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Using a Token System to Increase Compliance and Avoid Satiation during Reinforcer Preference Assessments

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Abstract

Preference assessments are commonly administered to identify potential reinforcers for use in behavioral interventions. This study examined the effectiveness of a token intervention for increasing compliance during paired-stimulus preference assessments. Three male preschool children with hypothesized tangible-motivated problem behavior participated. For Experiment 1, an ABAB reversal design was used to evaluate the effects of tokens on students' compliance and problem behaviors. Experiment 2 used a concurrent-operants design to compare children's choice of concurrent VI-15s schedules of token delivery and exchange at the end of each session versus immediate access to a highly-preferred item. Results demonstrated that two of the three children exhibited an increase in compliance with item surrendering during the token intervention phases compared to baseline. Only one participant demonstrated a preference for tokens over access to their highest preferred item. Implications of the study on the increase in compliance using generalized conditioned reinforcers are discussed.

Using a Token System to Increase Compliance and Avoid Satiation during Reinforcer Preference Assessments

by

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Assessments for identifying stimuli to use in reinforcement-based programs are commonly administered to individuals with intellectual and developmental disabilities (e.g., Hagopian, Long, & Rush, 2004). Despite their frequent use in identifying potential reinforcers, the removal of desired tangible items during preference assessment trials may itself evoke problem behavior. Historically, problem behavior exhibited during the administration of a preference assessment would be placed on extinction however few if any preference assessment instructions explain how to continue testing when problem behavior is occurring. Variations of this could include ignoring all problem behavior and continuing with the administration of the assessment, blocking problem behavior, or finishing any instructions (e.g., removing all attention and toys from the child) and waiting until problem behavior ceases to continue with the assessment. All of these options may differentially influence the results of the assessment in two ways. First, if the child is engaging in high rates of problem behavior but the assessment persists, results could be inaccurate and teachers or clinicians may place themselves or the child in danger. Second, if the preference assessment is halted contingent on problem behavior, the time needed for completion of the assessment may become too cumbersome for teachers or clinicians to implement.

Although problem behavior is rarely addressed within the preference assessment literature, differences between the function of a child's problem behavior and preference assessment types have been observed. Kang et al. (2011) examined the rate of problem behavior maintained by different reinforcers across preference assessments. In this study, seven children with developmental disabilities between the ages of 4 and 8 were administered Paired Stimulus

(PS), Free Operant (FO), and Multiple Stimulus Without Replacement (MSWO) preference assessments and problem behavior was recorded. Results demonstrated that for the children with tangible maintained problem behavior, MSWO and PS preference assessment measures evoked the highest rates of problem behavior. Additionally, within-session analyses were conducted to see whether the problem behavior occurred when a) the child was asked to choose an item, b) when the child had access to the item, or c) when the item was removed from the child. For participants with tangible-maintained problem behavior, results indicated that 80-84% of their problem behavior occurred when the item was removed from the child. One limitation, however, was that this study did not hold the duration of access to selected items constant across preference assessments. Thus, the duration of access to reinforcers that the participants had may have functioned as a motivating operation for problem behavior.

Tung, Donaldson, and Kahng (2017) addressed this limitation by holding the duration of access to reinforcers constant across all preference assessment measures. This study replicated previous findings by demonstrating that problem behavior occurred at higher rates during PS and MSWO assessments compared to FO assessment conditions for four children between the ages of 8 and 10 with intellectual and developmental disabilities. These results suggest that for this study, satiation did not influence the rate of problem behavior across participants. Rather, it likely increased opportunities for item removal or surrendering that evoked the highest rates of problem behavior within the MSWO and PS conditions.

Free Operant preference assessments have been demonstrated to evoke the lowest rates of tangible-maintained problem behavior compared to MSWO and PS preference assessments (Kang et al. 2011; Roane et al. 1998; Tung, Donaldson, & Kahng, 2017; Verriden & Roscoe, 2016). Although lower rates of problem behavior have been observed, FO preference

assessments may not be desirable for identifying clear and reliable preference hierarchies when multiple reinforcers are assessed. Instead of obtaining a clear preference hierarchy by requiring the child to choose between all items, a Free Operant preference assessment allows the child the option to engage entirely with their highest preferred item and ignore all other options. Additionally, FO preference assessments may result in satiation effects during subsequent reinforcement conditions due to the ability to obtain continuous access to highly preferred stimuli (Roane, Vollmer, Ringdahl, & Marcus, 1998; Vollmer & Iwata, 1991). Therefore, alternative procedures for reducing problem behavior while conducting effective and reliable preference assessments (i.e., paired stimulus preference assessments) are needed.

Preference Assessment Types

To date, there are a variety of preference assessment procedures that have been shown to be effective at identifying highly preferred items that are likely to function as reinforcers. Single stimulus (SS), single stimulus engagement (SSE), multiple stimulus (MS), multiples stimulus without replacement (MSWO), response restriction (RR) and free operant (FO) preference assessments have all been used to determine a participant's preference for tangible reinforcers. These assessments vary considerably in item presentation and replacement procedures. More specifically item presentation can vary between presenting either one item at a time (i.e., SS and SSE), two items for the individual to choose between (PS), or all items for the child to choose between (i.e., MS, MSWO and FO; Kang et al., 2013). Additionally, some measures allow for the replacement (i.e., MS) of the previously selected item into the array of items for the second selection while others do not permit replacement (i.e., MSWO) of previously selected items.

Pace, Ivancic, Edwards, Iwata, and Page (1985) conducted one of the first single stimulus preference assessments with six individuals (ages 3-18) with intellectual disabilities across two

experiments. In the first experiment, participants were presented 16 stimuli individually and approach behaviors were observed. Each session was made up of 20 trials where four predetermined items were presented five times in a counterbalanced order. If the participant approached the presented item within 5-s of its presentation, the item was made available for an additional 5-s. If the child did not approach the item within 5-s, the child was prompted to sample the item to ensure that the child's preference was not due to inexperience. The item was then presented for a second session, and if the participant approached the item, 5-s of access was provided to the item. If the participant still did not approach the item, the item was removed and the next stimulus was presented. Results indicated that all participants differentially approached the assessment stimuli and that patterns of responding were idiosyncratic across all participants (Pace et al., 1985).

For Experiment 2, the reinforcing effects of the previously identified preferred and nonpreferred stimuli were examined for each participant (Pace et al., 1985). Preferred stimuli were identified as items that the participants approached at least 80% of the trials. Nonpreferred items were identified as stimuli that the participants approached on 50% or less of the trials. A reversal design was implemented comparing baseline, preferred, and nonpreferred conditions. Preferred and nonpreferred stimuli were provided contingent on arbitrarily selected responses within their respective conditions. No reinforcers were provided for baseline conditions. Results indicated that the use of contingent preferred items increased target responding in preferred conditions for five of the six children compared to baseline and nonpreferred conditions.

Fisher et al. (1992) compared the results of single stimulus preference assessments to a forced choice (i.e., paired stimulus) preference assessment procedure using a concurrent operations paradigm with four children with intellectual disabilities between the ages of 2 years

and 9 months and 10 years old. Prior to the forced-choice assessment, a single stimulus preference assessment was conducted using the procedures developed by Pace et al. (1985). Next, the same stimuli (16 items) were used for the forced choice assessment and were presented in pairs. All stimuli were randomly paired with every other stimulus for a total of 120 stimulus-pair presentations (Fisher et al., 1992). Participants were permitted to approach one of the two items and receive 5-s of access to the selected item and removal of the other stimulus. Attempts to approach both items were blocked. If the participant did not approach either item, they were allowed to sample both items before having the items re-administered for them to choose between. If neither item was approached the second time, both items were removed and the next trial was administered. Results of the forced choice preference assessment demonstrated a preference hierarchy across items and created greater differentiation among stimuli compared to single stimulus assessment.

Additionally, Fisher et al. evaluated the extent to which items identified as preferred from each preference assessment procedure functioned as actual reinforcers. Stimuli that were identified as highly preferred in both the forced choice and single stimulus preference assessments were labeled as high-high stimuli items and stimuli that were identified as highly preferred on only the single stimulus preference assessment were identified as SP-High Stimuli. During concurrent operants phases, participants received access to either their high-high or SP-high stimuli by sitting in either of two locations in a room. Results demonstrated that participants spent more time at the location for which they could earn items identified as highly preferred by the forced choice assessment (i.e., high-high stimulus).

DeLeon and Iwata (1996) compared three preference assessment methods (i.e., PS, MS, and MSWO) for seven adults with profound developmental disabilities. All assessments included

seven identical edible or non-edible items and selection of each item resulted in 30-s of access to the item. The MSWO assessment was conducted by placing all stimuli in a straight line for the participant to select. The participant was then permitted to select an item and received access to the selected item until the next trial was initiated. Following 30-s access, the item was subsequently removed from the area and the participant was allowed to select another item. This continued until all items were selected or no selection was made after 30-s of the trial. The MS procedures (Windsor et al., 1994) were conducted identically to the MSWO option, however all items were returned or replaced to the array of displayed items. The PS procedures consisted of 21 pairs of items for the participants to select between. Failure to select an item resulted in the termination of that trial and the presentation of the next two stimuli. Each participant was administered five consecutive sessions for each procedure (i.e., 15 sessions) and the order of the procedures varied across participants. Results for all participants showed moderate to high across-session correlations between the MSWO and PS preference assessment methods with means of .81 and .83, respectively. Mean correlations for the MSWO/PS procedures and MS/PS procedures were .72 and .61 respectively. Additionally, 5 of the 7 participants displayed higher correlations between MSWO/PS procedures than for MS/PS procedures as evident by their Kendall rank-order correlation coefficients.

Based on the results of the preference assessments, edible stimuli that were identified as reinforcing on the PS and MSWO assessments but not the MS assessment were evaluated to determine their reinforcing effects. Participants were trained to emit target responses (e.g., placing game pieces into a Connect Four game) and baseline responding was recorded. A fixed-ratio (FR) 1 schedule of reinforcement was then implemented contingent on target responding. For three of the four participants, items that had never been selected by the MS procedure but

were selected by the MSWO and PS procedure resulted in increases in contingent responding (DeLeon & Iwata, 1996).

