THE EFFECTS OF THE DURATION OF FREE OPERANT PREFERENCE ASSESSMENTS IN
YOUNG CHILDREN WITH AUTISM

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ABSTRACT

In this study, 2-minute and 5-minute free operant preference assessments were conducted. Preference hierarchies and the order of item selection were both identified and compared. The preference assessments were administered in alternating order and the resulting differentially preferred items were utilized in subsequent reinforcer assessments to determine if the items selected were reinforcing. The reinforcer assessments were conducted using an initial baseline and an alternating treatment design. Social validity was assessed with both the families and the participants. Treatment fidelity and inter-observer agreement data were also collected. The 2-minute free operant preference assessment was shown to be effective at identifying effective reinforcers for two out of the three participants. The third participant did not respond consistently to the free operant preference assessment at any length and responded aversively to the presentation of the free operant preference assessment, one which is known for yielding few problem behaviors. For the two participants that responded to the preference assessment, items that were identified functioned effectively as reinforcers. There was also a strong correlation using the Spearman's Rank-Order Correlation Coefficient between the preference hierarchies and the order of selection list. This study supports the usage of the shortened free operant preference assessment but requires expansion and repetition. The author discussed the limitations of the current study and directions for future research.

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CHAPTER 1
LITERATURE REVIEW

The Necessity of Reinforcement

One of the founding principles of Applied Behavior Analysis (ABA) is the utilization of reinforcement to increase the frequency of socially valid, appropriate behaviors. All ABA treatment programs utilize this technique in some manner. With reinforcement being such an important concept in ABA, it should come as no surprise that significant research has gone into the most effective strategies for its application (DeLeon & Iwata, 1996; Fisher, Plaza, Bowman, Hagopian, Owens, & Selvin, 1992; Hagopian, Rush, Lewin, & Long, 2001; Hanley, Iwata, Lindberg, & Conners, 2003; Pace et al., 1985; Roane, Vollmer, Ringdahl, & Marcus, 1998). Reinforcement has been identified as essential for reduction of problem behaviors, as well as effective therapy (Vollmer, Marcus, & LeBlanc, 1994; Rispoli, et al., 2016).

ABA has been applied to the treatment of children with autism for decades through the utilization of reinforcement-based interventions (Lovaas, 1987). Children with autism exhibit a variety of deficits across socialization, communication, and restricted or repetitive behavior (American Psychological Association, 2013). These children require a comprehensive therapeutic approach that involves the teaching of a vast array of individual skills or significant response classes (Lovaas, 1987). Reinforcement is necessary to teach all of these skills. Children with autism possess deficits in social interactions and engagements, which can result in decreased responsiveness to generalized social reinforcers (APA, 2013; Lovaas, Schreibman, Koegel, & Rehm, 1971). Since these children are not responding to the reinforcers

naturally available to them in their environment, specific additional reinforcement must be identified and/or contrived to strengthen appropriate behaviors (Lovaas et al., 1971; Pace, Ivancic, Edwards, Iwata, & Page, 1985). ABA therapy for children with autism begins as early as possible and for these young children their responsiveness to social reinforcement has not been specifically reinforced or taught yet (Lovaas, 1987; Dawson et al., 2010). Selecting these items is challenging for children with autism and especially young children as they cannot always tell what they want.

Preference Assessment

With the importance of reinforcers and the difficulty with identifying them, it is imperative that their identification be as effective and efficient as possible (Nottingham, Vladescu, & Kodak, 2015). Research has shown that effective therapy with minimal problem behaviors requires the identification and usage of reinforcers (Vollmer, Marcus, & LeBlanc, 1994). Vollmer et al. showed that just offering access to identified reinforcers prior to a session can decrease problem behavior. Effective use of reinforcement begins with the selection of the correct items or activities to utilize in order to increase the desired behavior. Conducting a formal preference assessment increases the likelihood of identifying the optimum reinforcers to effect behavior change (Virués-Ortega, Pritchard, Grant, North, Hurtado-Parrado, Lee, Temple, Julio, & Yu, 2014). There are several preference assessment types that have been investigated and compared for both effectiveness and efficiency.

Paired Stimulus. Due to the significance of identifying effective reinforcers, several strategies have evolved over the years to most efficiently ascertain the items that will function as reinforcers for each individual (Canella, O'Reilly, & Lancioni, 2005;

Daly III, Wells, Swagner-Gagné, Carr, Kunz, & Taylor, 2009; Geckeler, Libby, Graff, & Aheard, 2000). One popular strategy, known as Paired (or Pairwise) Stimulus (PS) Preference Assessment, was developed by Fisher, Plaza, Bowman, Hoagopian, Owens, and Selvin in 1992. PS assessments present a pair of stimuli, require the person to make a choice between the two, and then continue this strategy until all stimuli have been paired in all possible orders (Fisher et al., 1992). Studies have shown this to be an effective, but time-consuming, process for identifying a hierarchy of preferred items/activities that can be used as reinforcers (Kang, O'Reilly, Lancioni, Falcomata, Sigafoos, & Xu, 2013; Karsten, Carr, & Lepper, 2011).

Multiple Stimulus Without Replacement. To address the extended length of PS assessments, DeLeon and Iwata (1996), utilized a Multiple Stimulus Without Replacement (MSWO) Preference Assessment. Rather than presenting items two at a time, the MSWO presents the entire array of potential items, usually 5-7 items, and asks the individual to choose. After choosing, the child gains access to the desired item for 30 seconds. Following access, the item is taken away, and the child is presented again with the remaining items from which to choose. This process continues until all items have been chosen or the child stops selecting items. This method has also been shown to produce highly preferred items that function as reinforcers during subsequent assessments, and takes less time to conduct; however, due to the frequent removal of items, this procedure can lead to increased problem behavior during the assessment (Davis, Brock, McNulty, Rosswurm, Bruneau, & Zane, 2010; Kang, Lang, O'Reilly, Davis, Machalicek, Rispoli, & Chan, 2010; Karsten et al. 2011).

Free Operant. In 1998, Roane et al. developed a different type of preference assessment that could eliminate these problem behaviors. For the Free Operant (FO) preference assessment, items are nominated to be included. These items can be a mixture of foods and toys or either category exclusively. The items are then arranged in a room equidistant from where the participant will be during the assessment, typically shaped in a semicircle. The assessment begins by guiding the participant towards the items, taking him/her over to each individual item and showing him/her how that item can be utilized. The observer then guides the child back to the middle of the semicircle and tells the child to go play with whatever toys they want. The observer records the amount of engagement with each item, by using duration or partial interval data, throughout the assessment over a 5-minute period of time. After five minutes the child is guided to another area and the assessment is completed. No items are ever taken away and participation with items is not interrupted during the procedure.

FO assessments lead to fewer problem behaviors maintained by access to tangibles and identify items that can be effective reinforcers while taking approximately half the time of the MSWO (Cannella et al., 2005; Kang et al., 2010; Karsten et al., 2011; Kodak, Fisher, Kelley, & Kiassamore, 2009; Virués-Ortega et al., 2014). While the highly preferred items identified in the FO assessments are not always as effective in concurrent operant reinforcer assessments, they do still function as effective reinforcers in single operant reinforcer assessments (Verriden & Roscoe, 2016). This assessment also does not require any prerequisite skills.

The Impact of Duration

One question that remains is whether duration of stimulus access impacts the results of the assessments. FO assessments provide access to items for 5 min while PS and MSWO assessments allow only 30 sec of access before the item is removed, but when their effectiveness as reinforcement is assessed, individuals are only typically allowed access for 30 sec or less per item during the reinforcer assessment (DeLeon & Iwata, 1996; Fisher et al., 1992; Pace et al., 1985; Piazza, Fisher, Hagopian, Bowman, & Toole, 1996; Steinhilber, & Johnson, 2007). Steinhilber and Johnson (2007) evaluated the effects of access duration on reinforcer outcomes using 15-second and 15-minute access MSWO assessments. Steinhilber et al. (2007) demonstrated that the amount of time that an individual has access to an item during a preference assessment can be predictive of the amount of time that an individual should have access for optimal effect during the reinforcer assessment. A replication was done in 2014 by Jones et al. with the change that they decreased the differences in access duration and compared 30 second with 5 minutes (Jones, Dozier, & Niebert, 2014). These researchers were not able to find an effect of access duration on MSWO assessments, with consistent preference hierarchies found across both access duration lengths (Jones, et al., 2014). These findings complicate the research that demonstrates the relative effectiveness of FO and MSWO assessments (Kang et al., 2013; Karsten et al., 2011; Kodak et al., 2009; Virués-Ortega et al., 2014). The difference in findings may be due to the difference in magnitude between the comparisons. Access duration may impact the effectiveness of items identified in a

preference assessment; however, it may be possible that a shorter preference assessment can identify an equally effective reinforcer.

