the course of the study as the same stimuli were used for all six sessions for each participant. Future

research should assess durability of preferences across time to analyze potential effects of satiation on preferences.

Additionally, the use of tablets during this study may have had an influence on results. For some individuals, the tablet may be considered an activity instead of a tangible. This is because the participant has the option to watch a variety of videos or play various games on a tablet. To address this limitation, future research should conduct preference assessments where either all of the presented activities are on tablets or the assessment does not include any tablets in the array. Additionally, future research should be conducted to compare the results of preference assessments that include tablets and various tangible items in the array in comparison to those that include tangible items and no tablets in the array.

Another possible limitation for this study was that the researcher that conducted all of the studies was more familiar with some participants than others. The researcher had worked individually with each participant in the school setting prior to the study. However, the researcher had spent more time conducting one-on-one ABA therapy-based sessions with Connor in comparison to the other three participants. Thus, it is possible that the researcher had greater stimulus control over Connor. This difference in stimulus control across participants could have influenced results.

An additional limitation is that the presence of the four stimuli during the tangible MSWO may have influenced which item the participant picked. This could

have caused the participant to choose differently in comparison to the verbal MSWO. The sight of the stimuli could have influenced the participants selection, increasing or decreasing the likelihood of their selection for each item. Future research should compare the results of verbal preference assessments with the stimuli within sight versus those with no stimuli present.

Another potential limitation was that for Daniel the item chosen as the control stimulus (a ball) may have become a preferred item during the study. The ball was chosen as the control stimulus because in the Reinforcer Assessment for Individuals with Severe Disabilities that was conducted for Daniel, therapists noted that he rarely interacted with balls when given a choice of what stimuli to interact with. However, upon Daniels first interaction with the item during the study he noticed that it made a noise contingent upon touch. In later sessions, Daniel chose the ball more frequently than the other items. During the verbal MSWOs conducted, the ball was the most preferred item for Daniel. Future researchers should ensure all participants interact with the items before they begin their study to prevent control items from becoming potential reinforcers.

Another potential limitation was in regards to how control items were selected. Control stimuli were selected based on the results of the RAISD for each participant. However, just because a stimulus is less preferred or less familiar to the participant does not mean that stimulus will not function as a potential reinforcer. It is important to have a control stimulus during preference assessments because even

if an item is less preferred, it can still function as a reinforcer. However, the item should also not be aversive to the participant. Thus, it can be difficult for researchers to accurately select an item to serve as a control that will not become a reinforcer nor be aversive to the participant. Future research should develop methods that can accurately identify control stimuli for preference assessments.

Lastly, this research study consisted of three participants with ASD and one participant with Fragile X Syndrome. Participants were all at a similar functioning level but their ages varied (ranging from five years old to 17 years old). This is a potential limitation for this study because the group of participants were not completely homogenous. To address this limitation, future researchers should try and select participants with the same or similar diagnoses, similar functioning level, and within a smaller age range to result in a more homogenous sample.

Future researchers should also consider conducting verbal MSWOs utilizing more or less than four stimuli, to determine if this influences results. Additionally, future researchers should conduct verbal MSWOs with individuals with various developmental disabilities, to see if there is an influence on results. Third, future researchers could conduct a comparison of the verbal MSWO to other types of preference assessments, such as a free operant preference assessment or paired stimulus preference assessment. An additional direction for future research is the consideration of modality of stimuli in preference assessments. The modality of stimuli may have an influence on how reinforcing a stimulus is for a participant.

Participants with visual, vocal, or motor stereotypy may prefer different stimuli based on their modality. Prospective researchers should also examine variations of the verbal MSWO to see if different variations will result in a shorter session duration compared to the tangible MSWO. This is important to clinicians because any time that can be spared during preference assessments could be spent in treatment to benefit the client. Additionally, another suggestion for future research is for verbal MSWOs to be conducted with individuals in the general education setting. The simplicity of the verbal MSWO could be beneficial to teachers in general education classrooms. Prospective researchers should examine whether or not the order in which stimuli are listed in verbal MSWOs has an influence on results. This could include the researchers listing the stimuli in a different order during each trial in comparison to listing the stimuli in the same order across all trials. Future researchers should also conduct verbal MSWOs with activities that cannot be represented by stimuli. The results of activity based verbal MSWOs should be compared to MSWOs that represent activities with pictures. Future researchers could also represent activities through the use of tablets, these results should also be compared to verbal MSWOs to determine which variation of the MSWO is most effective and efficient. Lastly, other investigations might include analysis of verbal MSWOs, where the participant is not given access to the item following selection during the preference assessment to determine if participants

can accurately select an item with no stimuli present before or after selection (Kuhn et al., 2006).

Overall, the results of this current study found that verbal MSWOs were not necessarily shorter in duration than the standard tangible MSWO. Results also indicated idiosyncratic results across participants, thus suggesting that the verbal MSWO may be a more accurate method for identifying potential reinforcers for some high functioning individuals with developmental disabilities.