Additionally, MSWO and PS preference assessments have been identified as exhibiting higher preference stability compared to FO and Response Restriction (RR) preference assessments. Verriden and Roscoe (2016) evaluated preference stability across four preference assessment methods (i.e., MSWO, PS, FO, and RR) as well as rates of problem behavior across assessment methods for six children, between the ages of 8 and 15, within a residential school setting. All four assessments were administered six times to determine stability in preference rankings for each preference procedure. Spearman rank-order correlation coefficients and a Kendall rank coefficient of concordance were calculated for each preference assessment method to determine test-retest reliability. The mean Spearman correlation coefficients were above the stability criterion of .60 for four of the six participants using the PS and MSWO methods, three of the six children using the FO method, and two of the five children using the RR method. Additionally, the Kendall's coefficient was significant for four of the six children for the FO and RR methods, five of the children for the MSWO method, and across all six children for the PS method. Lastly, results indicated that the FO preference assessment evoked the lowest rates of problem behavior compared to MSWO, PS, and RR assessment methods for all participants (Verriden & Roscoe, 2016). Overall, the results of this study suggest that greater stability across assessment administrations can be obtained with PS and MSWO methods compared to the FO and RR methods.

Access to Tangible Reinforcement as an Establishing Operation

Access to tangible reinforcers can serve as an establishing operation that can impact subsequent behaviors. Michael (1982) defined establishing operations as "an environmental

event, operation, or stimulus condition that affects an organism by momentarily altering (i) the reinforcing effectiveness of other events and (ii) the frequency of occurrence of that part of the organism's repertoire relevant to those events as consequences." (Michael, 1982; Wilder & Carr, 1998, p. 44). Research has demonstrated that the amount of time exposed to a tangible reinforcer can subsequently alter the preference for that reinforcer (Gottshalk, Libby, & Graff, 2000; McAdam et al., 2005; O'Reilly et al., 2009). Deprivation or brief exposure to tangible reinforcers has been shown to impact the preferences of reinforcers. Exposure to tangible reinforcers can serve as an establishing operation if access is deprived or is not long enough for satiation to occur. More simply, if a child has access to a highly preferred item for a short period of time, removal of that item may result in problem behavior as an attempt to regain access to the item.

O'Reilly et al. (2009) examined the impact of three different pre-session conditions on tangibly maintained problem behavior for two children (ages 5 and 8) with Autism Spectrum Disorder (ASD). Participants were exposed to brief access, no access, and satiation conditions prior to tangible sessions using multielement designs. Children were exposed to the tangible condition of a functional analysis across all three conditions. Prior to each session, the child was exposed to either brief access (continuous access for 5-min immediately before the session), no access (no prior access over past 8 hours), or satiation (continuous access to the item until item-rejection behaviors were exhibited three times) depending upon the condition. High levels of problem behavior occurred across both participants for no-access and brief access conditions, with little problem behavior occurring following satiation sessions. During the brief-access conditions the mean percentage of intervals with problem behavior were 65% and 71% for each participant, and 51% and 58% for no-access conditions. Satiation conditions resulted in lower levels of problem behavior, with the mean percentage of intervals with problem behavior

equaling 9% and 3% for each participant. Results suggest that brief and no access conditions functioned as an establishing operation for tangible reinforcers, and that brief-access may be a slightly more powerful establishing operation than no-access conditions.

Conversely, over-exposure to tangible reinforcers can serve as an abolishing operation that can result in satiation and decreased preference for the reinforcer. McAdam et al. (2005) examined the impact of motivating operations on the outcome of preference assessments of leisure items with six individuals between the ages of 3 and 18 years old. Paired-choice preference assessments were conducted to identify high and moderate preference stimuli prior to the experimental conditions. Participants were later exposed to control, satiation, and deprivation conditions and their preferences were recorded. Satiation conditions decreased the selection of the target items in at least two of the satiation conditions for every participant. Additionally, at least one of the previously identified highly or moderately preferred items was never selected by each participant during satiation conditions. These results suggest that satiation effects have the potential to influence preference assessment outcomes and thus alter the reinforcing quality of individual items that are selected to be used for treatment reinforcers. When one tangible item is identified to be used consistently for treatment within the clinical setting, it is possible that satiation could occur and reduce the efficacy of treatment.

Tokens as Generalized Conditioned Reinforcers

Generalized conditioned reinforcers have been used in applied and basic research as a way to shape desired behaviors. Tokens are said to be generalized conditioned reinforcers when they can be exchanged for more than one back-up reinforcer (Ayllon & Azrin, 1965; McLaughlin & Malaby, 1972; Phillips, 1968). Furthermore, tokens are believed to maintain their reinforcing functions across a larger range of conditions than nongeneralized (i.e., specific)

reinforcers (Skinner, 1953; Hackenberg, 2018). Although token economies can differ procedurally, there are four key components necessary for successful implementation. Kazdin and Bootzin (1972) identified these four components as (a) identifying target behaviors, (b) selecting available and effective reinforcers, (c) establishing tokens as secondary reinforcers, and (d) providing the client with the rules of the token system (i.e., how to earn, spend, and/or lose tokens).

Early applied research on tokens. Ayllon and Azrin (1965) conducted one of the first studies using generalized conditioned reinforcers within a psychiatric impatient ward. Multiple experiments were conducted to evaluate the effects of token reinforcement procedures on maintaining desired behavior (i.e, performance of work in on- and off-ward hospital jobs). For all experiments, tokens were exchangeable for a variety of reinforcers including privacy, social interaction time with staff, and commissary items that had a high level of occurrence when freely allowed. All experiments were conducted using an ABA experimental design.

For Experiment 1, researchers attempted to identify the impact of token reinforcement on the choice of off-ward jobs that patients (n=8) selected to complete. Condition A allowed patients to receive tokens for working at a preferred job with all non-preferred jobs placed on extinction (i.e., no tokens), and Condition B provided reinforcement when patients chose to work at a non-preferred job with the preferred job placed on extinction. Results showed that seven of the eight patients immediately shifted their preference of job with the reinforcement contingencies across all phases suggesting that tokens were more reinforcing than any uncontrolled reinforcement provided by a specific job assignment.

Experiments 2 and 3 examined the levels of performance on these jobs when reinforcement was contingent and non-contingent on performance. During condition A, patients

were provided tokens after their job assignment had been completed satisfactorily. Condition B allowed patients to receive their tokens before they began their job. Results indicated that all patients stopped working when tokens were not contingent on performance.

Experiment 4 examined patient performance when reinforcement was provided contingent upon performance or placed on extinction. During condition A, patients were provided with the same token reinforcement upon satisfactory job completion as previous experiments. However, no token reinforcers were provided during condition B and all back-up reinforcers (i.e., reinforcers previously earned in exchange for tokens) were freely available. The results of this experiment were identical to Experiment 3, where 36 of the 44 participants demonstrated a decrease in performance when reinforcement shifted from available to unavailable and increased when shifted from unavailable to available.

McLaughlin and Malaby (1972) demonstrated the effects of a classroom token economy on assignment completion with a combined fifth and sixth grade classroom. Students were awarded points for desirable behaviors (e.g., items correct, neatness, or extra credit) and lost points for undesirable behaviors (e.g., incomplete assignments, fighting, or cheating). First, assignment completion data were collected in the absence of a token economy during the baseline condition. Results indicated that assignment completion was variable during the baseline condition, ranging between 64% and 94% assignment completion. Next, the token economy was implemented and children were permitted to exchange their tokens for privileges (e.g., sports, playing games, or coming in early) every five days. Variability of assignment completion decreased during this phase and assignment completion increased.

Basic research on tokens. Basic research on token reinforcers has focused primarily on the basic mechanisms believed to be responsible for their effectiveness (e.g., as conditioned

reinforcement; Kelleher, 1956) within tightly controlled settings. Tokens were found to have reinforcing, discriminative, or eliciting functions depending on the various contingencies in place (Bullock & Hackenberg, 2015; Hackenberg, 2018). Schedules of token-production and exchange-production have also been examined to determine their effects on token reinforcement. Additionally, basic research has attempted to examine the differences between generalized and specific conditioned reinforcers. However, generalized conditioned reinforcers are limited within basic research due to the limited number of potential back-up or terminal reinforcers (i.e., food, water, or drug; Hackenberg, 2018).

Kelleher (1956) examined token-production schedules with conditioned reinforcement contingent on lever pressing for two chimpanzees. Chimpanzees were first trained to press a lever for food reinforcers when a light (discriminative stimulus) was activated. In the next phase, chimpanzees were trained to exchange plastic poker chips for food by inserting them into a designated slot based on the discriminative stimulus. Lastly, the chimpanzees received plastic poker chips in exchange for lever pressing. Three schedules of conditioned reinforcement were implemented within this phase and cumulative response curves were recorded. The first schedule of reinforcement was a 5-min fixed interval schedule. During this phase, sessions lasted 1-hr and tokens were exchanged at the end of the session. Results of this condition showed low responding rates, suggesting that the conditioned reinforcers may not be effective unless they are able to be exchanged more frequently. The second schedule of reinforcement combined both interval and ratio schedules in a multiple 5-min fixed interval (FI; orange light) or fixed ratio 20 (FR; green light) schedule. Results indicated that behavior of both chimpanzees came under control of the discriminative stimuli. Rates of responding were high during the FR schedule with few pauses, whereas responding was relatively low under the FI schedule. Lastly, the third

schedule of conditioned reinforcement was an FR20 schedule alone and responding occurred at the characteristic ratio rate (Kelleher, 1956). Results of this study provided preliminary evidence for the effects of conditioned reinforcers on responding and the effects of token-production schedule on responding.

Research examining the effects of token-production schedules on responding have also been examined within an applied setting. De Luca and Holborn (1990) examined the effects of FI and FR schedules of token reinforcement on bike pedaling with four 11-year-old obese and non-obese boys. An ABCB experimental design was conducted using baseline, FI 1-min, and an individualized FR schedule for all boys. Results demonstrated an increase in pedaling duration for all contingency phases (FR and FI) but higher response rates were examined during the FR phases for all participants compared to FI and baseline phases.

Laboratory research with pigeons in token economies has demonstrated a preference for generalized compared to specific conditioned reinforcers. DeFulio, Yankelevitz, Bullock, and Hackenberg (2014) demonstrated this across different experimental conditions with pigeons. In this study, pigeons were able to obtain specific conditioned reinforcers or generalized conditioned reinforcers. Specific tokens were redeemable for water (i.e., red tokens) or food (i.e., green tokens) whereas generalized (i.e., white) tokens were redeemable for either water or food. Results showed that when both options were available at equal costs, pigeons favored generalized tokens over specific tokens for 80% of the conditions.