FO preference assessments typically take 5 minutes to complete but the preference hierarchies created are not as complete or consistent from one assessment to the next (DeLeon & Iwata, 1996; Hanley et al., 2003; Verriden & Roscoe, 2016; Virués-Ortega, 2013). This variability has typically been perceived as a flaw of the FO preference assessment and one of its chief criticisms (Verriden & Roscoe, 2016); however, it could be conceptualized in another way. It is possible that the FO preference assessment is more sensitive to the moment-to-moment fluctuation in preference that occurs for a child due to its shorter presentation and less formal structure, which allows for more natural responding. While the FO is typically presented in a 5-minute session where duration of engagement with items is assessed, one study recently utilized an adapted FO presentation (Tung, Donaldson & Kahng, 2017). The authors compared PS, MSWO, and FO preference assessments, as well as the problem behavior that occurred during and after the assessments. The authors conducted 2-minute FO preference assessments and determined which items were interacted with for the longest duration to determine the preference hierarchy. The item that was chosen for the longest period of time during the FO preference assessment was yoked to the access duration in the subsequent PS and MSWO assessments. This strategy controlled for the access duration difference that often occurs between preference assessment methods. Using this strategy, the authors found that the preference hierarchies for all methods were similar but that the FO assessment produced the fewest problem behaviors and took the least time to conduct.

One element of preference that is not accounted for in FO preference assessments at any duration is order of selection. The MSWO and PS preference assessments utilize order of approach and/or selection to determine their preference hierarchies (Kodak, et al., 2009). The FO assessment only assesses the duration of engagement with the various items. If the order of approach/selection is indicative of highest preference in FO assessments like in other assessments, it could make the procedure even more efficient. The first item approached in a free operant preference assessment may be the item that will ultimately be engaged with for the longest duration and the most effective reinforcer. If the efficiency of the FO can be improved even further, it could significantly enhance the quality of reinforcement-based therapy.

Present Study

The present study l conducted separate 2-minute and 5-minute access duration FO preference assessments. During these assessments, the experimenters will document the duration of engagement with each item, as well as the order that the items are selected. Then the highest preferred items from each assessment and the first item selected in each assessment were compared in a reinforcer assessment.

Research Questions

1. Do the same patterns of preference hierarchies exist between FO preference assessments of 2-minute and 5-minute duration?

2. Will the order of selection within the preference assessments present the same pattern of highest preference?

3. Will the preferred items function as effective reinforcers?

CHAPTER 2
METHOD

Participants

The participants were recruited through an agency that provides early intervention

and ABA services to children in a large metropolitan region in the Mid Atlantic section

of the United States. All participants have participated in reinforcement-based therapy but

none have participated in formal FO preference assessments prior to this study. The three

participants were diagnosed with Autism and ranged in age between 26 and 65 months

(see Table 1). The three participants all displayed varying levels of listener behavior,

communication, and adaptive behavior skills, but all demonstrated the ability to sit at a

table or on the floor and persist with an activity. They also all demonstrated previous

success with making choices and displayed protest behavior when denied access to highly

preferred items or activities. One caregiver for each participant completed a preference

assessment questionnaire. Participants were selected based on availability and consent as

per IRB. All preference and reinforcer assessments occurred in the participant's homes.

The participants' parents chose their pseudonyms for this study.

Table 1
Participant Data

Participant	Age (Months)	Diagnosis
Elliot	65	Autism
Elmer	26	Autism
Marshall	43	Autism

Materials & Settings

All sessions were conducted in the individuals' homes, using their living or play

rooms for the preference assessments and reinforcer assessments. The items for the

preference assessments were taken from those available in each household; consequently,

they varied from one participant to the next. Access was not restricted to these items between sessions, the rationale behind and ramifications of this decision will be discussed later.

Preference Assessments

Materials were recruited for the preference assessments using a modified version of the open-ended parent preference assessment utilized by Russo, Tincani, & Axelrod (2014). Caregivers were asked to nominate six foods, toys, and/or activities that their children preferred or frequently engaged with throughout their day. Parents were instructed to provide suggestions that were readily available in the home and could be delivered consistently throughout the study. If an insufficient number of items was identified by the parent, the list would have been supplemented by items based on observation of staff and what items were readily available in the participant's home, but this action was never necessary.

Elliot's parents nominated six toys for inclusion in the preference assessment: a toy computer, an electronic train, a toy music player, a dinosaur named Ned, an electronic drum set, and a stuffed animal, Chewbacca. For Elmer, his parents nominated three toys and three foods/drinks: a pile of ball pit balls, a vehicle island puzzle, a toy guitar, cookies, macaroni and cheese, and juice. For Marshall, his grandmother initially nominated three toys and three foods/drinks; however, after conducting the first few preference assessments, it was determined to replace the three food/drinks with more toys as unrestricted access to the food/drink items during sessions proved undesirable for the family. The final list of items for the preference assessment for Marshall included: plastic

cars and trucks, a memory game, an ABC dry erase book, a diamond shaped bead maze, a Doodle Pro, and a pile of mega blocks.

Once the list of potentially preferred items/activities was identified, each individual participated in the preference assessments with the same items being used in every preference assessment, except the initial preference assessments for Marshall. Two preference assessments that were conducted were FO 5-minute duration and FO 2-minute duration. The two preference assessments were conducted in sessions using an alternating treatment design, with at least 4-6 sessions of each type of preference assessment. For Elliot, 8 sessions of each type of preference assessment were conducted. For Elmer and Marshall, 7 sessions of each type were conducted.

The FO 5-minute and 2-minute duration assessments were both conducted similarly to the model described by Roane et al. (1998); the presentation was the same during every session. The items were arrayed in a semicircle around the participant. Prior to the assessment, the instructor escorted the participant to each item, said its name, and prompted them to engage with that item. Then, the instructor told the participant they can go play with the items. No further interaction was delivered. Utilizing a 10-second partial interval scale, the instructor tracked the participant's engagement with each activity. Engagement was defined as any contact by the participant's arm with the materials, lasting for at least one second. Additionally, the instructor noted the order in which materials were interacted with.

Inter-Observer Agreement and Treatment Integrity

Table 2
IOA/Treatment Integrity

	Elliot Average (Range)	Elmer Average (Range)	Marshall Average (Range)
IOA- Preference Assessment	100% (100%)	100% (100%)	100% (100%)
IOA- Reinforcer Assessment	99% (92%-100%)	100% (100%)	100% (100%)
Treatment Integrity- Preference Assessment	100% (100%)	100% (100%)	100% (100%)
Treatment Integrity- Reinforcer Assessment	98.8% (90%-100%)	100% (100%)	100% (100%)

For Elliot, Interobserver Agreement (IOA) and Treatment Integrity (TI) data were collected for 8 out of 16 preference assessment sessions with an average of 100% IOA and 100% TI. IOA and TI data were collected for 16 out of 33 reinforcer assessment sessions with an average of 99% IOA and 98.8% TI. These represented 50% of preference assessment sessions and 48% of reinforcer assessment sessions. For Elmer, IOA and TI data were collected for 6 out of 14 preference assessment sessions with an average of 100% IOA and 100% TI. IOA and TI data were collected for 13 out of 24 reinforcer assessment sessions with an average of 100% IOA and 100% TI. These represented 43% of preference assessment sessions and 54% of reinforcer sessions. For Marshall, IOA and TI data were collected for 8 out of 14 preference assessment sessions with an average of 100% IOA and 100% TI. IOA and TI data were collected for 17 out of 27 reinforcer assessment sessions with an average of 100% IOA and 100% TI. These represented 57% of preference assessment sessions and 63% of reinforcer sessions.

Quantitative Analysis

The results of the FO assessments were analyzed by identifying the percentage of intervals of engagement. A rank order was identified for each condition. Spearman's Rank-Order Correlation Coefficients were obtained comparing the ranking from the 2 and 5-minute preference assessments for each client. Additionally, the author tracked the order in which items were selected, created a composite order of selection for each condition, and Spearman's Rank-Order Correlation Coefficients were obtained comparing the ordered list to the ranked list for each preference assessment length for each participant. The Spearman's Rank-Order Correlation Coefficient provides a quantitative number describing the relationship between two rank-order lists with various scores indicating various levels of correlation between the two lists: 0.0-0.30 for a weak correlation, 0.30-0.70 for a moderate correlation, and 0.70-1.0 for a strong correlation (Verschuur et al., 2011).