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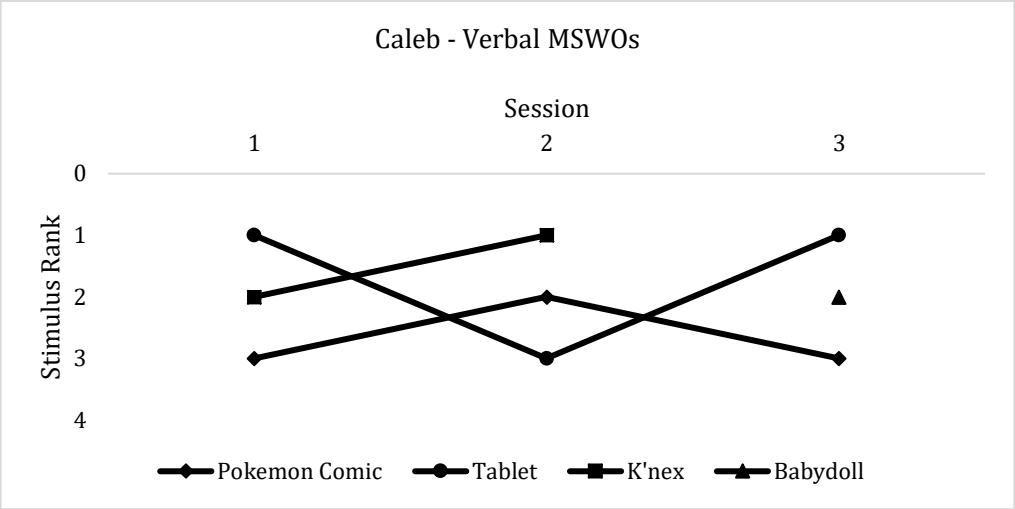
Appendix A

Figures:

Figure 1



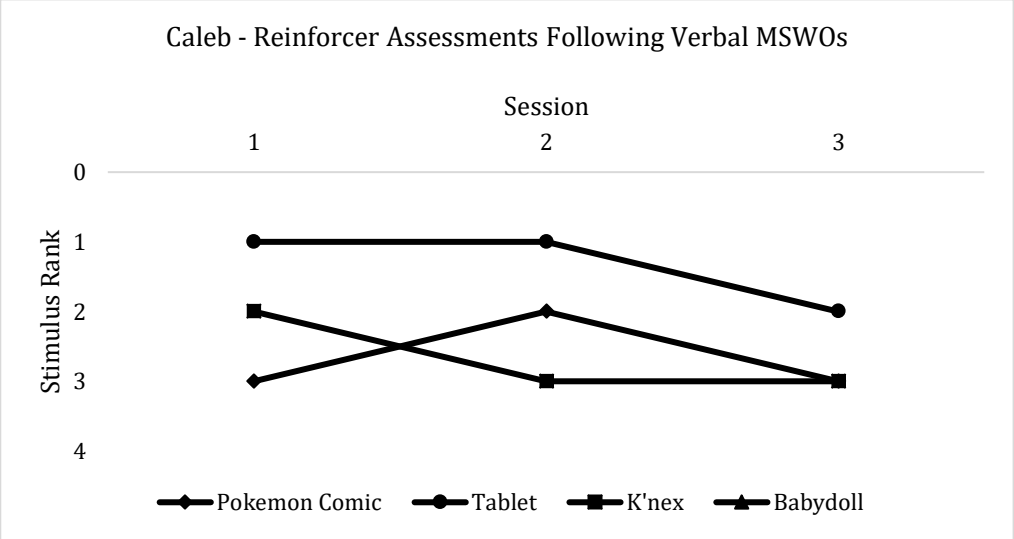
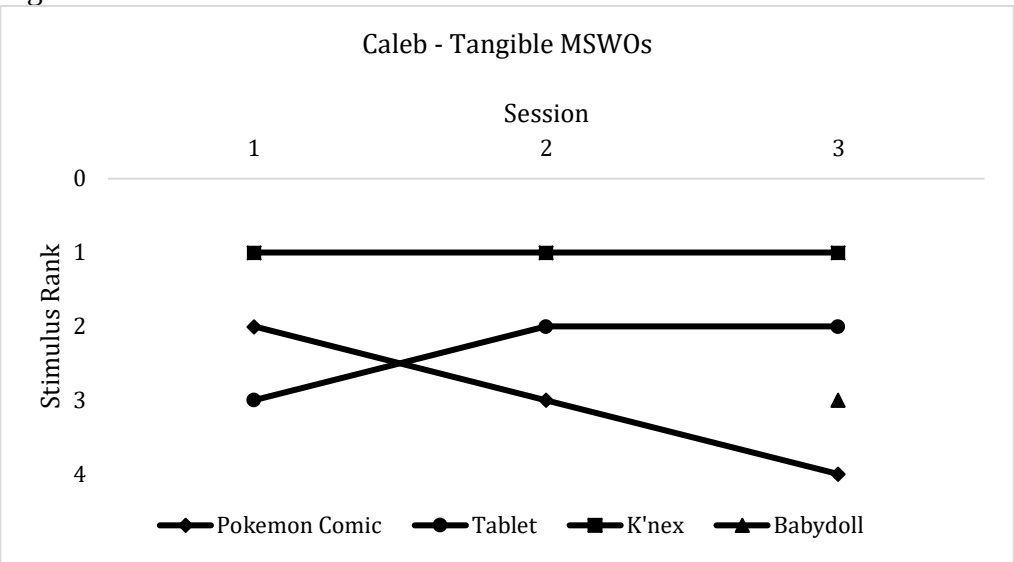