These results have also been replicated within an applied setting. Sran and Borreno (2010) examined three typically developing preschool-aged (i.e., 4-years-old) children's preference for generalized or specific conditioned reinforcers (i.e., tokens) that were obtained by completing tracing activities. Tokens could subsequently be exchanged for previously identified,

highly preferred, edible reinforcers. A multielement design was implemented to differentiate responding between no-choice (i.e., presented with one high-preferred edible), single-choice (i.e., choice between five of the same high-preferred edibles), and varied-choice (i.e., choice between five different preferred edibles) conditions. Results showed that all three children exhibited a preference for the generalized reinforcers (i.e., varied choice) over single or no-choice conditions.

Purpose of the Present Study

Conducting a PS preference assessment (Fisher et al., 1992) is often one of the first steps in identifying potential reinforcers for the effective treatment of problem behavior within a preschool setting. This can be difficult to execute, however, if the preference assessment itself evokes high rates of problem behavior. Applied research has demonstrated the effects of token economies on decreasing problem behavior as well as increasing desired behaviors (e.g., academic responding; McLaughlin & Malaby, 1972) within clinical and school settings. Additionally, basic research suggests that generalized conditioned reinforcers may be more effective at increasing desired behaviors compared to specific conditioned reinforcers, especially when contingent on the desired behavior (e.g., fixed rate schedule). The combination of these findings suggests that generalized conditioned reinforcers may be effective at decreasing problem behavior and increasing compliance during the administration of preference assessments. Specifically, tokens may prove beneficial in increasing appropriate item surrendering and reducing problem behavior for children by functioning as generalized conditioned reinforcers.

It is possible that the use of generalized conditioned reinforcers could increase item surrendering and decrease problem behavior exhibited during a PS preference assessment. The

goals of this study were to evaluate the extent to which tokens as generalized conditioned reinforcers could reduce occurrences of tangible-maintained problem behavior during preference assessment sessions (Experiment 1) and examine token's susceptibility to satiation compared to a specific high-preferred reinforcer during treatment sessions (Experiment 2). For Experiment 1, it was hypothesized that children's problem behavior would decrease and item surrendering would increase when exposed to generalized conditioned reinforcement contingencies. Secondary hypotheses of Experiment 1 were that (a) the highest preferred item identified by results of the PS preference assessment would correspond with the item most engaged with on average during the FO token exchange period at the end of token reinforcement sessions and (b) results of the PS preference assessment during baseline and token conditions would be highly correlated. For Experiment 2 it was hypothesized that when given a choice during the treatment phase, children would prefer tokens over access to their highest preferred item.

EXPERIMENT 1

Method

Participants and Setting

Three male preschool children, Gary, Ryan, and Ethan, receiving special education services within a classroom in central New York were recruited as participants. Names were changed to protect participant anonymity. Demographic information for each participant can be found in Table 1. English language learners and/or children classified as non-verbal were not eligible to participate in the study. Participants were chosen from classrooms based on teacher nominations. In order to be eligible for inclusion in the study, participants: (a) exhibited problem behavior upon removal of preferred items, (b) showed a tangible function for problem behavior

based on the results of a functional behavior assessment, and (c) understood verbal instructions. Aggression was identified as a target behavior for all three participants following the results of the functional behavior assessment. For Ryan and Ethan, hitting and kicking were the two primary topographies of problem behavior reported by the teachers. For Gary, hitting, kicking, pinching, and scratching were all behaviors of concern. While all participants were able to communicate verbally, Ryan frequently used sentences to communicate whereas Gary and Ethan communicated in short phrases (~3-5 words). Speech and occupational services were provided to all participants on a weekly basis. Approval for this study was obtained from the Syracuse University Institutional Review Board as well as the participating preschool. Parental consent was also obtained prior to the start of the study and child assent was obtained prior to each session.

All sessions were conducted in an empty room within the preschool. Sessions lasted approximately 5 min and were conducted 3-5 days per week depending on participant availability. The session schedule was determined for each child depending on their therapy schedule and teachers' classroom schedule. The study lasted approximately 7 weeks for all participants and all sessions across both experiments were conducted by the author.

Materials

Preference assessment items. Ten items were selected prior to the beginning of the study to be used as potential reinforcers across all sessions. Edibles were not selected as reinforcers for the purpose of this study. Items such as Justice League 2" action figures, 9-piece wooden peg puzzles, Animal and Ocean encyclopedia books and/or building toys (e.g., Lincoln Logs, Legos, and/or interlocking stars) were selected by the teacher and experimenter as

potential reinforcers and remained constant across all sessions in accordance with previous methods used by Kang et al. (2011).

Tokens. Two different colored tokens were selected for each child based on their identification as equally and moderately preferred from the results of a color preference assessment. The separate colored tokens were distinct for each condition. Therefore, token color A represented all baseline sessions and held no conditioned or redeemable value. Token color B was provided during intervention phases and acted as a generalized conditioned reinforcer to the child. That is, token B was redeemable for additional toy access following the conclusion of each session's preference assessment.

Observer equipment. All data collectors were equipped with a computer for every session. BDataPro (Bullock, Fisher& Hagopian, 2017) was installed on all computers prior to the beginning of the study and was used for data collection across all sessions. BDataPro is a computer program that can be used to collect multiple frequency- and duration-based behaviors in real time. In addition, behavioral data can be summarized in terms of average responses per min, percentage of 10-s intervals, and cumulative responses within 10-s bins and reliability coefficients can be calculated between observers (Bullock et al., 2017). A paper data sheet was also used for Experiment 1 to calculate the frequency of problem behavior, item selection, item surrendering, and tokens earned for each session.

Response Measurements

During direct observations of the functional behavioral assessment and all experimental sessions involving forced-choice preference assessments, frequency of problem behaviors and percent of successful item surrendering recorded. Problem behaviors were determined and

operationally defined for each child prior to the beginning of the study. Aggression was defined as anytime the child made forceful contact (e.g., bite, hit, or kick) towards the instructor with their body or an item (e.g., toy). Compliance was defined as completing the action requested within 3-s of a verbal prompt. This definition was used to also evaluate compliance with common classroom directions including item surrendering throughout the functional behavior assessment. Percent item surrendering was calculated as the number of times the child complied with an instruction (as defined above) divided by the number of total instructions. Item engagement, defined as anytime the child is touching or looking at an item, was scored for duration during the token exchange period of the treatment sessions. Undergraduate and graduate students in psychology were trained in the use of BDataPro for data collection through practice videos. Undergraduate students participated in an in-person BDataPro training (conducted by two graduate students) and then completed three practice video attempts independently.

Preliminary Assessments

Functional behavior assessment. A functional behavior assessment was conducted to confirm a possible tangible function of participants' problem behavior. The functional behavior assessment was comprised of indirect and direct descriptive measures. Indirect Measures included a modified problem identification interview (PII) with the teacher (Erchul & Martens, 2010) and administration of a modified Questions about Behavioral Function (QABF) scale (Paclawskyj et al., 2000). See Appendices A and B for the modified PII and QABF measures, respectively. Major goals of the PII were to assess the scope of teacher concerns and confirm a tangible function for problem behavior within the classroom. Teacher reports of access to tangible reinforcers as a consequence for the target behavior, as well as problem behavior

occurring following the removal of tangible items, were considered for further investigation of a hypothesized tangible function for problem behavior.

A modified version of the QABF was also administered as an informant report scale. The QABF is made up of 25 questions using a 4-point scale of 0=Never, 1= Rarely, 2= Some, and 3=Often for how frequently the given behavior occurs for the reason listed. The questions address possible attention, escape, non-social, physical and tangible functions for problem behavior. Questions regarded as demonstrating a tangible function (see Appendix B) scored as Some (2) or Often (3) would support a possible tangible function of behavior. A score of 10 or higher on the tangible subscale was needed in order to support a tangible function. Psychometric properties of the QABF have been examined and compared in numerous studies, demonstrating its reliability and validity (Matson et al., 2012; Shogren & Rojahn, 2003; Zaja et al., 2011). Matson, Bamburg, Cherry, and Paclawskyj (1999) examined the validity of the QABF at identifying clear behavioral functions for 398 persons with intellectual disability and a targeted problematic behavior (i.e., Self-injurious behavior, aggression, and stereotypies). Results found that the QABF was successful at deriving clear behavioral functions for 84% of the individuals across all topographies of behavior (Matson et at., 1999). Shogren and Rojahn (2003) found test-retest reliability varied from .62 to .93 across subscales within a two-week interval. To assess interrater reliability, Pearson product-moment correlations (r) were also calculated. Coefficients ranging between .46 and .60 across subscales were reported. These scores can be interpreted as ranging from fair to good using Cicchetti's (1994) interpretive guidelines.

Three sessions each of restricted access to tangibles and a free play control condition of a structured descriptive assessment (SDA) were conducted as direct measures in the functional behavior assessment. SDAs are direct (observational) strategies used in a functional behavior

assessment that focus on the motivating operations for problem behavior (Anderson & Long, 2002; Martens et al., 2018*).* SDA assessments have been conducted in classrooms by teachers (Anderson & Long, 2002), and allow researchers to observe rates of children's problem behavior in a naturalistic setting after a teacher or caregiver manipulates establishing operations for its reinforcement (e.g., restricted access to tangibles, diverted attention, high rates of demands). Tangible and control conditions were conducted in accordance with procedures used by Anderson and Long (2002) and alternated in a multielement design. Prior to each session across both conditions, experimenters instructed the teacher to provide two minutes of access to the child's normal play activities. At the end of the two minutes, the teachers were given instructions for the specified condition and were asked to respond to problem behavior as they typically would. During the tangible condition, the teacher was told, ''In this activity we want to see how the child reacts when preferred activities end. When we tell you to begin, say, "It's time to stop playing with [preferred item] and remove the item. You may interact with the child as you desire, but please refrain from attempting to engage the child in work activities.'' During the control condition, preferred items remained available following the 2-min of free access, and the teacher was informed, ''In this activity we would like to see how the child responds when you are not making requests and preferred items are available. Please play with the child as you normally do until we tell you it's time to stop'' (Anderson & Long, 2002). Behavioral data were collected using BDataPro to calculate problem behavior throughout the entire session. An increase in problem behavior during the tangible conditions compared to control conditions helped to support a tangible function for problem behavior.