Reinforcer Assessments

The reinforcer assessments were single operant reinforcer assessments in an alternating treatment design with an initial baseline design (Cooper, Heron, & Howard, 2007). The single operant reinforcer assessment was used because of the research showing the effectiveness of the FO preference assessment at the 5-minute length to identify effective reinforcers with this assessment (Verriden & Roscoe, 2016). The task utilized for the reinforcer assessment was a continuous activity that had previously been acquired by the participants. This task allowed the participants to display a wide range of total counts for responding, while still maintaining that no additional skills would need to

be taught. During all conditions, the subject sat at a table or on the floor. The researcher placed an empty shoebox in front of the participant. The instructor presented a pile of 160 picture-labeling index cards and told the participant to put them into the container. During the baseline assessment phases, completing the activity resulted in no reinforcement. During the experimental phases, the researcher utilized a fixed ratio 3 schedule of reinforcement and alternated between two conditions: reinforcing the activity with the highest preferred item from the 5-minute assessment and reinforcing the activity with the highest preferred item from the 2-minute assessment. The instructor presented the activity on the table with the item being utilized as the reinforcer behind it on the table. The participant was told to complete the task to earn access to the item behind it and the instructor started a 5-minute timer. Every three times the participant completed the activity, they gained access to the assigned potential reinforcer, with the timer paused while they interacted with the item. The instructor then took the item back, restarted the timer, and re - presented the task. Participants continued to have the opportunity to complete the task until the 5-minute timer was completed. The instructor tallied how many times the participant completed the activity. Preference assessments were conducted twice per 2-hour session.

This activity had to be adapted for one of the participants. Marshall demonstrated high levels of responding between 70 and 100 cards placed in the box during the baseline with the picture-labeling index cards. His responding was reinforced by looking at the cards and labeling them to himself, as well as the novelty of having free access to a pile of materials usually used for therapeutic purposes. The team brought blank index cards to replace the picture ones for Marshall. His responding decreased to zero levels during

baseline with the blank index cards and they were utilized during the reinforcer assessment as well instead of the picture cards.

Experimental Design

The preference assessment sessions were quasi-randomly chosen with a counterbalance so that no more than two consecutive sessions of the same assessment were conducted. Data were collected on the duration of engagement with toys and the order in which items were accessed. To avoid satiation, no more than two preference assessments were conducted per session, and the sessions took place at the same time every day to ensure that motivating operations were controlled across presentation.

The reinforcer assessment sessions were conducted using an alternating treatments design with an initial baseline. During all trials, data were collected on the number of activities complete. To avoid potential satiation with the reinforcers, no more than two reinforcer assessments were conducted in each session. Completion of phases and introduction of the next one was decided based on visual inspection of the data to determine consistent trends within conditions.

Dependent Variables

1. Percentage of 10-second intervals during which the participant engaged with each item. Those percentages will then be used to create a preference hierarchy.

2. Order of items selected during the preference assessment.

3. Number of cards placed into a box were assessed throughout each reinforcer assessment.

Social Validity

To assess the social validity of the study, all parents were asked to score each

preference assessment method on 5-point Likert scales to identify if they liked the

assessment, thought it was effective, and would like it to be used in their future treatment.

The participants were presented with a survey containing smiley faces and a five-point

scale and asked how they felt about the assessments at the conclusion of each type of

assessment (Buron & Curtis, 2012). Due to some of the participants not understanding

the question being asked about the social validity, an area was added for the observer to

document the participant's response to the assessment through behaviors, such as crying,

laughing, smiling, talking, etc.

CHAPTER 3
RESULTS
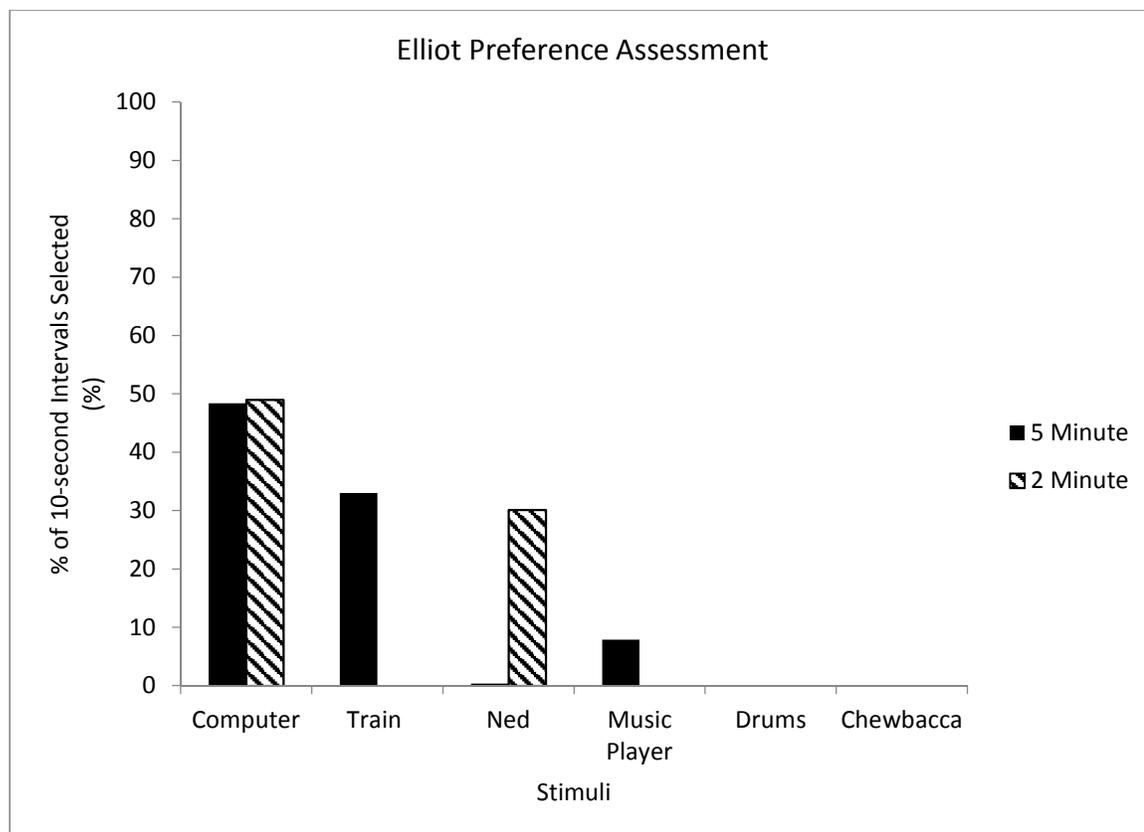
Preference Assessments

Figure 1. The percentage of 10-s intervals item was chosen during the free operant preference assessment for Elliot.

Figure 1 displays Elliot's responses in the preference assessment. Elliot engaged with only one item, the toy computer, for most preference assessments, whether 5-minute or 2-minute. Other than the computer, Elliot did not engage with the same item in both of the other assessments. The next most interacted with item was the train from the 5-minute preference assessment. The computer and the train were selected from the preference assessments to be utilized in the reinforcer assessment.