Figure 1. The rank of each stimuli during each session for the verbal MSWO and reinforcer assessment following the verbal MSWO for participant one, Caleb. Sessions in which there is no data point for a stimulus represent instances where that stimulus was not selected and the session was ended.

Figure 2



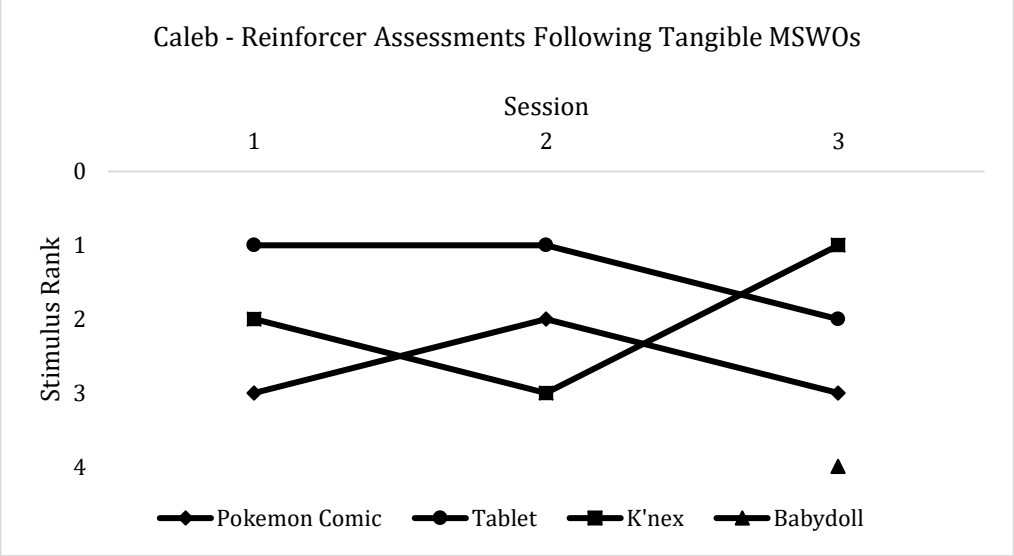
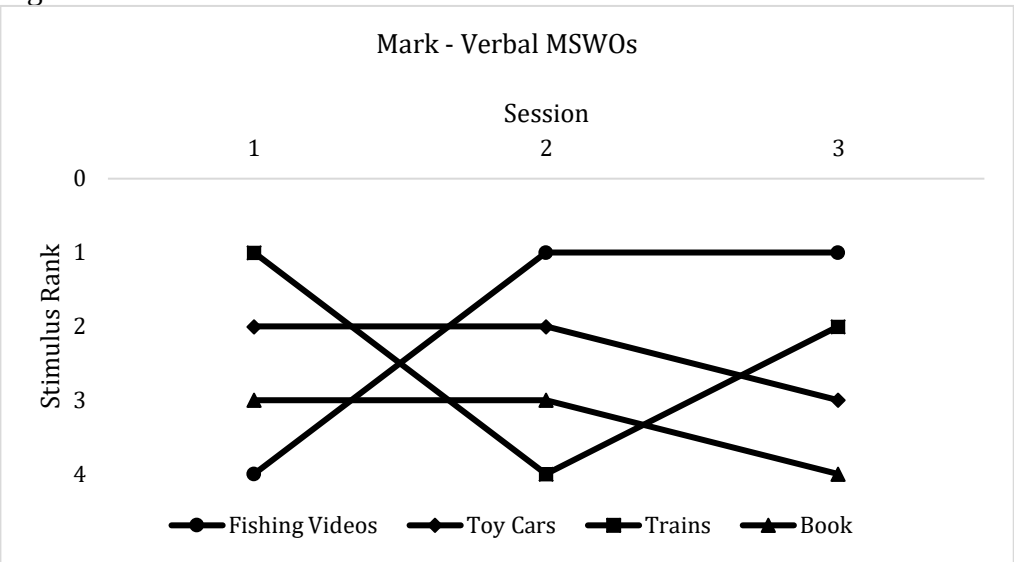


Figure 2. The rank of each stimuli during each session for the tangible MSWO and reinforcer assessment following the tangible MSWO for participant one, Caleb. Sessions in which there is no data point for a stimulus represent instances where that stimulus was not selected and the session was ended.