Color preference assessment. A paired-stimulus preference assessment (Fisher et al., 1992) was used to determine two moderately preferred colors to be used for the tokens in this

study. Staff were trained to administer the paired-stimulus preference assessment based on the skills identified for staff training by Lavie and Sturmey (2002; Appendix C). Using procedures similar to Heal, Hanley and Layer (2009), colors identified as high preferred and low preferred were excluded as potential token colors.

Experimental Design and Procedures

An ABAB reversal design was used to evaluate effects of generalized conditioned reinforcers (i.e., tokens) on participants' item surrendering and problem behaviors. Experimental control is demonstrated when each child serves as their own control, other potential confounding variables are held constant, and the independent variable produces clear differences in child behavior that are (a) large enough to be seen when graphed, (b) occur repeatedly for each participant at the discretion of the researcher, and (c) occur for all participants in the study (B. Martens, personal communication, April 12, 2016). Experimental control is demonstrated through the reversal of intervention and baseline phases while other variables are held constant (e.g., same child, classroom, items in the preference assessment, time of day, and presence and color preference of tokens). My original plan was to evaluate the effects of tokens on both problem behavior and item surrendering, however no (Ryan, Ethan) or low (Gary) levels of problem behavior were observed for all three participants across all phases. Percent item surrendering were therefore used as the primary dependent measure in the study, with results interpreted using a prediction-affirmation-verification-replication sequence. The experimenter used baseline data to predict how item surrendering was likely to persist given the absence of intervention. Following the first baseline phase, an increase in item surrendering was evaluated during the generalized conditioned token intervention phase to demonstrate that the tokens had discriminative control over item surrendering. If these observations were affirmed by an increase

in item surrendering during the token intervention phase, a reversal back to baseline verified the effectiveness of the intervention by producing a decrease in the absence of the intervention. Finally, replicating an increase in item surrendering by re-implementing the token intervention within and across participants helped to increase decision confidence.

Experiment 1 took approximately five weeks to complete. The first week was used to identify eligible students for participation (i.e., teacher interview and preliminary assessments). Weeks two and four consisted of baseline phases and weeks three and five consisted of experimental phases.

Baseline. During baseline, participants were exposed to five trials of a 10-item paired-choice preference assessment each session. The paired-choice preference assessment was selected for this study over the MSWO preference assessment due to the ability to create the same number of trials with equivalent item exposure across sessions. All paired-choice trials within a session were randomized and every session had an equal number of presentations for each item. For example, if a session contained exposure to 10 different items, all items were presented once throughout the session. During each session, participants were exposed to two items and asked to choose the item they would prefer to play with (i.e., “Pick one.”). Upon selection, the child received 30-s of access to their selected item. Item engagement data were collected beginning when the child first obtained access to their choice. At the end of the 30-s access interval, the child was instructed (i.e., “give me the toy”) to return the item to the experimenter. The command to surrender the item was held constant across conditions. Once the instruction was delivered, the child had 3-s to comply with the instruction without the presence of problem behavior. If the child complied with the instruction, they were awarded a token that did not provide access to any additional reinforcement. If the participant engaged in problem

behavior following the instruction, the child was told, “Ok, you can have a little more time,” and an additional 5-s access to the item was granted. After the child engaged in problem behavior and received an additional 5-s of access to the reinforcer, they were instructed “All Done” and the item was removed so that the next trial may begin.

Token intervention. Similar to the baseline phases, students were administered five trials of a 10-item paired-choice preference assessment each session. Prior to the start of this phase, the experimenter instructed the student, “If you return the item when I ask you to, I will give you a new type of token. This [color] token can be exchanged at the end of the session and you can play with all of these toys for a little longer. The more tokens you have, the more time you will have to play with the toys at the end. If you do not return the item, I will have to take it from you and you will not receive a token.” A free-operant token exchange period was selected over a trial-based approach to allow the participants access to their preferred items without additional removal demands (i.e., taking away the toys after every token trial). This aimed to decrease problem behavior during the reinforcer interval and would be easier for staff implementation.

Prior to conducting preference assessment trials, participants’ understanding of the reinforcing properties of the tokens and how to earn one was assessed. If the child was able to demonstrate an understanding of the tokens by verbally describing the directions, the preference assessment trials could begin. Each child was instructed, “Here is a toy. If you give me the toy when I ask for it, you can earn a token. When you give me the token, you will get more time with the toy”. Ryan was able to verbally describe the directions. Gary and Ethan were unable to demonstrate an understanding of how to earn the tokens and were given additional training. Originally, training was supposed to consist of guided token exchange trials followed by time

delay fading until the child was able to exchange the tokens for a preferred item 80% of trials across 5 consecutive sessions within 5-s of receiving the token. For Gary, a second round of training trials was implemented to increase understanding of how to obtain the tokens through item-surrendering. For Ethan, two rounds of training trials occurred before the start of the first token phase. The preference assessment trials were initiated after the child surrendered the toy on 5 consecutive probe trials. Preferred items (i.e., toys) were selected based on teacher nomination and did not include items from the experimental sessions.

The preference assessment trials were administered in the same format as baseline phases; however problem behavior was placed on extinction. If the child engaged in problem behavior or failed to comply within 3-s following the instruction to surrender the item, the item was removed and the child did not receive a token. If the child complied with the instruction and did not engage in problem behavior upon surrendering the item, they were awarded one token. At the end of the session, the child was instructed that they have earned 5-s of access to all of the available toys for each token they earned. The tokens were counted out loud and the child was instructed of how much time they earned. Participant's were instructed "You've earned [number of tokens earned] tokens! Now you can play with all of these toys (motion to all toys) for [number of seconds earned] seconds. Are you ready? 3.2.1. Go!". Item engagement data were collected during the token exchange period to compare with the results of the preference assessment data.

EXPERIMENT 2

Method

Participants, Setting, and Materials

Ryan, Gary, and Ethan also participated in Experiment 2. Child assent was collected prior to each session. All sessions took place within the same setting. Session materials were determined based on results of the previous preference assessments conducted in Experiment 1. Two identical tables and children's chairs were placed approximately two feet away from each other with a Fabric 3 Drawer Rolling Cart placed directly between the two tables. A bin with each possible reinforcer that could be earned at the given table was placed at the top of the cart for the child to see (but not reach) while at the table. For example, Ryan saw an Ocean Animals book (his highest preferred item) when seated at the high-preferred table, and a bin with all other toys was on display at the token table. The chairs were placed at each table, approximately three feet away from each other to distinguish response allocation between high preferred and token conditions.

Experimental Design and Procedures

Experiment 2 consisted of a concurrent-operants design to compare children's choice of concurrent VI-15s schedules of token delivery and exchange at the end of each session versus immediate access to a highly-preferred item. This was implemented to assess the impact that generalized conditioned reinforcers (i.e., tokens) have on satiation compared to a high-preferred item within a treatment setting. Experiment 2 was implemented following the conclusion of Experiment 1 and lasted approximately one week.

During Experiment 2, each participant was given the choice between obtaining 5-s of access to their highest preferred item or a token that could be exchanged for 5-s of access to multiple moderately preferred items at the end of each session. Both options were available on concurrent variable interval (VI) 15-s schedules and sessions lasted for 2-min excluding all reinforcement intervals. Prior to the beginning of the session, the child was instructed "Now you

can choose what you would like to work for! If you sit at this table (point to table A) you will sometimes be given access to [name of high preferred item] toy (point to high preferred toy). If you sit at this table (point to table B), you will sometimes get tokens that you can use at the end of the session. The tokens will allow you to play with all of these toys (motion to moderately preferred items). Both tables have the same toy for you to play with while you wait. You can switch tables at any time. Ready? Begin." Gestural prompts were used during the instructions to increase student understanding. Both VI schedules were controlled using BDataPro data collection, timers, and paper data sheets with reinforcers administered accordingly. Reinforcement time was not included as part of the 2-min session. The lowest preferred item identified by the previous paired stimulus preference assessment was available at both tables for the child to engage with while waiting. At the end of the session, children were permitted to exchange their tokens using the same procedures as the token intervention phase of Experiment 1. The duration of time spent sitting at each table was recorded and defined as anytime the child's buttocks was in contact with the chair at that table. Therefore, the child could be leaning against the chair but still standing to be allocating time at either table. Satiation effects were determined by the percentage of time spent at each table, and the percentage of time that the child engaged with each item.

Interobserver Agreement and Procedural Integrity

An independent observer evaluated procedural integrity with checklists listing the different steps of each phase (i.e., baseline, intervention, and treatment phases; see Appendix D and E). Procedural integrity was collected for 38.6% of all experimental sessions and was 100% across experiments, participants, and phases. For Experiment 1, interobserver agreement (IOA) was calculated at the session level for the frequency of problem behavior, item surrendering,

duration of engagement with each item during the token exchange period, and item selection. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Interobserver agreement was calculated for 91.7% of all sessions across participants and experimental phases. The mean and range of IOA data were 100% for problem behavior, 100% for item surrendering, and 98% (80-100%) for item selection. Due to a shift from computer to paper data recording for Experiment 1, I was unable to obtain reliability data for the duration of engagement with each item during the token exchange period.

For Experiment 2, a separate reliability coefficient was calculated using the BDataPro collected data for the frequency and duration behavioral data. Exact Interval Agreement (EIA) was calculated through BDataPro for the number of tokens delivered and Partial Interval Agreement (PIA) was calculated for the duration of time spent sitting at each table and duration of engagement with each item during the token exchange period (Bullock, Fisher & Hagopian, 2017). All sessions were divided into consecutive 10-s intervals. When calculating EIA, an agreement was scored for an interval if both observers recorded the same number of tokens delivered. The number of agreements was then divided by the number of agreements plus disagreements and converted into a percentage. Behaviors measured by duration were also calculated in accordance with Bullock et al. (2017). For each interval, the lower duration of responses recorded was divided by the higher duration and converted to a ratio. If both observers recorded zero responses, a ratio of 1.0 was substituted. Finally, the ratios were summed and divided by the number of intervals in the session and then multiplied by 100 (Bullock et al., 2017). Interobserver agreement was calculated for 42% of the sessions across participants. EIA for the number of tokens delivered was 100% across all sessions, and PIA was 99% (98.44-100)

for time spent sitting at each table and 94% (81.72-100) for duration of engagement with each item during the token exchange period.