Elliot's preference assessment displayed a clear pattern of highest preference for the toy computer in both the 2 and the 5-minute preference assessments. His preference hierarchies correlated strongly with each other and with the order of selection. When the reinforcer assessment was conducted, he demonstrated some carryover from his history of learning with the baseline assessment. It required several sessions before he stopped completing the task without any reinforcement but then he did decrease to zero responding before immediately increasing when the reinforcers were delivered. Both the toy computer and the toy train functioned as effective reinforcers, with the computer being slightly more effective.
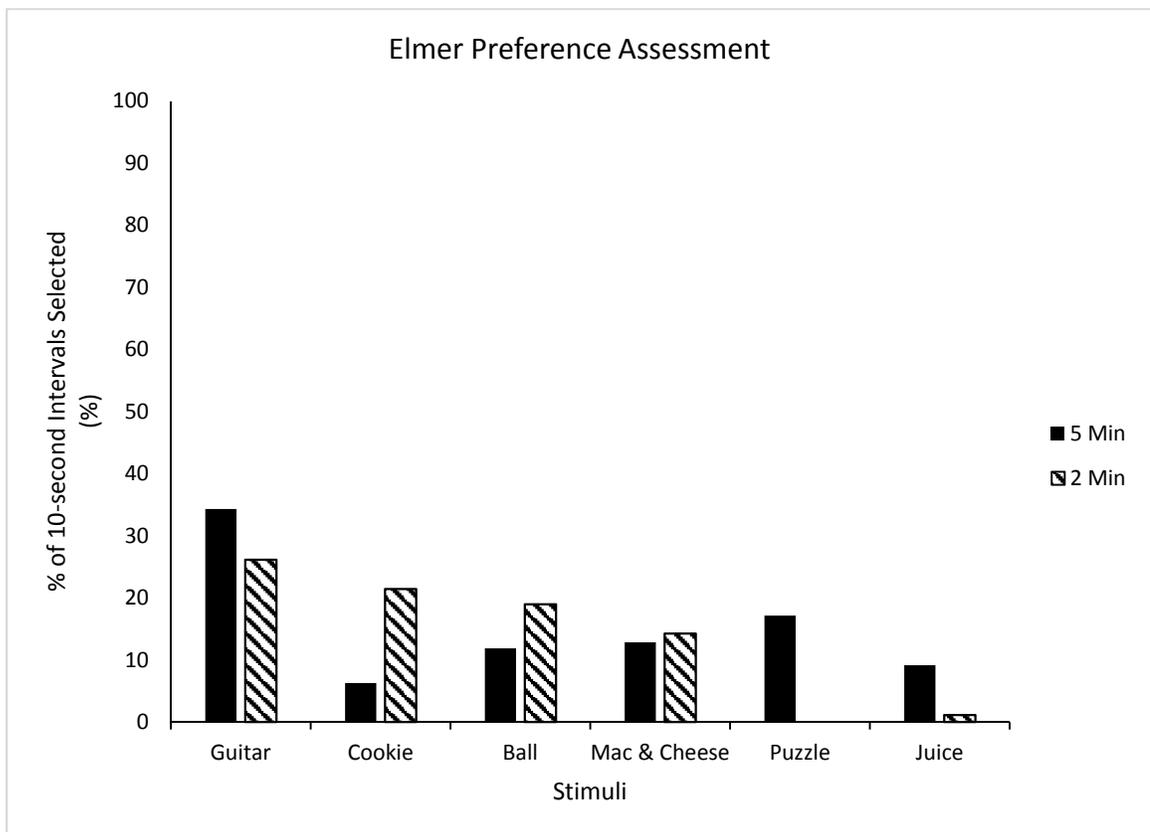

Figure 2. The percentage of 10-s intervals item was chosen during the free operant preference assessment for Elmer.

Figure 2 displays Elmer's responses in the preference assessment. Elmer typically engaged with multiple items throughout both preference assessment lengths but did engage with fewer during the 2-minute assessments. He chose to engage with the guitar the most in both preference assessments. The next most interacted with item was the cookie from the 2-minute assessment. When choosing to engage with the guitar, he brought it over to an adult and requested that they play and then he sang along. The guitar/singing activity and the cookie were selected as the items to utilize in the reinforcer assessment.

Elmer demonstrated a consistent pattern of highest preference for the guitar/singing activity in both length preference assessments. His preferences also correlated strongly with each other and with the order of selection. With the reinforcer assessment, he demonstrated very little responding initially, showing no carryover from his ABA therapy. The lack of carryover effects could be due to his short experience with ABA therapy.
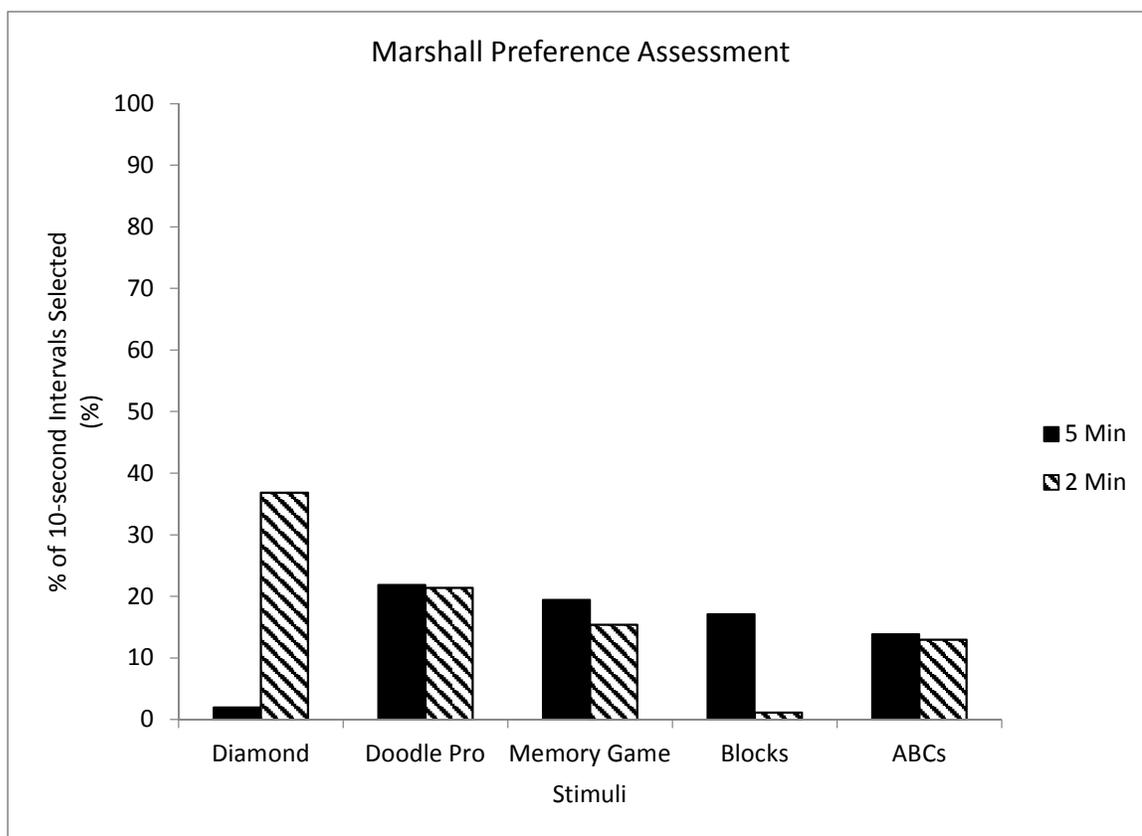
Figure 3. The percentage of 10-s intervals item was chosen during the free operant preference assessment for Marshall.

Figure 3 displays Marshall's responses in the preference assessment. His preferred items varied significantly between each session. The primary pattern displayed was a preference towards things that were new. He displayed this preference by selecting the new toys when the food and drink were removed and by choosing to select an item different from the one he picked in the previous session each time. During some of the sessions, he interacted with one toy throughout and in others he selected several different toys. This different pattern resulted in higher variability within the 2-min preference assessment results. In these assessments, he interacted with the diamond bead maze for the entirety of two assessments, and while he never interacted with it during a 2-min assessment again, he still interacted with it the most often during the 2-minute

assessments. He interacted with the Doodle Pro the most during the 5-minute assessment. The diamond bead maze and Doodle Pro were selected as the two items to use in the reinforcer assessment but it is noted that the difference in preference between these and the other items was not consistent or high.

Marshall demonstrated varied responding during the preference assessment and Elliot and Elmer both had the same most preferred thing for both assessments. Marshall's varied but his entire presentation varied, demonstrating a flaw/limitation of this particular type of preference assessment. If a child is not demonstrating consistency with responding then this type of structure preference assessment will be ineffective regardless of the length of time of the assessment.

Table 3

Spearman's Rank-Order Correlation Coefficient

Participant	5 Min – 2 Min	5 Min - Order	2 Min - Order
Elliot	0.82	1	1
Elmer	0.03	0.88	0.92
Marshall	-0.22	-0.49	0.77

Table 3 displays the Spearman's Rank-Order Correlation Coefficient data for all three participants. The correlations were identified for three different comparisons: the preference hierarchy for the 5-minute assessment and the preference hierarchy for the 2-minute assessment; the preference hierarchy for the 5-minute preference assessment and the order that items were selected for the 5-minute preference assessment; and the preference hierarchy for the 2-minute preference assessment and the order that items were selected for the 2-minute preference assessment. Correlation was strong for Elliot across all comparisons. Elmer's 5-minute and 2-minute assessments were not statistically correlated, even though he selected the same thing most often for both, but there was a strong correlation between each preference assessment and the order that items were

selected during each preference assessment. For Marshall, there was no statistically significant correlation except for with his 2-min preference assessment and the order selected.