Figure 3



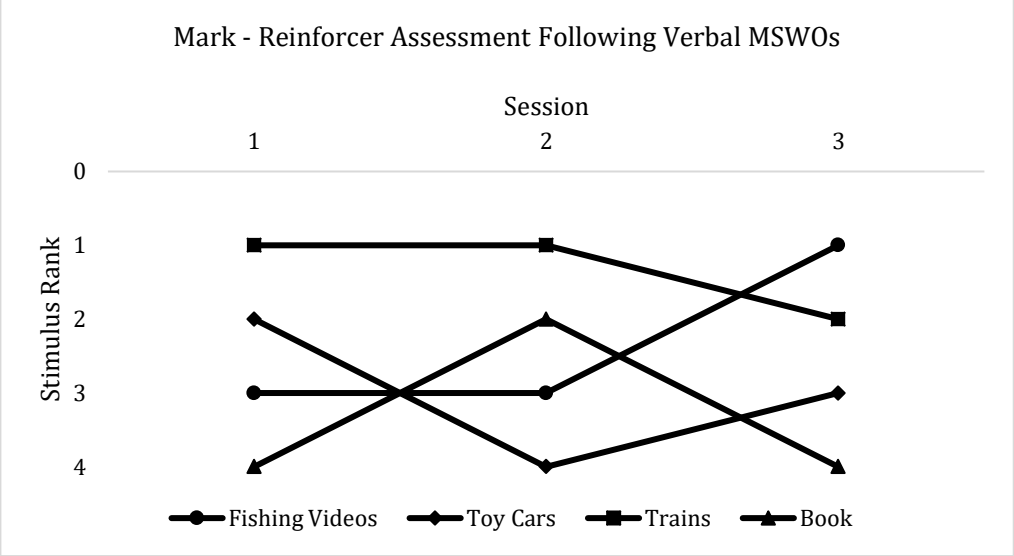
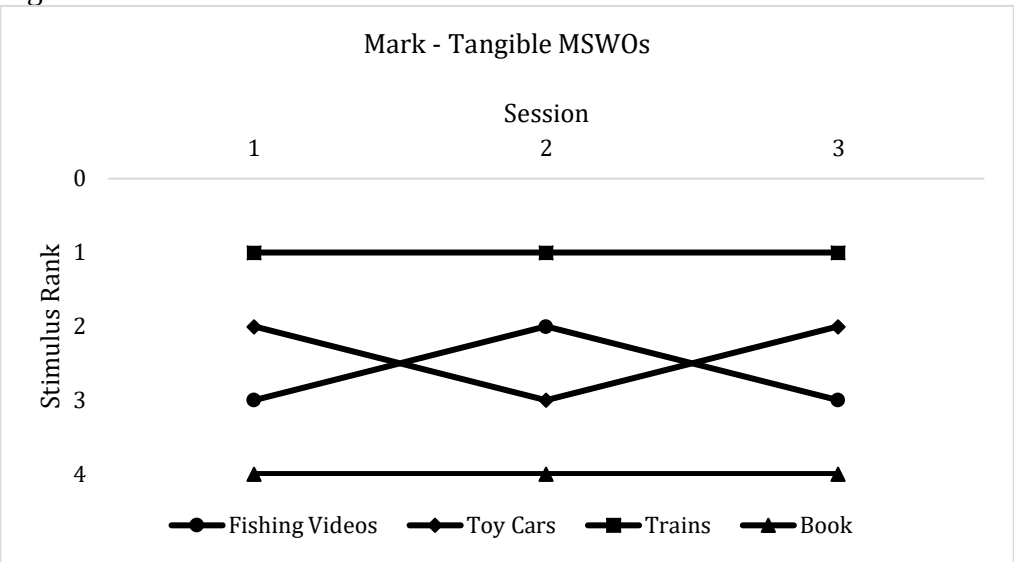


Figure 3. The rank of each stimuli during each session for the verbal MSWO and reinforcer assessment following the verbal MSWO for participant two, Mark.