Results

Functional Behavior Assessment

Indirect measures of the functional behavior assessment included a modified problem identification interview (PII) with the teacher (Erchul & Martens, 2010) and administration of a modified Questions about Behavioral Function (QABF) scale (Paclawskyj et al., 2000). The primary goals of the PII were to assess the scope of teacher concerns and confirm a tangible function for problem behavior within the classroom. Results of the PII indicated that all three participants were described as engaging in problem behavior following the removal of tangible items. A modified version of the QABF was also administered to further examine a hypothesized tangible function. For all three participants, a score of 10 or higher on the tangible subscale was obtained and thus supported the hypothesized tangible function. Gary, Ryan, and Ethan scored 14, 13, and 12 respectively.

Following the administration of both indirect measures, a modified structured descriptive assessment (SDA) was conducted. Three sessions each of restricted access to tangibles and free play control conditions were conducted as direct measures in the functional behavior assessment. An increase in problem behavior during the tangible conditions compared to control conditions supported a tangible function for problem behavior. For Gary, one additional session of restricted access to tangibles and free play control conditions were administered due to undifferentiated results during the first two sessions. All three participants demonstrated clear differentiation between control and restricted access conditions with an increase in problem behavior during

tangible conditions (Figure 1). A paired-stimulus preference assessment (Fisher et al., 1992) was used to determine colors for the tokens in this study. Token colors were two of the moderately preferred colors identified for each participant and can be found in Table 1.

Primary Analyses

For Experiment 1, participant frequency of problem behavior and item surrendering were calculated to evaluate the effects of the token intervention. As shown in Figure 2, minimal levels of problem behavior were observed for all three participants across all phases. For Ryan and Ethan, no problem behavior was observed during any of the experimental sessions. Additionally, Gary engaged in low levels of problem behavior with an average frequency of 1.2 aggressions (mode = 0) per session during baseline phases and 2.2 aggressions (mode = 0) per session across experimental phases. Due to the low levels of problem behavior across participants, percent item surrendering was used to evaluate the effects of the token intervention on item surrendering. Percent item surrendering was calculated as the number of times the child complied with an instruction to surrender an item divided by the number of total instructions, multiplied by 100.

Each child's percent item surrendering was graphed and visually inspected for clear, immediate changes in level between adjacent conditions that are replicated within and across all children. In addition to visual inspection, the non-overlap of all pairs (NAP) effect size statistic was calculated to assess the results. Non-overlap of all pairs of data was calculated by the number of comparison pairs (a datapoint from phase A with a datapoint from phase B) of data showing no overlap divided by the total number of comparisons (Parker & Vannest, 2009). For an ABAB withdrawal design, a separate NAP value is calculated for each baseline-intervention (AB) comparison and the final value is determined by averaging both comparisons. According to

Parker and Vannest (2009), NAP values between 0-.65 indicate a weak effect, while .66-.92 exhibit a moderate effect, and values above .93 demonstrate a strong effect.

Experimental control was demonstrated through the reversal of intervention and baseline phases while other variables were held constant (e.g., same child, classroom, items in the preference assessment, time of day, and presence and color preference of tokens). As shown in Figure 3, experimental control and the strongest effect were obtained for Gary and Ethan. Although NAP results indicated a moderate effect size for off-task behavior across all participants (Table 2), visual inspection suggests that this intervention was most effective for Gary. He demonstrated lower levels of item surrendering during baseline compared to token phases with the greatest difference occurring between the first baseline and token phases (Table 2). Gary's level of item surrendering was lower during the first AB comparison; however, he demonstrated a downward trend during the second baseline phase and upward trend during the final token phase. Although NAP results were the highest for Ethan (.89), visual inspection suggests that Ethan's item surrendering during the second baseline and token phases was more variable with a slight decreasing trend during the baseline phase. The weakest effect and degree of experimental control were found for Ryan. His item surrendering was generally high across all phases with the smallest differences in level.

For Experiment 2, it was anticipated that participants would show a preference for token reinforcers (TR) compared to access to their most highly preferred (HP) item. This was calculated using the percentage of time allocated to either location. As shown in Figure 4, Ethan was the only participant to demonstrate a preference for token reinforcers. Ethan spent an average of 78% of his time across sessions at the TR table and 13% of his time at the HP table. Conversely, Ryan and Gary both demonstrated a preference for the HP items. Ryan and Gary

spent 84.8% and 98.54% of their time at the HP table compared to 13.6% and 0% at the TR table, respectively.

Secondary Analyses

For Experiment 1, preference stability was evaluated across PS administrations. A Kendall's tau-b correlation coefficient was calculated across the baseline and token paired stimulus assessment results to determine if the correlation across assessments was significant. This was done by tallying the total number of times an item was selected to establish a preference hierarchy for each phase. Similar to the NAP calculations, a separate Kendall's tau-b correlation coefficient value was calculated for each baseline-intervention (AB1 and AB2) comparison. Across participants, preference stability was the highest for Ryan and Gary (Table 3). The correlation coefficients for Ryan were .627 and .847. For Gary, the tau-b correlation coefficients were .579 and .757. Ethan demonstrated the lowest preference stability during the first AB comparison with a correlation coefficient of .253. For the second AB comparison, Ethan's toy preferences demonstrated a significant increase in stability with a correlation coefficient of .815. With the exception of Ethan's coefficient during the AB1 comparison, the other five coefficients were statistically significant.

The consistency of rankings across assessment methods (free operant and paired stimulus) was also calculated using Kendall's tau-b correlation coefficient. Kendall's rank correlation was selected over Spearman's rho to examine the concordant and discordant pairs for a low number of ranked items (10-items). To compare the FO preference assessment results to the PS preference assessment results, a separate Kendall's tau-b correlation coefficient value was computed for each respective pair. That is, the preference rankings obtained by the first free operant preference assessment were compared with the rankings from the corresponding paired

stimulus preference assessment. For all three participants, the free operant preference assessment yielded a preference of fewer than 10 items. Therefore, all items that were not selected were given a ranking of 10. Across participants, preference stability was most consistent across preference assessment methods for Ryan (see Table 4). The correlation coefficients for Ryan were .705 and .818, both statistically significant. For Ethan, the tau-b correlation coefficients were .530 (nonsignificant) and .664 (significant). Gary demonstrated the lowest preference stability across methods with nonsignificant, negative correlation coefficients of -.026 and -.144. For all three participants, the highest preferred item identified by the paired stimulus preference assessments was also the highest preferred item identified by the free operant preference assessment. For Ethan and Ryan, the free operant preference assessment identified four preferred items with the highest two preferred items being Playdoh and an Ocean Animals Book, respectively. For Gary, seven of the 10 items were selected throughout the free operant Preference Assessments, and Playdoh was identified as his highest preferred item across both FO phases.

Discussion

This study examined the effectiveness of a token intervention for reducing tangible-maintained problem behavior and increasing item surrendering during paired-stimulus preference assessments. It was hypothesized that children's problem behavior would decrease and item surrendering would increase when exposed to generalized conditioned reinforcement contingencies. It was also hypothesized that the highest preferred item identified by results of the PS preference assessment would correspond with the item most engaged with on average during the FO token exchange period at the end of token reinforcement sessions, and that the results of the PS preference assessment during baseline and token conditions would correspond. Lastly, it

was hypothesized that when given a choice during the treatment phase, children would prefer tokens over access to their highest preferred item.

Evaluation of Research Hypotheses

Across both experiments, Ryan and Ethan did not engage in problem behavior. Additionally, Gary engaged in low levels of problem behavior across all sessions of Experiment 1. Therefore, I was unable to evaluate the first hypothesis with respect to a decrease in problem behavior with token reinforcement. The first hypothesis however was supported by Gary and Ethan with respect to an increase in item surrendering with token reinforcement and decrease in noncompliance. Item surrendering was defined as completing the action requested within 3-s of a verbal prompt. For all three participants, noncompliance occurred when the student ignored the instruction to surrender the item but did not engage in additional problem behavior. For example, noncompliance was scored if a participant continued to engage with the toy after being instructed to surrender the item. Although NAP results indicated a moderate effect size for item surrendering across all participants (Table 2), visual inspection of Figure 3 suggests that the largest differences in item surrendering occurred for Gary and Ethan. The weakest effect and degree of experimental control were found for Ryan who showed generally high levels of item surrendering across all phases.

The second hypothesis (highest preferred items would correspond across PS and FO preference assessment methods) was examined in two ways. First, I computed Kendall's tau-b correlation coefficients between the item rankings from both assessments. Using this approach, the second hypothesis was only supported by the results obtained for Ryan with significant Kendall's tau-b correlation coefficients of .818 and .705. Conversely, Gary and Ethan's results did not support this hypothesis as evident by negative and/or nonsignificant correlation

coefficients across preference assessment methods. Second, I compared the highest preferred items identified by the PS and FO preference assessments. For all three participants, the highest preferred item identified from the PS preference assessments matched the highest preferred item identified from the FO preference assessments. Similar to previous research (Roane, Vollmer, Ringdahl, & Marcus, 1998; Vollmer & Iwata, 1991), the results of the FO preference assessments were able to accurately identify the highest preferred item for all three participants, but did not establish a clear preference hierarchy with all 10 items. Interestingly, Gary engaged with the most items (7 out of 10) throughout the FO preference assessment, yet also demonstrated the weakest correlation coefficient across preference assessment methods. This suggests that engaging with more toys throughout the FO preference assessment does not necessarily establish the same preference hierarchy as a paired stimulus preference assessment would predict.

The third hypothesis (item preferences would correspond across PS and PS + token phases) was examined across both AB comparisons (i.e., AB1 and AB2) phases. Across participants, preference stability was the highest for Ryan and Gary. Ethan demonstrated the lowest preference stability during the first AB comparison but a significant increase in stability for the second AB comparison. With the exception of Ethan's correlation coefficient during the AB1 comparison, the other five coefficients were all statistically significant (Table 3) thereby supporting the third hypothesis.

The fourth hypothesis (preference for tokens over HP items) was only supported by Ethan. Ethan demonstrated a preference for token reinforcers when examining the percentage of time allocated to the token table compared to a high preferred item table in Experiment 2. As

shown in Figure 4, Ryan and Gary both demonstrated a clear preference for the table that provided access to the HP items.