The Spearman's Rank-Order Correlation Coefficient shows how closely correlated two rank-ordered lists are (Verschuur et al., 2011). The three different comparisons provided information in three different areas. The comparison of the preference hierarchies for the 2 and 5-minute preference assessments demonstrated how closely correlated the overall preferences for each participant were from the two different preference assessments. This helped to test the first research question of whether or not the two assessments would produce comparable preference hierarchies. The second and third comparisons demonstrated how closely correlated the order of selection was for each preference assessment with the overall preference hierarchy found for that assessment. This helped to answer the second research question of whether or not the order that items were selected would correlate with the overall preference hierarchies identified.

For Elliot this showed a strong correlation between the 5-minute and 2-minute assessments, as well as each preference hierarchy with the order the items were chosen. This demonstrated that the 2-minute assessment was just as effective in less time and the order of selection demonstrated that the thing chosen first was most often the most preferred. For Elmer, while the Spearman's Rank-Order Correlation Coefficient did not show a correlation between the total lists for the 2 and 5-minute preference hierarchies, both did show the same most preferred item. The other items in the preference hierarchies varied as he engaged with some for varying amounts of time. There was a strong

correlation for him between each preference assessment duration and the order of selection of the items, also demonstrating support for the high preference for items that were chosen first.

Marshall's preferences did not display significant correlations, except with the 2-minute preference assessment and the order of selection. Since most of his results did not conform to this particular preference assessment, his lack of high correlation is to be expected. The strong correlation with the 2-minute preference assessment and the order of selection had more to do with the fact that only a limited number of things were interacted with in the 2-minute assessment. In total, the Spearman's Rank-Order Correlation Coefficients demonstrated the correlations between the shorter and longer preference assessments and the order of selection, as well; these provide support for the utilization of the shorter preference assessment method, and informally the correlation between first item chosen and the item that is most preferred.

Reinforcer Assessment

The author used the items identified as being the most highly preferred from the preference hierarchies in a subsequent reinforcer assessment. This secondary assessment, while not directly addressing the initial research question, does provide evidence that the items chosen as most preferred could actually have clinical utility and function as reinforcers for a specific behavior of interest.
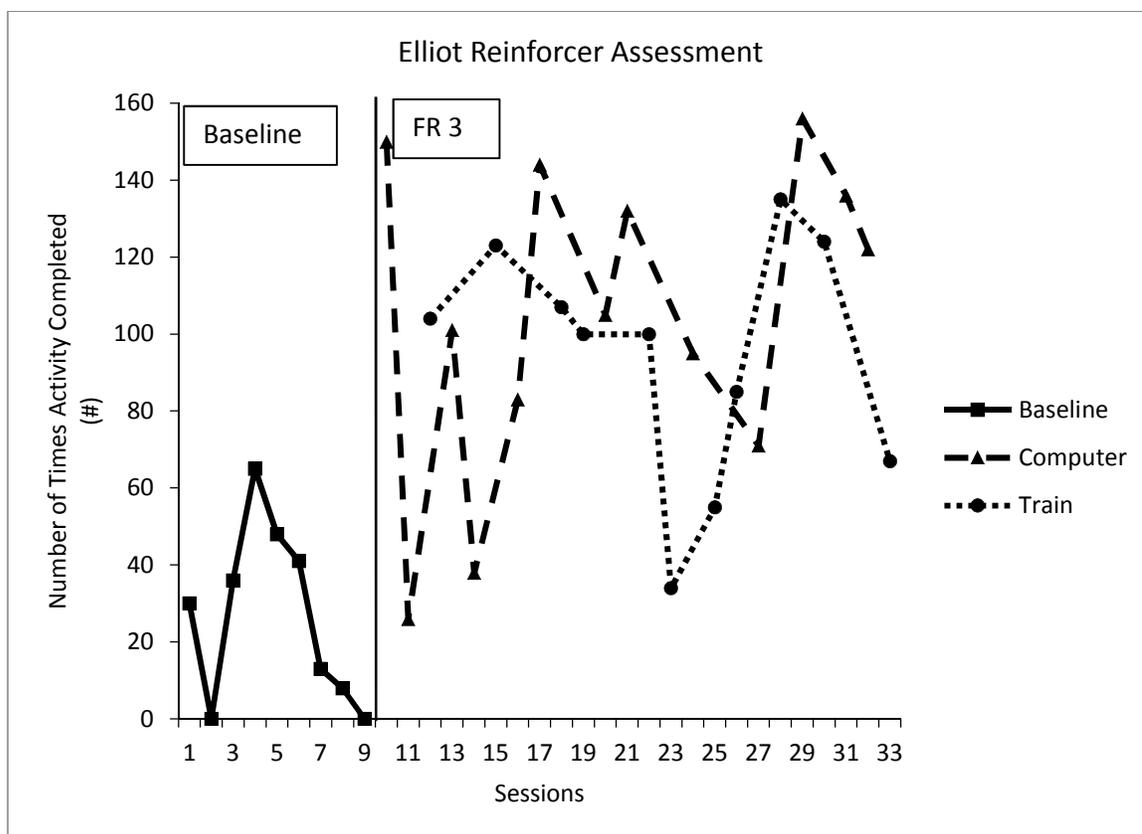
Figure 4. Number of times Elliot completed the card sorting activity in the reinforcer assessment during baseline and when the computer or the train were used as reinforcers.

Elliot's responding in the baseline was intermittent at first, with an increase from Sessions 2 to 4; however, it decreased in all sessions after that and decreased to zero. When the reinforcer assessment was begun with the computer and train being used as the reinforcers, Elliot completed 150 cards in the first session demonstrating an immediate effect of reinforcement. Elliot demonstrated above-baseline responding in the task when either item was used as a reinforcer with 83% non-overlapping data points. His responding was slightly higher when the computer was used as the reinforcer instead of the train.

Elliot's reinforcer assessment demonstrated the effectiveness of both items chosen during the preference assessment as reinforcers. The toy computer, which has been the

highest preferred in both length assessments, achieved the highest levels of responding but the toy items alternated in which was most effective. The preference assessment was able to identify effective reinforcers even at the shorter 2-minute interval.
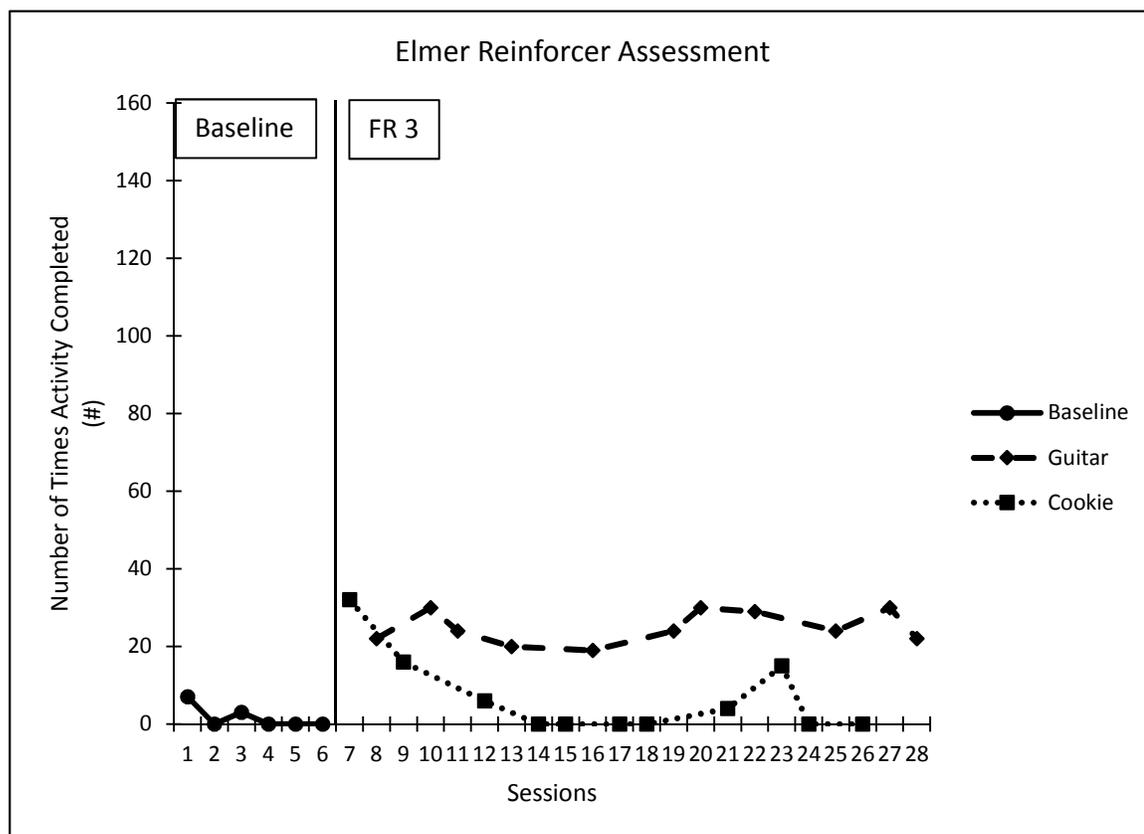

Figure 5. Number of times Elmer completed the card sorting activity in the reinforcer assessment during baseline and when the guitar or the cookie were used as reinforcers.