Figure 4



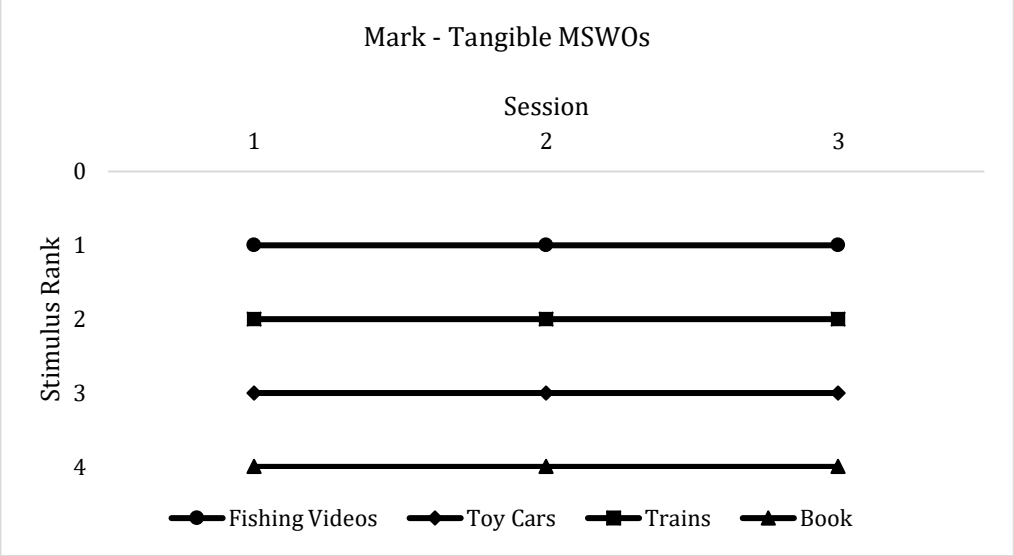
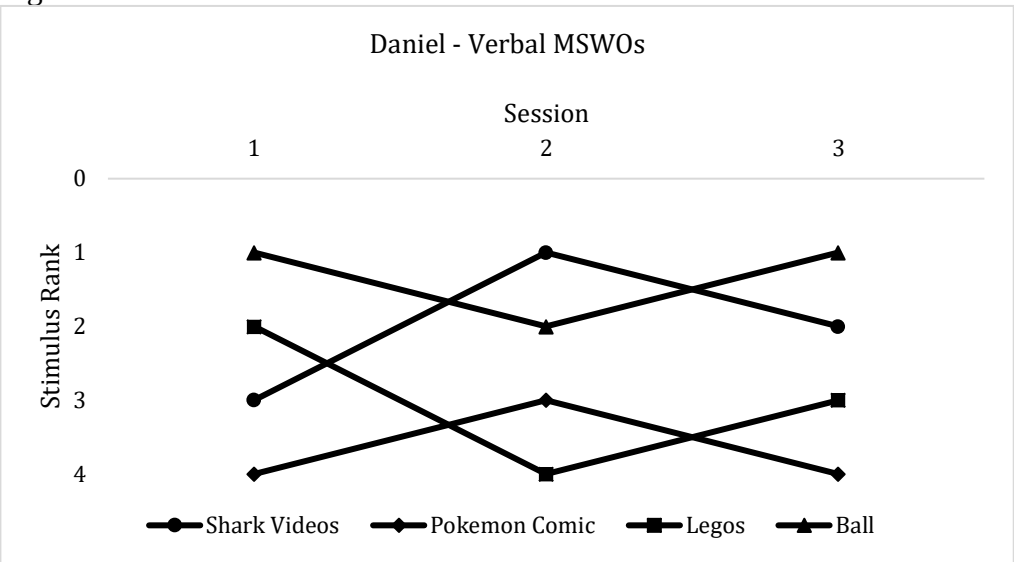


Figure 4. The rank of each stimuli during each session for the tangible MSWO and reinforcer assessment following the tangible MSWO for participant two, Mark.