Explanation of Findings

Although token reinforcement appeared to be moderately effective at increasing item surrendering for Gary and Ethan, several possible explanations exist for the failure to show larger effects as well as the general lack of effects with Ryan. First, rates of problem behavior during the restricted access condition of the structured descriptive assessment were higher for all three children than those observed during experimental phases. Across all experimental sessions, Gary was the only child to engage in problem behavior. Additionally, Gary's aggressive behavior observed during the preliminary assessments (i.e., hitting, kicking, and scratching) was more severe compared to experimental (i.e., light pinching with all fingers) phases. This inconsistency could be due to an increase in individual adult attention provided to all children during the experimental sessions. Specifically, experimental sessions for all three students were conducted in a small therapy room with two or three (reliability sessions) adults present. Although the data collectors remained silent throughout all sessions, it is possible that the presence of the multiple adults and the frequent attention (e.g., verbal requests) from the experimenter decreased problem behavior compared to preliminary observations in the classroom.

Second, during preliminary assessments we restricted access to preferred activities but did not evaluate the impact that attention had on problem behavior for participants. Although attention was of low quality during experimental sessions, it is possible that the high rate of attention was still reinforcing. Research has demonstrated that while some discrepancies have been noted between quality of praise, neutral attention is still more reinforcing than no praise

(Weyman & Sy, 2018). It is possible that the high rates of novel adult attention provided during the experimental sessions resulted in reduced problem behavior for all three students as well as the high rate of item surrendering across all sessions for Ryan. Future research would benefit from the examination of other possible functions of problem behavior within the classroom setting. Originally, modified preliminary assessments were selected to help reduce the length of the study's timeline. Future research should incorporate a full QABF and SDA to help better understand the various functions of problem behavior for each child and how these differences impact the results of the study.

Third, students may have had a prior history with token reinforcers that influenced their behavior across experimental sessions. Within the school setting, some teachers reported utilizing token interventions in their classroom. Although token interventions were not currently being implemented within the participants' classrooms, it is unknown if they were exposed to a token intervention in their previous classroom directly or indirectly (e.g., by observing a peer). If the participants had been exposed to a token intervention in the past, it is possible that the tokens (regardless of whether they could be exchanged for reinforcers) still acted as conditioned reinforcers, thereby resulting in the elimination (Ryan and Ethan) or reduction (Gary) of problem behavior throughout the experiments and across phases.

Fourth, for both experiments, participants had access to some type of tangible reinforcer throughout the majority of the session duration. That is, the only time that the child did not have access to a tangible item was immediately following item surrendering until they selected their next item. A study conducted by Vargo and Ringdahl (2015) examined resistance to change with conditioned (i.e., tokens) and unconditioned (i.e., fruit) reinforcers when prefeeding (i.e., access to fruit before each session) disrupted responding. Results demonstrated that instead of

increasing satiation and thus decreasing responding for unconditioned reinforcers, responding persisted for unconditioned reinforcers over conditioned reinforcers. It is possible that continued access to tangible reinforcers degraded the relation between the conditioned (token) and unconditioned (tangible) reinforcers as evident by Ryan's decreasing trend in item surrendering during the final token intervention phase and the preference for high preferred items for Ryan and Gary in Experiment 2 (Vargo & Ringdahl, 2015).

Limitations and Directions for Future Research

The current study has several limitations that should be addressed in future research. First, the session occurred in a novel room and adult attention may have impacted the rate of problem behavior exhibited within the study and thus could have impacted the effectiveness of the token intervention. Future research may benefit from examining the impact of the token intervention within a classroom setting. It is possible that the presence of teachers during the preference assessment sessions would have acted as a discriminative stimulus for access to preferred items thereby resulting in an increase in tangibly-maintained problem behavior.

Furthermore, it is unclear how these results would generalize across different participants. This study examined the effects of a token intervention on three male preschool children. Due to such a small sample size, it is unclear what effects a token intervention would have in item surrendering for children of different sex, age, or diagnoses. Future research may benefit from examining how various individual differences impact the token intervention. For example, the verbal and cognitive abilities of all three participants may have influenced their responses to the token intervention. Both of the participants with diagnoses of ASD (i.e., Gary and Ethan) required additional training trials before they were able to accurately demonstrate an understanding of how to earn the tokens. It is possible that a token intervention may have

differing effects on children with varying disabilities. For example, Heath et al., (2015) found that Functional Communication Training (FCT) was more successful for individuals with a diagnosis of autism as opposed to individuals with an intellectual disability. Understanding how children with varying disabilities respond to a token intervention, develop preference hierarchies, and experience satiation could all help to further understand the results of this study as well as the effectiveness of token interventions for the classroom.

The weakest effect and degree of experimental control for Experiment 1 as well as a preference for their highest preferred item over tokens in Experiment 2 was found for Ryan. Although Ryan did not respond as hypothesized to either of the experiments, his preference stability was the strongest of the three participants across both methods and phases. Similarly, although Gary demonstrated the strongest effect and degree of experimental control during Experiment 1, he demonstrated the lowest preference stability across preference assessment methods (FO and PS). The discrepancy between preference stability and intervention effects may indicate a need for further investigation to determine any possible influence that one may have on the other. That is, Ryan consistently preferred the Ocean Book over all other toy options, the option to earn tokens for delayed access to less preferred items may not be enough to shift Ryan's preference from the HP table to the MP table. Future research should examine whether the stability of an individual's preference hierarchy influences their resistance to satiation and preference for immediate access to their highest preferred item over tokens and delayed access to less preferred items.

Also, both Gary and Ethan received additional training with guided token exchanges whereas Ryan did not, and they showed the largest increases in compliance during token

conditions. It may important in future research involving preschoolers to provide token training to all participants before implementing the token system.

When examining the time that each participant spent with their highest preferred item during the free operant exchange periods, Ryan spent the largest amount of time with his highest preferred item (Ocean Book) at 58%. On the other hand, Ethan and Gary both spent less than 50% of their time with their highest preferred items (47% and 41%, respectively). These data suggest that Ryan had a stronger preference for his highest preferred item, and thus chose to spend more time with his highest preferred item during the free operant exchange periods compared to the other two participants. Research has demonstrated that highly preferred items are more effective reinforcers compared to less preferred items (e.g., Penrod, Wallace, and Dyer, 2008; Fisher et al. 1992). Additionally, research using progressive-ratio reinforcement schedules has demonstrated variability over time in the reinforcing values of initially identified equally high-preferred items (e.g., Roane, Lerman, & Vorndran, 2001). Therefore, items identified by students in the present study as their highest preferred may have been effective reinforcers but had differing thresholds before exhibiting satiation. It is possible that having a higher and/or stronger preference for an item could have resulted in Ryan being more resistant to satiation and/or the token intervention than his peers.

Additionally, research may benefit from examining the sensitivity of item preferences for the token intervention compared to delayed and immediate items. Experiment 2 examined the preference for tokens (and delayed MP items) compared to immediate access to HP items. Although this study suggests that the preference for tokens did not outweigh the desire for immediate access to the highest preferred item, it is unclear if or when this preference would shift. Examining various session lengths could provide valuable insight into satiation effects for

preschool-aged children. Research suggests that students are more likely to engage in high-effort tasks for higher preferred reinforcement (Roane, Lerman, & Vorndran, 2001) and thus it is also possible that satiation takes longer for HP items compared to MP or LP items. Examining the preference for tokens that can be exchanged for MP or HP items compared to immediate access to MP items or LP items could also provide different results. Exploring additional parameters surrounding preferred items and choice may provide valuable insight into the benefits of token interventions within the classroom as well as best practice techniques to increase the intervention's effects on item surrendering.

Gary and Ethan's results provide possible implications for the use of generalized conditioned reinforcers to promote item surrendering during PS preference assessment trials. Although Gary did not prefer the use of tokens over immediate access to his highest preferred item, both students demonstrated an increase in item surrendering through the use of a token intervention. Thus, for children who struggle to appropriately surrender items during PS preference assessments, tokens can be used as generalized conditioned reinforcers to increase item surrendering by allowing children to earn access to multiple toys at a later time. These results replicate previous research indicating the effects of token interventions within the preschool-aged population (e.g., Sran & Borreno, 2010) and expand the understanding of token interventions for increasing item surrendering among preschool-aged children within a special education program. Beyond PS preference assessment trials, this study provides preliminary evidence towards the effects of tokens on increasing item surrendering by preschoolers in general. Future research may benefit from examining the effects of tokens within the classroom setting as a way to promote transitions from preferred to non-preferred activities throughout the day. Additionally, this study provides valuable insight into preference stability across differing

preference assessment measures. Further research may benefit from examining the differences between free operant preference hierarchies and how varied percentages of engagement may differentiate the potency in reinforcer strength. Lastly, this study provides preliminary evidence towards the relationship between generalized conditioned reinforcers and their corresponding back-up reinforcers when access to the back-up reinforcers is already being provided on a rich schedule throughout the session.

To date, there is very limited research supporting token interventions within the preschool classroom, and yet they are frequently utilized within a clinical setting. Token interventions can be helpful in increasing item surrendering within the classroom setting and decreasing aggressive behaviors for children. The current study provides preliminary evidence toward a potentially effective intervention for use in preschool settings. While there is some evidence to suggest that this intervention may benefit some students with tangible-motivated problem behavior, additional research is needed.

Appendix A: PII Objectives

1. Assess the scope of consultee concerns
2. Prioritize problem components or identify target problem area
3. Define the target problem in overtly observable, behavioral terms
4. Estimate problem frequency, intensity, or duration
5. Identify tentative goals for change
6. Identify problem antecedents, sequences, and consequences

Appendix B: Questions About Behavioral Function (QABF)-Tangible Questions

Paclawskyj et al (2000)

Rate how often the student demonstrates the behaviors in situations where they might occur. Be sure to rate how often each behavior occurs, not what you think a good answer would be.

X = Doesn't apply 0= Never 1= Rarely 2=Some 3=Often

1. Engages in the behavior to get access to items such as preferred toys, food, or beverages.
2. Engages in the behavior when you take something away from him/her.
3. Engages in the behavior when you have something he/she wants
4. Engages in the behavior when a peer has something that he/she wants.
5. Does he/she seem to be saying "give me that (toys, item, food)" when engaging in the behavior?

Appendix C: Preference Assessment Instructions

(Fisher et al., 1992; Lavie & Sturmey, 2002)

1. Put two stimuli on the table in front of the child (0.7 m from one another and 0.7 m from the child) and wait for 5 s.