Elmer demonstrated very low responding to the task during baseline with zero responses for four out of 6 baseline sessions. The presentation of either object as a reinforcer immediately led to an increase in the responding but responding for cookie quickly decreased again. The most highly preferred item, the guitar, displayed 100% of data points non-overlapping with the baseline phase. The cookie was able to increase from baseline the number of responses for 50% of the sessions, as opposed to an increase in 100% of the sessions for the guitar.

Elmer's reinforcer assessment demonstrated a clear increase in responding when the guitar was presented as the reinforcer, showing its effectiveness; however, when the cookie was presented responding started off high but decreased to zero levels. He tried to crumble the cookie in his hands rather than participate in the activity. This could demonstrate the increased fluctuations in responding when primary reinforcement is utilized and the increased sensitivity that these potential reinforcers have to unknown abolishing operations. While the family was asked to not make any significant changes to their routine, the participant could have begun to eat lunch in close proximity to the session or have more consistent access to sweets outside of sessions. In contrast, the guitar was consistently demonstrated as an effective reinforcer after being identified in both the longer and shorter length assessments.
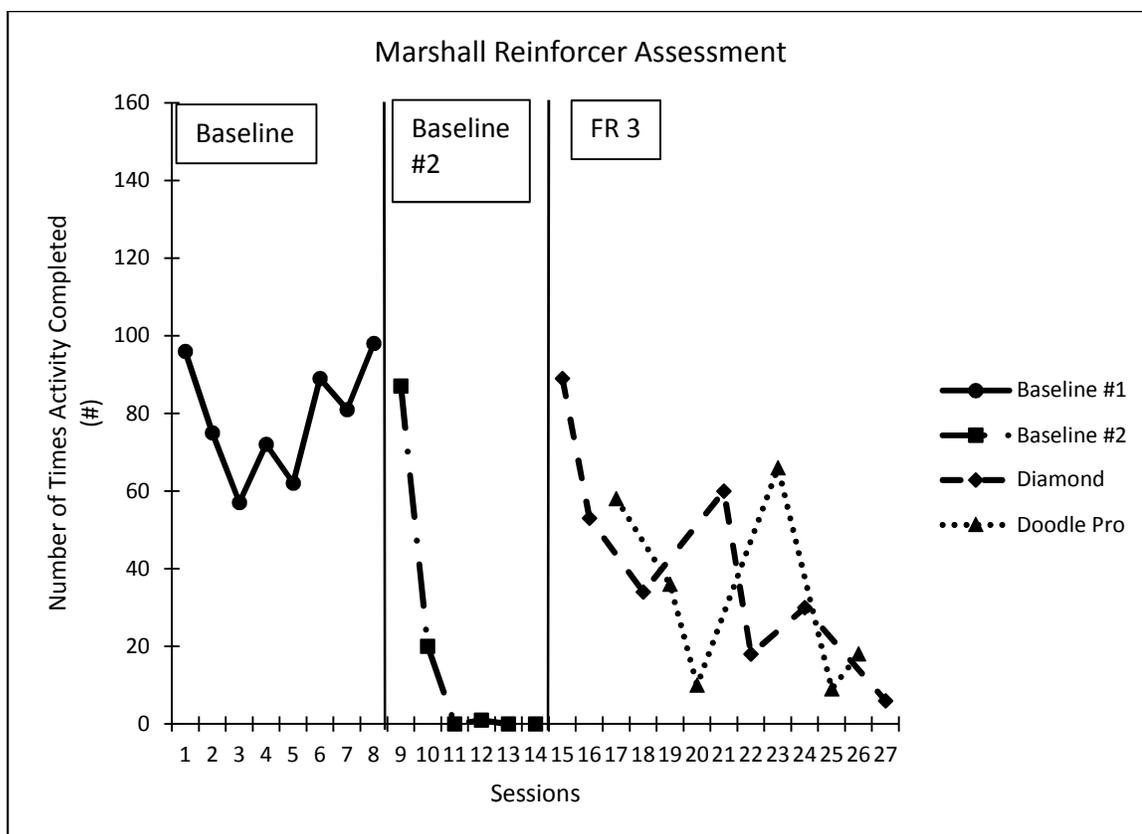
demonstrate a pattern of preference for one item over the other. In fact, as the assessment continued, his responding decreased for both items. There is only 8% of non-overlapping data points between the second baseline and the experimental phase, with points overlapping due to the initial high responding in the second baseline and the eventual decline of responding in the reinforcer assessment.

Marshall's reinforcer assessment demonstrated the initial effectiveness of both items as somewhat reinforcing but neither was as reinforcing as the original activity of just looking at the cards and labeling them. Both items varied in their effectiveness from one session to another similarly to how he demonstrated his preferences during the preference assessment. Both items decreased significantly in their effectiveness as reinforcers, demonstrating an abolishing operation for Marshall over the course of the study. There was no discernible difference in his responding for either target. He would initially respond for the item during the reinforcer assessment for most of the assessment but then stop towards the end, but with successive assessments he would respond for fewer and fewer trials. While both items were shown to be initially reinforcing, their power as reinforcers was inconsistent and decreasing providing further support for this preference assessment to not be providing the most accurate data for Marshall for stable preferences.

Social Validity

Table 4
Social Validity

Avg. SV score		Elliot	Elmer	Marshall
Parent-Preference Assess	Like	4	5	3.5
	Effective	4	5	3.5
	Repeat	4	5	3.4
Parent-Reinforcer Assessment	Like	4.4	4.4	4.2
	Effective	4.7	4.3	4.2
	Repeat	5	4.5	4.2

The Parent Preference Assessment and Child Preference Assessment were treated differently because of the quantitative vs. qualitative nature of the data. Across all participants, parents responded the same to the 2 and the 5-minute preference assessments, so they were combined for data analysis. Elliot's average scores were high with a 4 for the preference assessments and increased in the reinforcer assessments to between 4.4 and 5. Elmer's scores were all 5s in the preference assessment and 4.3 - 4.5 in the reinforcer assessment. The lowest social validity scores came from Marshall (3.5 - 3.4 in the preference assessment and 4.2 for all in the reinforcer assessment) where the most adaptations and changes were made throughout the process and where the assessments were the least effective.

The social validity of this procedure was demonstrated for all families, with the lowest scores coming for Marshall. While all of his scores averaged neutral or better, his grandmother did seek out several clarifications about the study and its potential implications. Since the results for the study were less conclusive for Marshall and she could observe those sessions, her increased concern was understandable. Neither of the other families demonstrated concerns and responded with between 4 and 5 for all responses. Interestingly, none of the families responded differently to the 2 or the 5-

minute assessments. While one was less time-consuming, the difference was not significant for the families.

The social validity for the participants was more difficult to identify. The inclusion of their caregivers partially assessed this; however, a second measure was used to try to assess it more directly. A smiley face questionnaire was used where the participants could select the picture that matched their mood; however, only one of the participants could respond to these questions and he was often inconsistent (e.g. smiling and laughing while saying "crying"). A section was added for the instructors applying the assessment to write down observations about the participant's behavior during the assessment as it relates to social validity. Two of the three participants smiled and played throughout most of the assessments. Marshall demonstrated some crying and refusal to choose during the preference assessment and the reinforcer assessment, providing further evidence that this was not the ideal assessment for him.

CHAPTER 4
DISCUSSION

This study set out to determine if the same patterns of preference hierarchies exist between free operant preference assessments of 2-minute and 5-minute duration and how the order of selection would correlate with the preference hierarchies identified in the preference assessments. We conducted 2 and 5-minute preference assessments for all participants and used the results to create a preference hierarchy. We compared the preference hierarchies to each other and to the order that items were selected.