Figure 5



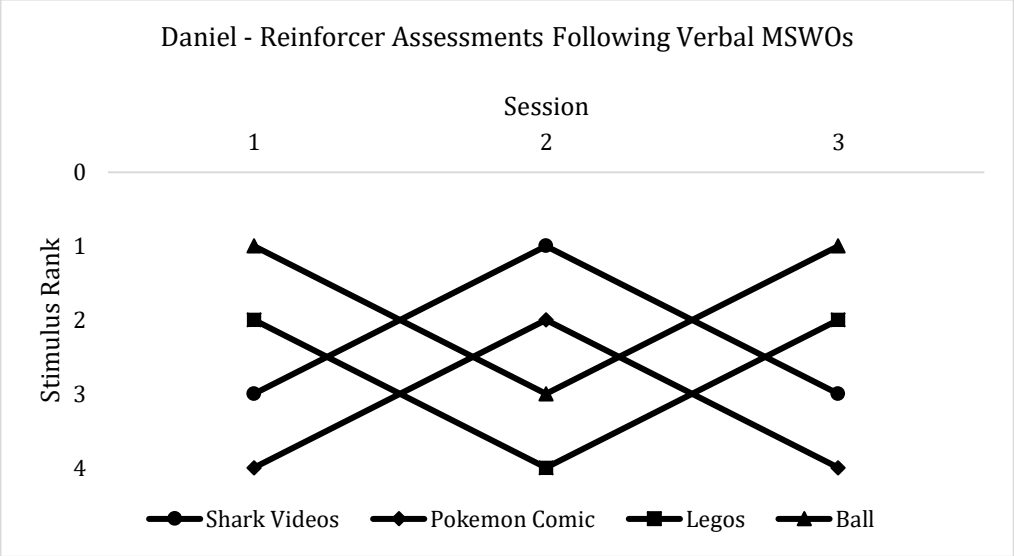
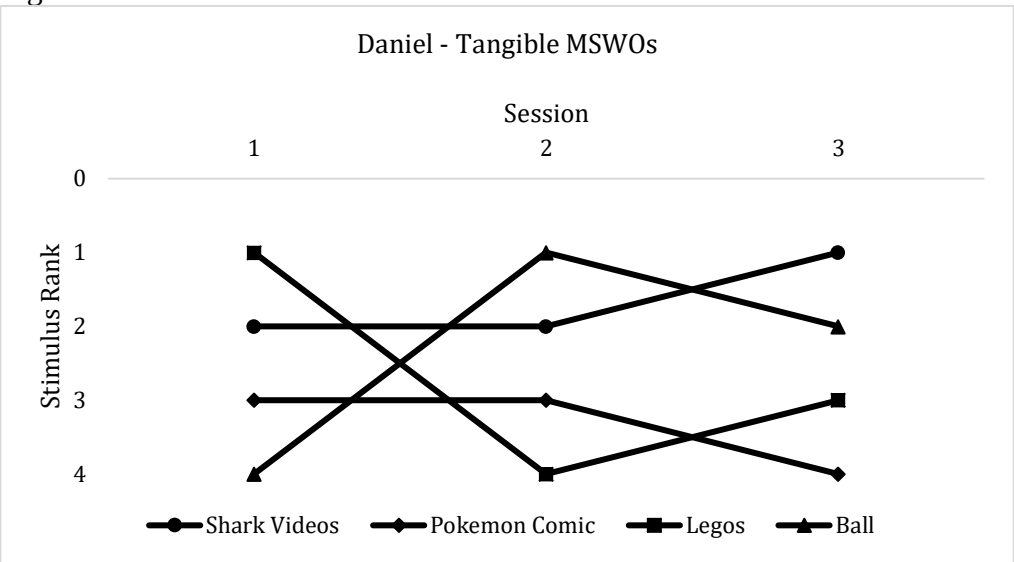


Figure 5. The rank of each stimuli during each session for the verbal MSWO and reinforcer assessment following the verbal MSWO for participant three, Daniel.

Figure 6



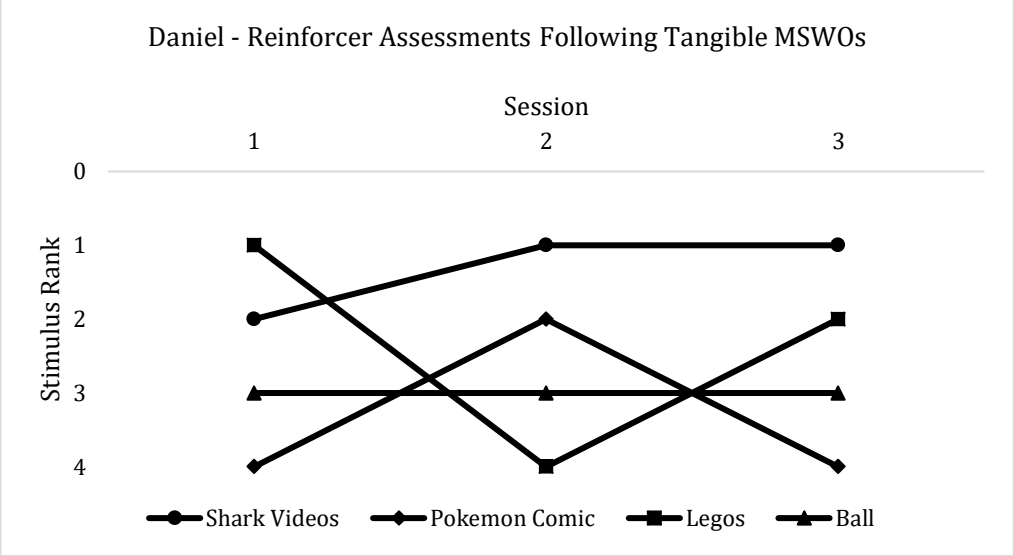
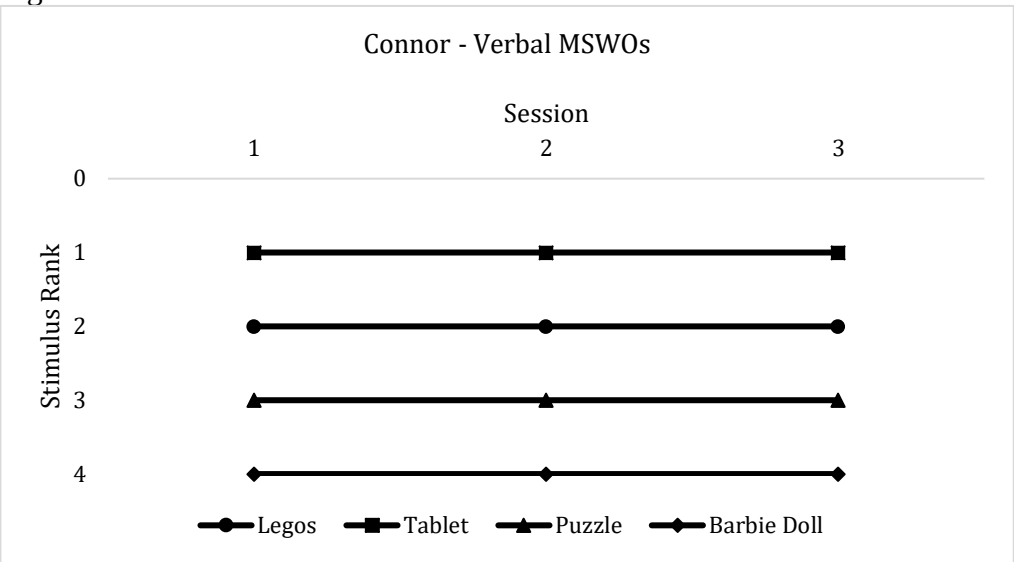


Figure 6. The rank of each stimuli during each session for the tangible MSWO and reinforcer assessment following the tangible MSWO for participant three, Daniel.

Figure 7



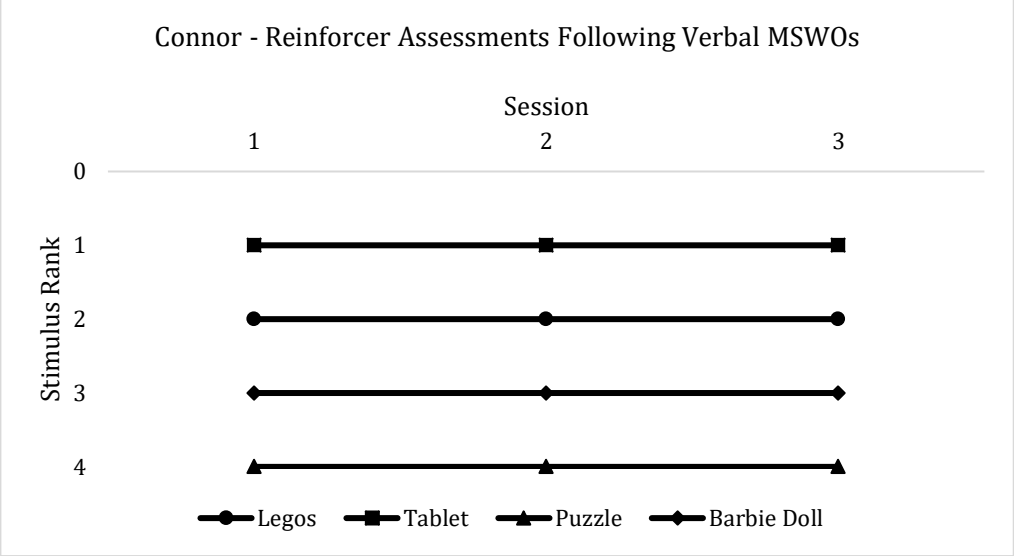
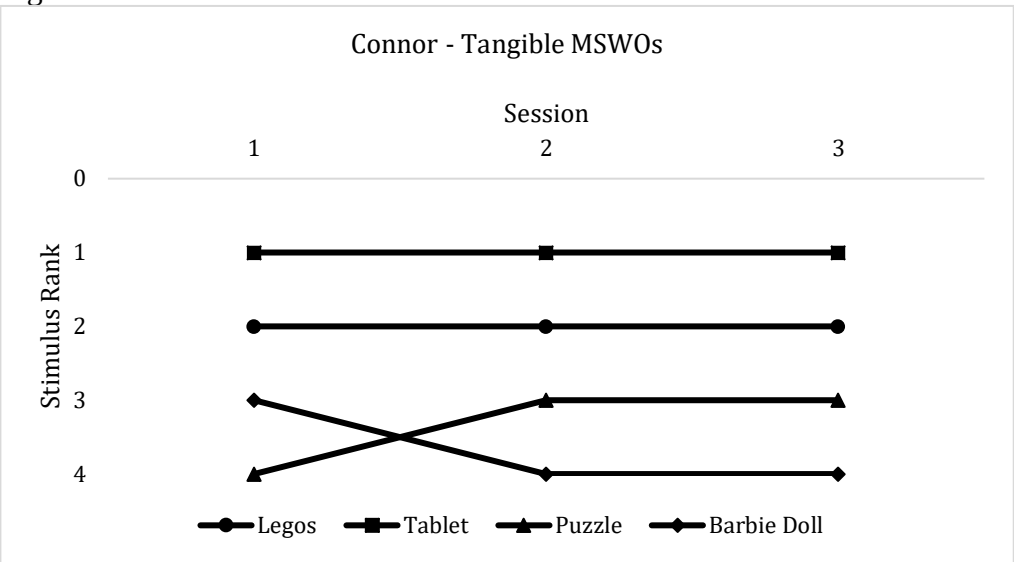


Figure 7. The rank of each stimuli during each session for the verbal MSWO and reinforcer assessment following the verbal MSWO for participant four, Connor.

Figure 8



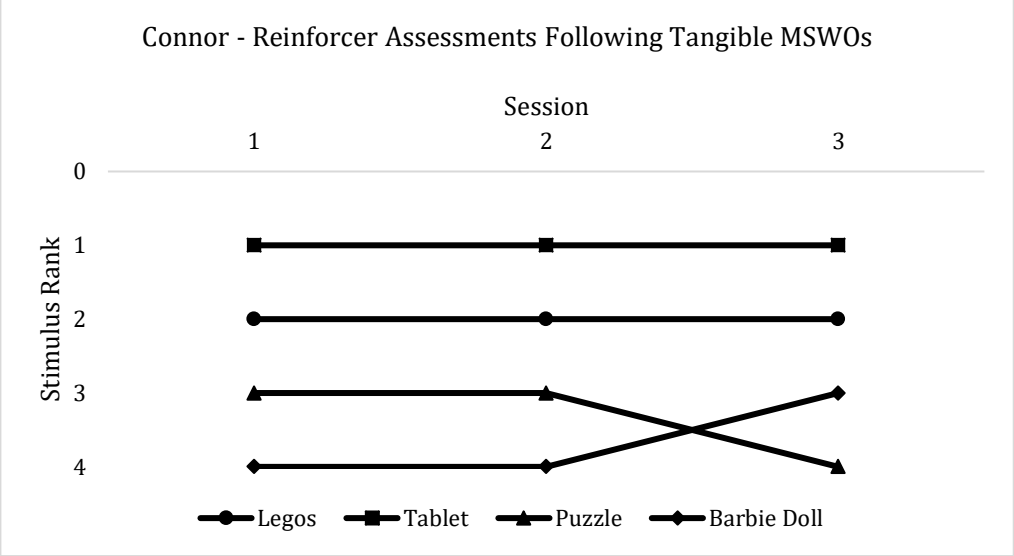


Figure 8. The rank of each stimuli during each session for the tangible MSWO and reinforcer assessment following the tangible MSWO for participant four, Connor.

Appendix B

Tables:

Table 1. Description of each participant's mean approach responses to each stimuli in the tangible MSWO and verbal MSWO

Participant	Stimuli	Tangible Rank (mean approach responses)	Verbal Rank (mean approach responses)
Caleb	K'nex	100%	28.57%
	Tablet	42.86%	60%
	Pokemon Comic	33.33%	37.50%
	Babydoll	9.09%	10%
Mark	Trains	100%	42.86%
	Toy Cars	42.86%	42.86%
	Fishing Videos	37.50%	50%
	Book	25%	30%
Daniel	Shark Videos	60%	50%
	Ball	42.86%	75%
	Legos	37.50%	33.33%
	Pokemon Comic	30%	27.27%

Participant	Stimuli	Tangible Rank (mean approach responses)	Verbal Rank (mean approach responses)
Connor	Tablet	100%	100%
	Legos	50%	50%
	Puzzle	30%	33.33%
	Barbie Doll	27.27%	25%

Table 2. Each participant's Spearman Rank Correlation Coefficient between verbal and tangible MSWOs, across tangible MSWOs, and across verbal MSWOs.

Participant	Spearman Rank Correlation Coefficient Between the Verbal and Tangible MSWOs	Spearman Rank Correlation Coefficient Across Tangible MSWOs	Spearman Rank Correlation Coefficient Across Verbal MSWOs
Caleb	**0.926**	**0.986**	**0.937**
Mark	**0.930**	**0.986**	**0.916**
Daniel	**0.944**	**0.923**	**0.951**
Connor	**0.986**	**0.993**	**0.993**

Bolded correlations indicate a statistically significant value at $r > 0.503$.

Table 3. The average duration of tangible MSWOs and vebral MSWOs for each participant.

Participant	Average Duration of Tangible MSWOs	Average Duration of Verbal MSWOs
Caleb	2.24	2.32
Mark	2.5	3.07
Daniel	2.55	2.54
Connor	2.39	3.19