2. If the child touches a stimulus, remove the non-chosen stimulus immediately.

3. Let the child interact with the chosen stimulus for 5 s. If the child samples the stimulus at the first opportunity move on to Step 9.

4. If the child approaches both stimuli, block him or her by holding the two stimuli down on the table.

5. If the child does not approach both stimuli after 5 s, prompt him or her to sample each stimulus for 5 s. Let the child hold the stimulus for 5 s.

6. After the child samples both stimuli, present the two stimuli again. (Note that this still constitutes the same trial.)

7. Repeat Steps 2 through 4.

8. If the child does not approach both stimuli, again remove the stimuli.

9. Record the data for each trial by writing the results on the score sheet provided.

Appendix D: Procedural Integrity Checklist- Experiment 1

Experiment 1

Session Number: _____ Participant Initials: _____ Observer Initials: _____

Phase: Baseline / Token Total Steps Completed: _____/ out of _____

CIRCLE THE NUMBER OF ALL COMPLETED STEPS FOR THE RELEVANT PHASE

All Phases:

1. Experimenter placed all items on the table out of the child's reach prior to the session
2. Experimenter followed the previously randomized schedule of paired-choices throughout the session
3. Experimenter placed two items on the table within reach (1 ft. apart from each other) and stated, "Pick one."
4. Upon selection, the child will receive 20-s of access to their selected item.
5. At the end of the 20-s access interval, the experimenter instructed the child "My turn with the toys. Please give me the toys back"
6. If the child complied with the instruction, they were awarded a token
7. If the child attempted to grab two items, they were blocked and represented with the two options with the instruction to "Pick one"
8. The child was allowed 5-s to comply to the instruction

Baseline ONLY:

9. If the child engaged in problem behavior following the instruction, the child was told, "Ok, you can have a little more time," and an additional 5-s access to the item was granted
10. After the child engages in problem behavior and receives an additional 5-s of access to the reinforcer, they were instructed "All Done" and the item was removed so that the next trial could begin.

Token Intervention ONLY:

9. Prior to the start of this session, the experimenter instructed the student, "If you return the item when I ask you to, I will give you a new type of token. This [color] token can be exchanged at the end of the session and you can play with all of these toys for a little longer. The more tokens you have, the more time you will have to play with the toys at the end. If you do not return the item, I will have to take it from you and you will not receive a token."
10. Problem behavior was placed on extinction.
11. If the child engaged in problem behavior or failed to comply within 5-s following the instruction to surrender the item, the item was removed and the child did not receive a token.
12. If the child complied with the instruction and did not engage in problem behavior upon surrendering the item, they were awarded one token.
13. At the end of the session, the child was instructed that they earned 5-s of access to all of the available toys for each token they earned.
14. The tokens were counted and the child was instructed of how much time they earned.

Appendix E: Procedural Integrity Checklist- Experiment 2

Experiment 2

Session Number: _____ Participant Initials: _____

Observer Initials: _____ Total Steps Completed: _____/ out of

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CIRCLE THE NUMBER OF ALL COMPLETED STEPS FOR THE SESSION

1. Experimenter set up two tables identically with the designated LP item on each table.
2. The child was instructed "Now you can choose what you would like to work for! If you sit at this table (point to table A) you will sometimes be given access to [name of high preferred item] toy. If you sit at this table, you will sometimes get tokens that you can use at the end of the session. The tokens will allow you to play with all of these toys (motion to moderately preferred items). Both tables have the same toy for you to play with while you wait. You can switch tables at any time. Ready? Begin."
3. The experimenter delivered tokens or access to HP reinforcement at the correct time and removed them at the correct time.
4. Reinforcement time was not included as part of the 2 min session.
5. At the end of the session, the child was instructed that they earned 5-s of access to all of the available toys for each token they earned.
6. The tokens were counted and the child was instructed of how much time they earned.

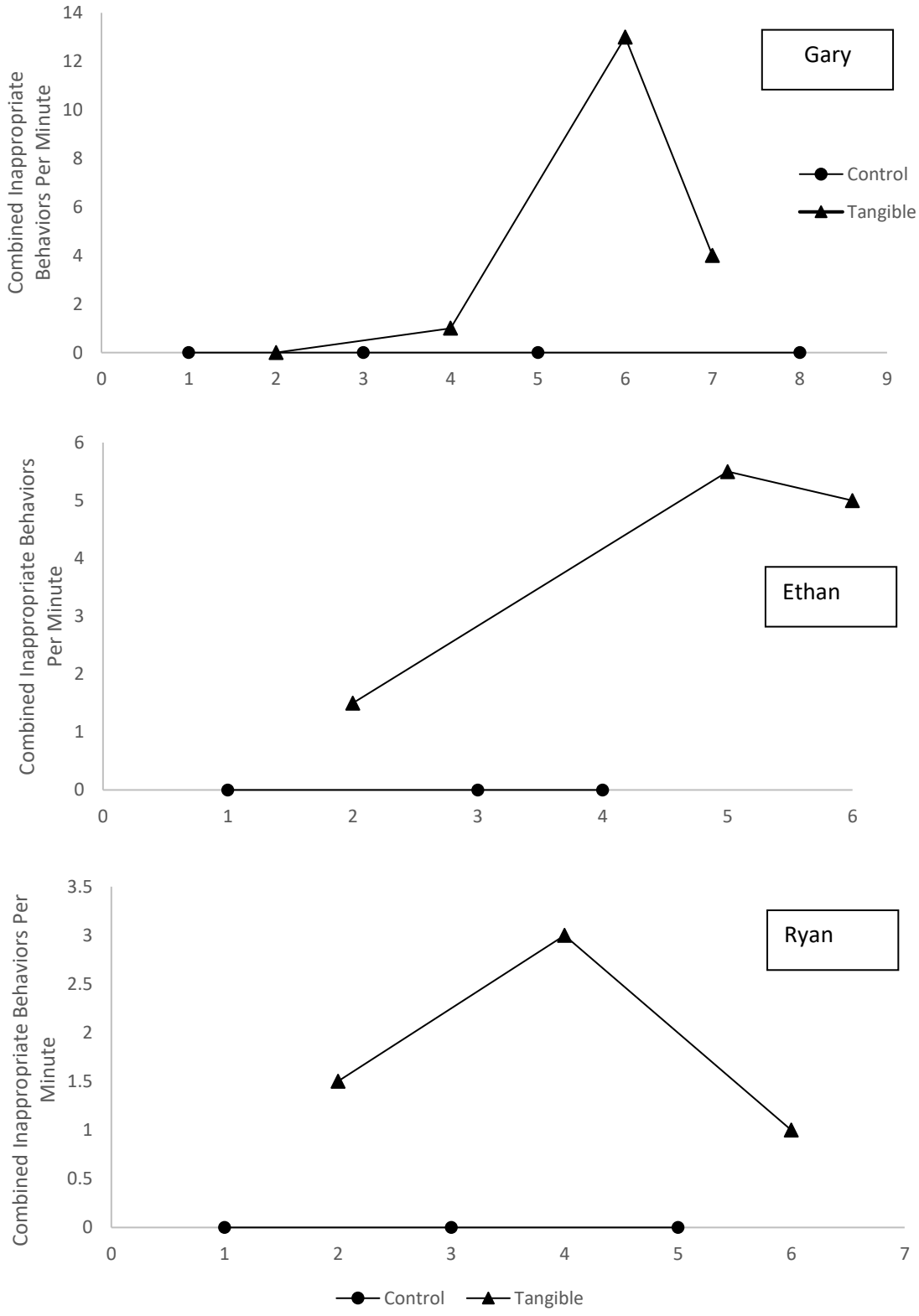

Figure 1. Results of Structured Descriptive Assessment in Experiment 1.

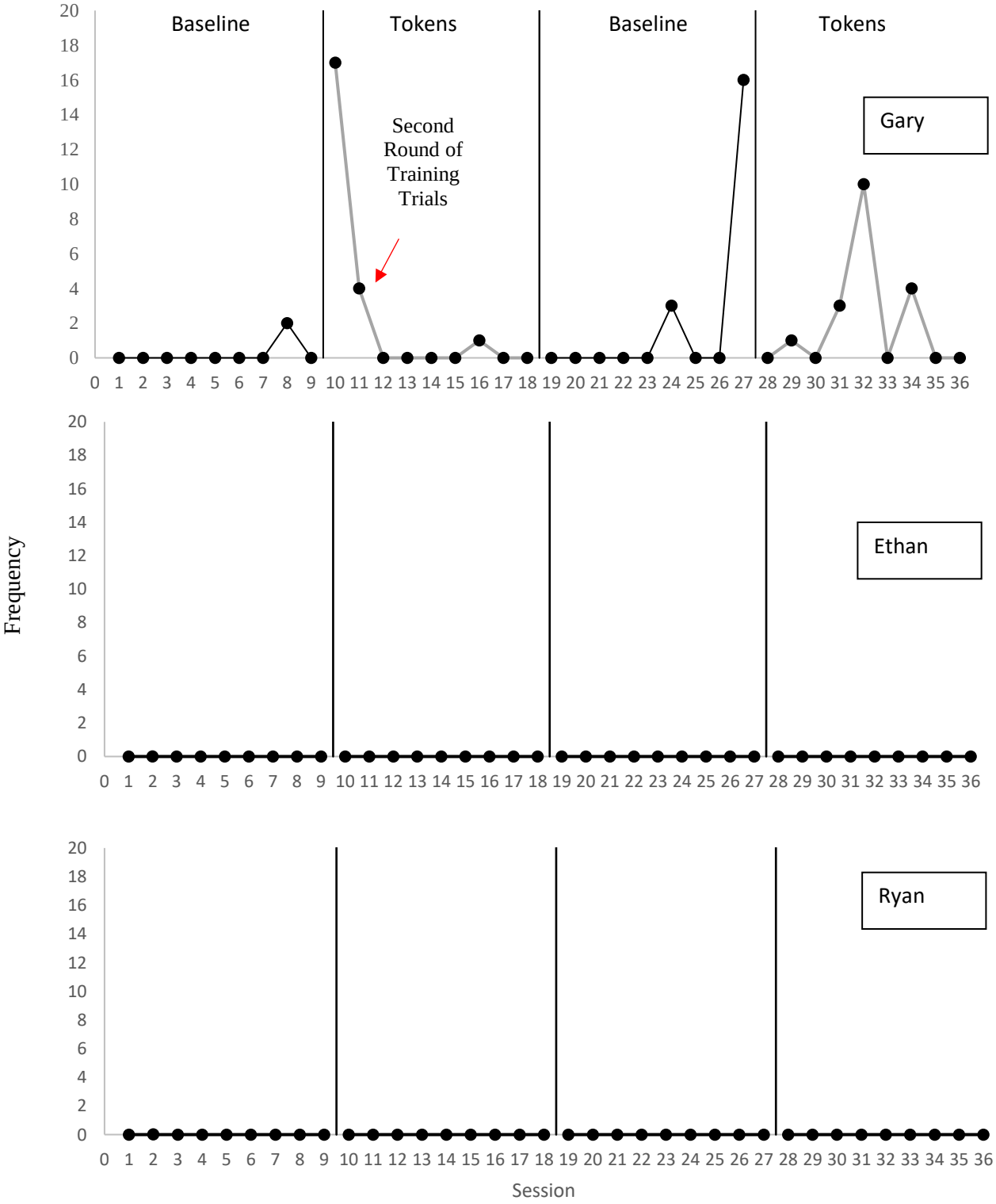

Figure 2. The frequency of problem behavior across participants in Experiment 1.

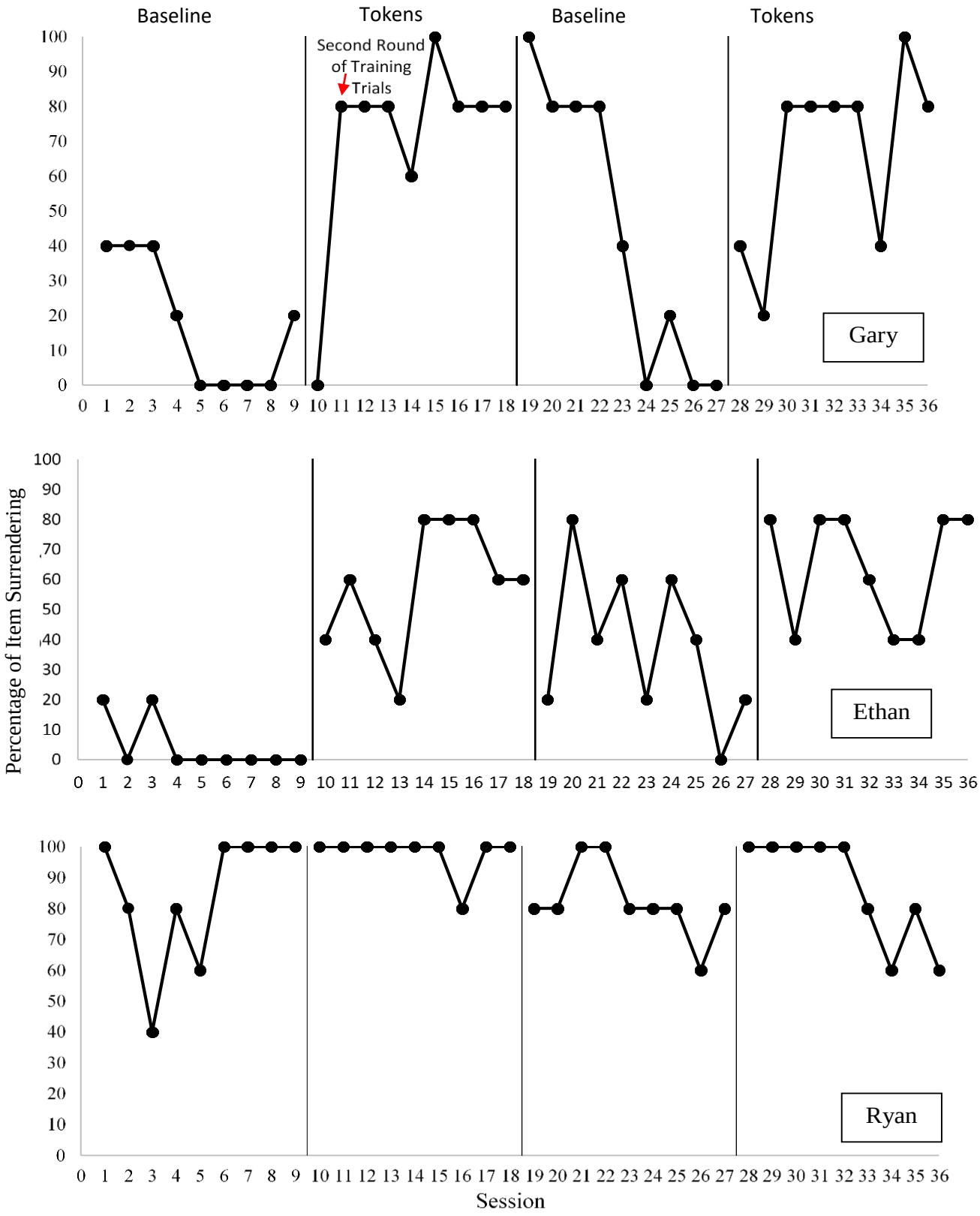

Figure 3. Item surrendering for each participant across sessions within Experiment 1.

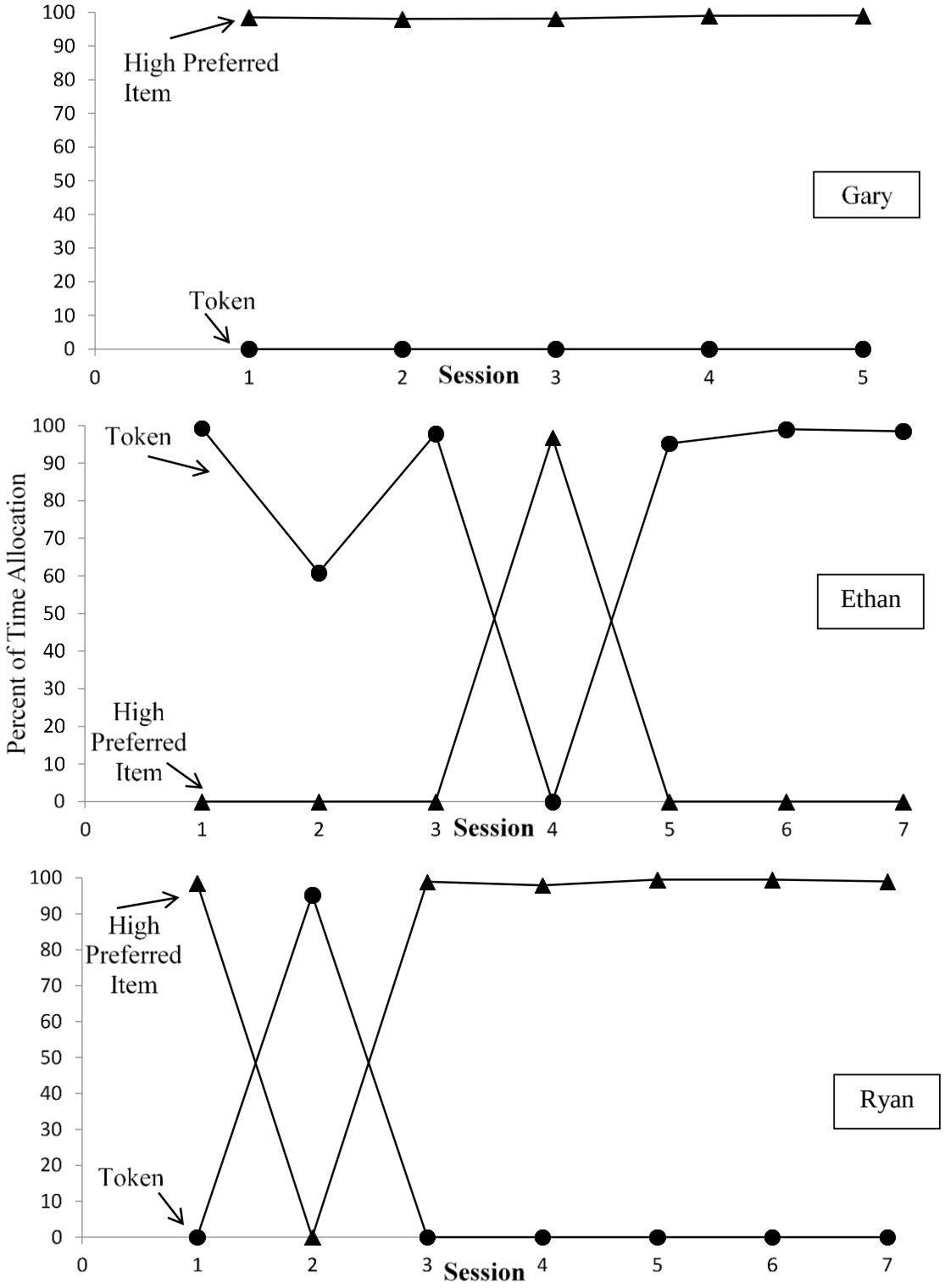

Figure 4. The percentage of time allocated to high preferred or token table in Experiment 2.

Table 1

Participant Demographic Information

Participant	Age	Diagnoses	Ethnicity	Token Colors	
				Baseline	Experimental
Ryan	4	None*	Caucasian	Salmon	Blue
Ethan	4	ASD	Caucasian	Light Green	Blue
Gary	4	ASD	Caucasian	Salmon	Dark Green

*Currently on the waiting list for a diagnostic evaluation.

Note. ASD = autism spectrum disorder.

Table 2

Experiment 1 Condition Means and NAP Effect Sizes for Participants' Item Surrendering

		Condition Means			
Participant	NAP	Baseline	Token	Baseline	Token
Ryan	.66	84.4	97.8	82.2	86.7
Ethan	.89	4.4	57.8	37.8	64.4
Gary	.79	17.8	71.1	44.4	66.7

Note. NAP= Non-Overlap of All Pairs Effect Size

Table 3

Experiment 1 Paired Stimulus Preference Assessment Stability Across Participants

Participant	Kendall's Tau-b	
	AB1	AB2
Ryan	.627*	.847**
Ethan	.253	.815**
Gary	.757**	.579*

**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Table 4

Experiment 1 Preference Stability Across Free Operant and Paired Stimulus Assessments

	Kendall's Tau-b	
Participant	B1 (PS-FO)	B2 (PS-FO)
Ryan	.818**	.705*
Ethan	.664*	.530
Gary	-.026	-.144

**Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

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