The 5-minute and 2-minute preference hierarchies produced the same most highly preferred item for two out of the three participants but only the preference hierarchies for Elliot were highly correlated with each other. This demonstrated for two participants that the most preferred items would have been identified with either length assessment. The third participant was not able to produce consistent preferences at any point in his preference assessment. This provides support for the usage of either the 2-minute or the 5-minute preference assessment when attempting to identify a single most reinforcing item, but supported previous research demonstrating that free operant preference assessments are not always sensitive enough to provide a comprehensive preference hierarchy in the way that PS or MSWO preference assessments can (DeLeon & Iwata, 1996; Hanley et al., 2003; Verriden & Roscoe, 2016; Virues-Ortega, 2013). While these preference assessments may not be ideal when creating a token economy where several different layers of reinforcement is necessary, they are efficient in identifying single highly effective reinforcers.

While this study provides evidence to support the utilization of the shorter preference assessment to determine the most highly preferred item (Tung et al., 2017), it

also raises questions about the universality of the free operant preference assessment. It is possible that some participants may not be able to demonstrate preferences in this assessment. While studies have utilized the potential for problem behavior as a reason to not engage other preference assessment strategies (Roane et al., 1998, Verriden & Roscoe, 2016), this is not typically considered a reason for cause or concern with the free operant preference assessment, although maybe it should be. The increase in problem behavior for Marshall directly contradicts the findings of several authors regarding the decrease in problem behavior typically associated with the FO preference assessments (Kang et al., 2010; Karsten et al., 2011; Kodak et al., 2009; Virues-Ortega et al., 2014; Tung et al., 2017); however, because the problem behavior was only reported on anecdotally during sessions and specific data were not taken for each participant our ability to draw conclusions related to problem behavior is severely limited.

In general, Marshall responded throughout to a preference for novel items and activities and a sensitivity to satiation or the abolishing operation of access in a previous session. It is possible that children that present with a similar preference may not be ideal candidates for this type of preference assessment. This will be further discussed in the limitations and directions for future research.

In terms of the order that individual items were selected, data for both Elliot and Elmer displayed a strong correlation between the orders and the individual preference assessment hierarchies created for each length of assessment. The preference hierarchy in the 2-minute preference assessment strongly correlated with the order that items were selected during that assessment, and the same for the 5-minute preference assessment for both Elliot and Elmer. This shows that single trial preference assessments could yield

items that function as effective reinforcers, which would continue to streamline the preference assessment process. The order of selection functioned as a good predictor of effectiveness of the potential reinforcers.

The most highly preferred items from the preference assessments were then utilized in reinforcer assessments to ensure that they would function effectively as reinforcers. Two of the three participants provided strong evidence that the items that were identified as the most highly preferred in the preference assessments were also effective at reinforcing a behavior. This supported the usefulness of this preference method at identifying items of clinical significance for the participants with the 2 or 5-minute assessment. The fact that these items selected were also strongly correlated with the order of selection further supports the immediate demonstration of preference in these assessments and the potential effective usage of shortened free operant preference assessments.

The findings for Elliot and Elmer replicated previous research, demonstrating that these assessments could produce effective reinforcers (Roane, 1998; Virues-Ortega et al., 2014; Verriden & Roscoe, 2016); however, the findings for Marshall, could not replicate the effectiveness of the FO preference assessment. Overall, the findings supported the findings in Verriden & Roscoe (2016), where it was identified that while the FO preference assessment could produce items that were effective in single operant preference assessments, it lacked the nuance to identify the items that would be the most effective when compared in concurrent schedules of reinforcement. Marshall's results most closely replicated Verriden & Roscoe because the assessment was able to identify items that initially increased the rate of responding but not when compared with a novel

picture card labelling activity. When looking for one item that will reinforce a behavior, the FO preference assessment's usage is supported by the literature and this study.

Limitations

The logic of this preference assessment assumes that repetition will display patterns of preference hierarchy. This did not prove true for Marshall, which could have been for any one or a combination of several reasons. For Marshall, the items nominated may not have been his preferred items. Alternatively, he could have become overwhelmed by the presentation of so many things at once and having to make the choice could have made the entire task aversive for him. Marshall's primary preference could be for novelty over any one specific item or activity, resulting in no discernible pattern of preference. His preferences may simply not be static and be in consistent flux from one session to another.

Motivating operations (Michael, 1982, 1993) alter the reinforcing value of items, as well as the frequency of behaviors associated with gaining those items. Motivating operations may have been changing for Marshall that impacted his preferences from session to session, including access to particular types of play at school before his therapy sessions. Additionally, the motivating operation of access to items in the previous session could decrease the value of those items in the succeeding session. While restricting access between sessions could control for the motivating operations, if access in the previous session was functioning as a motivating operation decreasing the likelihood of seeking out individual items, this procedure could not account for that. Marshall's responding in the reinforcer assessment further supports the potential for the motivating operations to be controlling his behavior across sessions. He demonstrated a sensitivity to

the abolishing operation of access to the item in a previous session with compounding effects over the course of the reinforcer assessment. This sensitivity to the abolishing operation of previous access, otherwise known as a preference for novelty, was also displayed in his responding to the individual picture cards.

For Marshall, his reinforcer assessment activity also had to be changed from picture cards to blank index cards due to high levels of responding. The author determined to change the activity because of his high rates of responding during the initial baseline, displaying that this behavior may not be sensitive to reinforcement. Additionally, this activity was ultimately the most reinforcing one for putting cards into a box but was not used as a potential reinforcer. This decision was made because it was not part of the initial nominated items by the family and the topography too closely mirrored the ultimate reinforcer assessment response of placing an index card into a box. It is possible that the inclusion of this activity could have confounded his ultimate reinforcer assessment results. Alternatively, this initial baseline could be viewed as additional support for the findings regarding Marshall's preference for novelty. When the entire activity was its most novel, his responding was the highest. When he was receiving access to items that were novel, he responded the most often. As the activity became less novel and the materials were changed to decrease novelty, his responding also decreased.

The author made the decision to focus on items that were readily available to the family and the participant in the household throughout their daily lives. This decision allowed for the items to be meaningful for the family and be able to be used if they needed to reinforce appropriate behaviors outside of therapy sessions. This increased the external validity of the study since it made it more likely that the items found to be the

most reinforcing in the study could also be be used by the family outside of the sessions to reinforce actual behaviors. The use of family-provided items did introduce the additional complication, however, of not being able to control access to the items prior to or after the assessments and not being able to control for potential variations in motivating operations between sessions. The sessions occurring at the same time each day attempted to control for this but variability in what activities were interacted with most recently could have produced abolishing operations for any one or all of the items throughout both the preference and the reinforcer assessment. While the results were still consistent for two out of the three participants, the exact impact of potential access outside of sessions cannot be specifically analyzed nor completely ignored.

Within any study that takes place over a long period of time, time itself presents its own limitations. The participant may mature or their preferences may change over the course of the study. One of the participants, Elmer, moved to a new home during the study, did not have sessions for two weeks at one point, and then suffered an injury outside of session at another point. While his responding remained consistent across environments, all of these life events that were known and any unknown ones could have impacted these results for him, as well as the other participants.

While single operant reinforcer assessments with an alternating treatment design have been utilized in other preference assessment studies and have been demonstrated to be effective (Verriden & Roscoe, 2016; Russo et al., 2014), it did include the rapid and repeated delivery and removal of the potential reinforcers. This could lead to satiation for the participants' behavior and impact the effectiveness of the items as actual reinforcers. Elliot continued to demonstrate high levels of responding throughout the 5-minute

reinforcer assessments; however, both of the other two participants typically responded at higher rates for the first two to three minutes before declining and/or stopping entirely. While this limitation was applied equally to all sessions controlling for its impact in any one session, it could have also had a cumulative effect of satiation over the course of the study. Participant responding did decline significantly over the course of the study for Marshall, supporting that if a child is particularly sensitive to satiation, the effect of the repetitive presentation and removal must be considered, especially when considering if this procedure is correct for any one individual child.

The therapy history of each participant with ABA clearly impacted their performance, particularly during the reinforcer assessment. Marshall and Elliot have each received at least one year of intensive ABA therapy, whereas Elmer had only received two months of therapy prior to the start of the study. The impact of the participants' history with ABA became clear when Elliot and Marshall both demonstrated higher rates of responding in the baseline of the reinforcer assessment. The behavior of responding when directed to do so was more resistant to extinction for both of them than it was for Elmer. While conclusive results were ultimately gained by Elliot, the carryover from a history of reinforcement with the instructors is unknown and difficult to rule out.

While the study moved from one phase to another as quickly as possible for each participant, significant time did elapse between the beginning of the preference assessments and the end of the reinforcer assessment (between two and three months). Over that period of time, it is possible that preferences can change and develop in ways which could have impacted the internal validity of the study.

One final limitation came in the form of assessing social validity for the participants. The original assessment utilized smiley faces for the participant to circle to identify their current mood. Only one participant could complete this task when asked and his responding bore no relationship to his level of responding in the task or the amount that he laughed or smiled during the activity. More research is necessary to determine the most effective means of assessing social validity for children with little to no language.

Directions for Future Research

The core of science and research is repetition. The first and most important next steps for future research would be for other researchers to repeat the usage of the shortened 2-minute preference assessment and identification of the order of responding to evaluate its impact with their participants. Using a shorter, more efficient preference assessment or even a single-trial version for clinical application would be beneficial to ABA and its daily therapeutic applications, but to do so confidently requires an increased body of literature using these shortened assessments. The extrapolation of these findings to girls, other age groups, other populations, and other locations would also bolster these findings.

It may be possible in future studies, especially since the first item selected was demonstrated to be likely to be an effective reinforcer, to conduct a reinforcer assessment immediately following the preference assessment within the same session to control for the shifting of preferences over time. Utilizing a reinforcer assessment immediately following the individual trials would also parallel clinical practice. In clinical practice, informal preference assessments are often conducted immediately prior to conducting

ABA therapy and then the items are used for teaching as reinforcers and the efficacy is immediately displayed. Doing the research in this specific manner would make the findings more likely to extend out to clinical practice and potentially improve external validity.

Another potentially fruitful direction for future research would be to explore characteristics of children that make them more or less likely to respond to free operant preference assessments. Marshall demonstrated some avoidance, crying, and verbal protest even during the free access preference assessments where no demands were being placed on him. It could be that a quick pilot of the assessment could determine if the child is likely to engage in the preference assessment successfully or if they are likely to require a different preference assessment. He also demonstrated an overall increased sensitivity to the abolishing operation of access to the item in the previous session. It would be interesting to see how other children with the same profile of increased sensitivity to this abolishing operation, otherwise displayed as a preference for novelty, respond to free operant preference assessments, or other traditional means of assessing preference.

While the indirect preference assessment did ask the families to rank the preference of the items, the families' lists bore no correlation to the preference hierarchy demonstrated by any of the children. It is possible that additional instructions could be given or emphasized to explain the need for items that are of different levels of preference, or potentially to specify that these items could potentially be used by the family later to affect important behavior changes. These changes could alter the way that

parents would respond to the questionnaire, resulting in a hierarchy that is more likely to

correlate with the one found experimentally.

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APPENDIX A
TREATMENT INTEGRITY- PREFERENCE ASSESSMENT

Staff Initials: _____

Participant's Pseudonym: _____

Date: _____

Time: _____

Free Operant Preference Assessment

1.	Present stimuli equally distributed around the room				
2.	Place the correct color-coded time sign in the room				
3.	Tell the child how long they will get to play				
4.	Take the child to each item in the room				
5.	Label the item				
6.	Demonstrate how to use each item				
7.	Tell the child how long he can play				
8.	Tell the child that he can begin playing				
9.	Start the timer				
10.	Track any problem behaviors that occur				
11.	Track the child's engagement with each item				
12.	Escort the child to another area when the time goes off				

APPENDIX B
TREATMENT INTEGRITY- REINFORCER ASSESSMENT

Staff Initials: _____
Participant's Pseudonym: _____
Date: _____
Time: _____

Reinforcer Assessment

1.	Place the potential reinforcers on the table in front of the child				
2.	Tell the child what they are working for				
3.	Place the box and cards in front of the child				
4.	Tell the child to start				
5.	Start the timer				
6.	Deliver the item when the child puts three cards in the box				
7.	Pause the timer while the child plays with the item				
8.	Track the cards placed into the box				
9.	Remove the item and restart the timer				
10.	Continue for 5 minutes				

APPENDIX C
INDIRECT PREFERENCE ASSESSMENT

Parent's Name:
Participant's Pseudonym:
Date:
Instructions
In the spaces below, please write three edibles or drinks (if you choose to do so), and three activities (or 6 if no food/drinks are chosen) that your child likes in order of preference. For example, if your child likes grape juice the most and goldfish the second most, then you would write grape juice in the first space and goldfish in the second space. Try to identify things that are readily available and can be given to your child by a therapist during a therapy session. For example, a top or M&M's are things that a therapist could easily deliver during therapy, while ice cream or a car ride are not things that a therapist could easily deliver during therapy.

Edibles/ Drinks (Optional)
1._____
2._____
3._____

Activities/ Toys
1._____
2._____
3._____
(optional) 4._____
(optional) 5. _____
(optional) 6. _____

APPENDIX D
PREFERENCE ASSESSMENT INTERVAL FORM

Participant's Pseudonym: _____ Date: _____

Length of Free Operant Assessment: 5 minute   or   2 minute   (Circle One)

Stimuli Selected _____ Interval (Put X when item is engaged with)						
0:00-0:10						
0:10-0:20						
0:20-0:30						
0:30-0:40						
0:40-0:50						
0:50-1:00						
1:00-1:10						
1:10-1:20						
1:20-1:30						
1:30-1:40						
1:40-1:50						
1:50-2:00						
2:00-2:10						
2:10-2:20						
2:20-2:30						
2:30-2:40						
2:40-2:50						
2:50-3:00						
3:00-3:10						
3:10-3:20						
3:20-3:30						
3:30-3:40						
3:40-3:50						
3:50-4:00						
4:00-4:10						
4:10-4:20						
4:20-4:30						
4:30-4:40						
4:40-4:50						
4:50-5:00						
Total Intervals						
% Total						
Rank						
Order Chosen						

APPENDIX E
REINFORCER ASSESSMENT RECORDING FORM

Participant's Pseudonym: _____   Date: _____

Preferred Items _____ Tally for Each	
Session 1 (5 min duration)	
Total	
Avg per Minute	

Preferred Items _____ Tally for Each	
Session 2 (5 min duration)	
Total	
Avg per Minute	

APPENDIX F
PARTICIPANT SOCIAL VALIDITY FORM

Participant's Pseudonym: _____   Therapist's Initials: _____

Date: _____

Session Type: *(Circle One)*
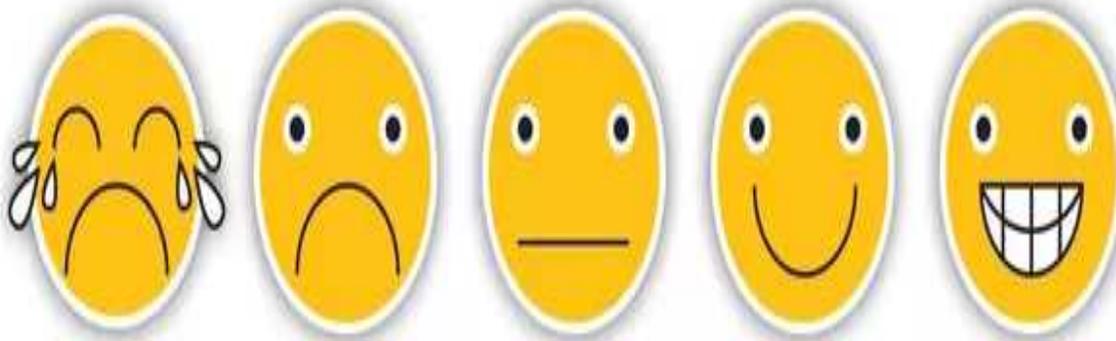
2-Min Preference Assessment   5-Min Preference Assessment

Baseline-Reinforcer Assessment   5-Min Reinforcer Assessment

How did you like the intervention?   *(Circle One)*

Notes if Child Does Not Understand:

APPENDIX G
ADULT SOCIAL VALIDITY FORM

Participant's Pseudonym: _____   Therapist's Initials: _____

Date: _____

Session Type: *(Circle One)*

2-Min Preference Assessment   5-Min Preference Assessment

Baseline-Reinforcer Assessment   5-Min Reinforcer Assessment

Circle the number that corresponds to the correct answer for how much you agree with the statement.

I liked the assessment.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

I think the assessment was effective.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

I think this assessment should be done again in the future.

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree