EVALUATING THE EFFECTS OF CHOICE ACROSS VARYING LEVELS OF PREFERRED ITEMS

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The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

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presented by Emily Whitaker,

a candidate for the degree of Master of Science in Applied Behavior Analysis,

and hereby certify that, in their opinion, it is worthy of acceptance.

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Abstract

The current study compared the differential effects of choice and no-choice conditions on skill acquisition, when provided as a consequence and when choice conditions involved the opportunity to choose from an array of items of varying levels of preference (high, moderate, and low preference). These effects were evaluated across four conditions: top preference choice, varying-level preference choice, no choice, and control. Additionally, the current study evaluated children's preferences for choice-making opportunities among three children with autism spectrum disorder. Results indicated that the top preference choice condition increased treatment efficacy for two of the three participants, and two of the three participants demonstrated preference for choice-making opportunities

Evaluating the Effects of Choice Across Varying Levels of Preferred Items

The term "choice" can be defined as the opportunity to select from an array of response options (Fisher & Mazur, 1997). In the past 20 years, behavioral researchers have evaluated choice and the effects of providing choice-making opportunities in a variety of ways. More specifically, researchers have evaluated different variables within choice (e.g., Brandt et al., 2015; Fenerty & Tiger, 2010; Tiger et al., 2006) as well as the effects of choice in treating problem behavior (e.g., DeLeon et al, 2001; Hanley et al., 2005; Romaniuk et al., 2002; Tiger et al., 2010) and improving skill acquisition (e.g., Elliott & Dillenburger, 2016).

Variables Affecting Choice

One common variable evaluated in choice is the temporal location of choice within the three-term contingency (i.e., antecedent, behavior, consequence). Research has shown that choice is effective in both the antecedent and consequences events of the three-term contingency. For example, researchers have evaluated antecedents in the form of providing the opportunity to choose tasks to complete (Romaniuk et al., 2002) and choice of materials to use. Research has also evaluated the impact of providing choice of reinforcer (e.g., Peterson et al., 2016). For example, when a child is given the opportunity to choose between five different colors of M&M's after completing a worksheet.

Peterson et al. (2016) compared the effects of providing the opportunity to choose reinforcers immediately before or immediately after task responding in four boys with autism spectrum disorder (ASD). Results of their study suggested that providing choice-making opportunities before task responding increased rates of independent and accurate responding for some individuals.

Similarly, Fenerty and Tiger (2010) assessed children's sensitivity to task-choice and consequence-choice conditions. During the task-choice condition, the participant was provided with the opportunity to choose between five identical academic worksheets to complete. During the consequence-choice condition, only one academic worksheet was presented, completion was prompted, and then the participant was presented an array of five identical edible items to choose from, following task completion. Results from their study suggest that children prefer the opportunity to engage in consequence-choice opportunities rather than task-choice or no-choice conditions.

Choice and Treatment of Problem Behavior

Previous research has shown that choice can be used to decrease challenging behaviors and increase appropriate behaviors (Hanley et al., 1997; Hanley et al., 2005) such as compliance and task completion (e.g., DeLeon et al., 2001; Tiger et al., 2010). The effects of providing choice have been evaluated for various functions of problem behavior including social negative reinforcement in the form of escape from demands (e.g., Romaniuk et al., 2002) and social positive reinforcement in the form of attention.

Hanley et al. (1997) was one of the first studies to evaluate social acceptability or consumer preferences for functional communication training (FCT) and noncontingent reinforcement (NCR). Researchers acknowledged that most previous investigations on the topic utilized indirect measures (e.g., rating scales) to assess the social acceptability of behavioral interventions. The decision of which intervention to use was, and still is, most often based on the opinions of caregivers rather than those of the individual who actually receives the behavioral treatment. To address this issue, Hanley et al. (1997) evaluated children's preference for NCR versus FCT when used as a treatment for

destructive behavior maintained by social positive reinforcement in the form of attention. During the NCR condition, participants were given reinforcers on a fixed-time schedule of 30-s (i.e., every 30 s the reinforcer was given regardless of problem behavior). During FCT, reinforcers were delivered on a fixed-ratio 1 schedule (i.e., reinforcers were given after each instance of the target response). Researchers found that both treatments were equally effective in reducing rates of destructive behavior that were sensitive to attention as reinforcement. After evaluating the efficacy of the treatments, the experimenters evaluated each participant's preferred treatment. Both participants preferred FCT relative to the NCR procedure. Researchers hypothesized that the participants preferred FCT because it allowed them to obtain reinforcement when their motivation was high and not request when their motivation was low, whereas during NCR reinforcement was provided independent of fluctuations in motivation.

Several years later, Hanley et al. (2005) further evaluated children's preferences for treatment interventions by providing them with the opportunity to choose the type of intervention they receive. Hanley (2005) evaluated the effects of providing children the opportunity to choose between treatments involving FCT with and without punishment components. They evaluated these effects with two participants whose problem behavior was maintained by social positive reinforcement in the form of adult attention. Within their study, researchers found that FCT was only partially effective in reducing problem behavior. However, when the punishment component was added, problem behavior was reduced to near-zero levels. After evaluating the efficacy of the treatments, the researchers provided the participants with the opportunity to choose which treatment they preferred. Results of the study suggest that both participants preferred FCT with

punishment relative to FCT alone. The research of Hanley et al. (2005) remains an important study in the evaluation of providing choice because it acknowledges that while questionnaires and rating scales may be appropriate for evaluating the acceptability of an intervention with critical stakeholders in the intervention process (e.g., caregivers, teachers, or community members), the values and preferences of others may not always be in the best interest of the consumer or client. Hanley et al. (2005) allowed the participants to take an active role in choosing their own treatment.

Finally, Romaniuk et al. (2002) evaluated whether the function of an individual's problem behavior was related to the effectiveness of an intervention involving choice among tasks. Results of their study showed that problem behavior maintained by social negative reinforcement in the form of escape could effectively be reduced when participants were given a choice among tasks to complete. However, providing a choice among tasks was not shown to be effective in reducing problem behaviors maintained by social positive reinforcement in the form of attention.

Choice and Skill Acquisition

Choice may be used to improve skill acquisition. Previous researchers have demonstrated that providing choice can increase motivation to engage in tasks (e.g., Elliott & Dillenburger, 2016) and may result in stronger maintenance of skills. Elliott and Dillenburger (2016) evaluated the effects of the introduction of reinforcer choice during discrete trial teaching (DTT) of Wh- questions (who, what, where discriminations) on the accuracy of discrimination for three children with ASD. They found that the opportunity to choose resulted in an increase in accurate responding and motivation to engage in

tasks, as well as the emergence of novel and advanced behavioral variability in one participant. However, the effects were not observed with the other two participants.

Some research has shown that providing choice-making opportunities can increase the frequency of academic responding (e.g., Tiger et al., 2010). Tiger et al. (2010) compared the effects of choice and no-choice reinforcement conditions on task responding of three children with ASD across simple fixed-ratio (FR) schedules and progressive-ratio (PR) schedules. The different schedules required different amounts of responding to occur to obtain reinforcement. The FR schedules resulted in reinforcement after a set number of responses, while the PR schedules gradually increased the number of responses required to obtain reinforcement. During the choice condition, the participant was presented with a plate of five identical items from which they could choose one following schedule completion, whereas the no-choice condition involved the presentation of a plate containing only one edible item (identical to those presented during choice sessions) following schedule completion. During the control condition, no reinforcers were delivered. A concurrent operants assessment was then conducted with one participant. That is, three colored pieces of paper were placed in front of the participant at the same time and the participant was required to respond to one of the colors. Each piece of paper corresponded to a different reinforcement contingency (choice, no-choice, or control) that the participant received contingent on engagement in the target response (i.e., drawing a line on one of the papers). The task completion rates of all three participants appeared to be similar across choice and no-choice conditions when compared in the FR schedule format. Two of the participants engaged in increased rates of task completion during choice conditions when compared in a PR schedule

format. However, for one participant neither format appeared to increase rates of task completion, so they conducted the concurrent operants assessment. During the concurrent operants assessment, the participant responded more toward the choice option. These results provide support that choice-making may enhance the efficacy of reinforcement-based interventions.

More recently, Toussaint et al. (2016) evaluated the effects of providing choice-making opportunities as a consequence on skill acquisition, as well as children's preference for choice-making opportunities in three preschool-aged boys. Experimenters evaluated the effects of contingent choice on correct responses under three conditions (choice, no choice, and a control condition). Within the choice condition, participants were given the opportunity to choose between three identical highly preferred edible items contingent on correct responding. During the no-choice condition, the participants were not given the opportunity to choose their reinforcer. Instead, the experimenter delivered an edible item yoked to selections in the previous choice condition contingent on correct responding. During the control condition, no programmed consequences were delivered contingent on correct responding. The experimenters found that providing choice-making opportunities as a consequence effectively increased skill acquisition rates in preschool children.

After the treatment evaluation, the experimenters conducted a preference evaluation to assess participants' preferences for choice-making opportunities. The preference assessment was conducted using a concurrent-chains arrangement. That is, the participants were allowed to choose between different initial links (i.e., different colored cards that directly corresponded to each specific condition), and each initial link

corresponded with a particular terminal link (i.e., the condition-specific consequence immediately following completion of the task). During this evaluation, the experimenter placed the three initial-link stimuli in front of the participant and instructed them to "pick one." After the participant made their initial-link selection (i.e., touched one of the colored cards), the experimenter presented the antecedent stimulus (i.e., instructed the participant to engage in a task), and responding resulted in access to the respective terminal-link contingencies for that session (i.e., choice, no choice, or no reinforcement). The experimenters found that the participants preferred the choice condition.

Northgrave et al. (2019) noted that children may not always prefer choice and that preferences may change due to learning histories and exposure to differential consequences. For this reason, their study aimed to replicate and extend Toussaint et al. (2016). Their study involved two children diagnosed with ASD and took place in the children's homes. Experimenters evaluated the effects of contingent choice on correct responses under three conditions (no choice, child-choice, or experimenter-choice). During the child-choice condition, unprompted or prompted correct responses resulted in the experimenter providing praise and presenting a plate with five non-identical edibles from which the participant could choose one. The only difference between the child-choice and experimenter-choice conditions was the delivery of the reinforcer. During the experimenter-choice condition, the experimenter provided praise and presented a plate of five non-identical edibles, but instead of allowing the participant to choose from the array, the experimenter chose one item from the array and gave it to the participant. Similar to Toussaint et al. (2016), the experimenter's selection was yoked to the participant's selections during the previous child-choice condition session. During the no-

choice condition, the experimenter provided the participant with a brief verbal statement (e.g., "okay") following unprompted correct and incorrect responses. Researchers found that for their participants, experimenter-choice appeared to be more efficient for both participants.

The findings of Northgrave et al. (2019) did not replicate the findings of Toussaint et al. (2016). However, the researchers noted several potential reasons why this may have occurred. First, different skills were taught across the two studies. Toussaint et al. taught speaker responses to all participants (e.g., answering wh- questions or labeling objects and pictures), while Northgrave et al. taught auditory-visual conditional discriminations to one participant and tacts (i.e., labeling) of common objects to the other. Additionally, the two studies differ in the types of prompting procedures used. Toussaint et al. used a progressive prompt delay, whereas Northgrave et al. employed a constant prompt delay. A third difference between the two studies was the number of reinforcers simultaneously presented to the participants. A plate of three non-identical edibles was presented by Toussaint et al. (e.g., M&Ms), while a plate containing five non-identical edibles was presented by Northgrave et al. This difference in the number of reinforcers may have impacted participant responding. A final difference was that different reinforcement arrangements were used. Northgrave et al. arranged nondifferential reinforcement throughout their entire study (i.e., the experimenters provided reinforcement for prompted and unprompted correct responses throughout the entire study), whereas Toussaint et al. initially arranged nondifferential reinforcement but then transitioned to differential reinforcement when participants demonstrated two consecutive sessions with 50% unprompted correct responses (i.e., only unprompted

correct responses were reinforced). The exact impact of the differences between the two studies may have contributed to the conflicting findings.

Although previous researchers have evaluated the effects of reinforcer choice on skill acquisition, conflicting results have been observed across studies. For example, Toussaint et al. (2016) suggest that providing child-choice conditions is effective at increasing accurate responding, while Northgrave et al. (2019) found that experimenter choice was more efficient for both of their participants, suggesting that providing children with the opportunity to choose is not necessary for choice to be effective. Thus, additional research is warranted on whether allowing the opportunity to choose improves skill acquisition.

It is also interesting to note that both studies involved the presentation of high-preferred edibles, regardless of the medium in which they were received (i.e., child choosing or experimenter choosing). It's possible, that the high preference stimuli may decrease the value of choice, whereas different patterns of responding may be observed if stimuli of lower preference are presented during the choice and no-choice conditions following responding. For this reason, it is important that research evaluate the effects of providing choice with not only highly preferred items but with items of lower levels of preference, such as moderate and low preferred. Thus, it is unclear whether providing choice-making opportunities involving varying levels of preferred items as a consequence of correct responding may have the same effects on skill acquisition.

Purpose

Thus, the purpose of the current study was to replicate and extend Toussaint et al. (2016) by evaluating the effects of providing choice-making opportunities as a

consequence on skill acquisition rates when choice conditions involve items of varying levels of preference.

Methods

Participants & Setting

Three children diagnosed with ASD participated in the current study. All three participants were involved in services through an outpatient clinic for autism and developmental disorders. Each child was between 5 and 17 years of age. All sessions were conducted in a 5 m by 5 m session room, 2 to 4 days per week. Each session room was equipped with a wide-angle camera, a workstation with work materials and any materials needed for learning targets, edible reinforcers, and two chairs placed at the table.

Tyson was a 7-year-old African American male, diagnosed with ASD and epilepsy. Tyson had been receiving outpatient autism services for approximately 4 years at the beginning of the current study. Tyson was enrolled in speech therapy and communicated using vocal speech in the form of one-word statements or requests and demonstrated a strong echoic repertoire. Tyson demonstrated low rates of independent correct responding to tasks in the areas of receptive object labeling (ROL) and listener responding feature, function, and class (LRFFC). Tyson was involved in the current study to address skill deficits in the area of LRFFC.

Tanner was a 6-year-old male of Asian descent, diagnosed with ASD. Tanner's primary language was English, however, at home, his parents often communicated with each other in Vietnamese, so Tanner often received exposure to the language, but was not explicitly taught to speak in Vietnamese, as his parents only communicated with him in

English. Tanner communicated using vocal speech and often spoke in statements or phrases of two words or more and demonstrated a strong echoic repertoire. Tanner engaged moderate rates of vocal stereotypy in the form of scripting (i.e., non-contextual repetition or recitation of statements or phrases). At the beginning of the current study, Tanner had been involved in outpatient autism services for approximately 5 months. Tanner attended a typical elementary school 5 days per week, where he was involved in a self-contained special education classroom for kindergarteners and first graders. Tanner demonstrated high rates of independent correct responding to tasks in the areas of receptive object labeling (ROL) and listener responding feature, function, and class (LRFFC), but low rates of correct responding to intraverbal tasks. Tanner was selected for involvement in the current study to address skill deficits in the area of intraverbal fill-in statements.

Dane was a 17-year-old Hispanic male, diagnosed with ASD. Dane had been receiving outpatient autism services for approximately 2 years at the beginning of the current study. Dane demonstrated strengths in the areas of identical and non-identical matching, tacting, and ROL, but demonstrated low rates of independent correct responding to LRFFC tasks. Dane was selected to participate in the current study to address skill deficits in the area of LRFFC.

Measurement, Interobserver Agreement, and Procedural Fidelity

During the treatment efficacy evaluation, observers recorded session data on a trial-by-trial basis. Observers consisted of two registered behavior technicians (RBTs) employed by the university-affiliated outpatient clinic. During the efficacy evaluation, data were collected on correct responses. Correct responses were defined as accurate,

unprompted responses to the task. On the datasheet, independent correct responses were recorded as a "+," prompted correct responses were recorded as a "P+" and incorrect responses were recorded as a "-". During the preference evaluation, data were collected on initial-link selections. Initial-link selections were defined as any part of the participant's hand coming in contact with one of the initial-link stimuli.

Interobserver Agreement

During each session, a second trained observer collected data on each trial. Interobserver agreement was calculated for a minimum of 34% of sessions within each phase. Agreement for unprompted correct responses was scored if both observers independently recorded the same target responses during a trial (i.e., if the participant independently (unprompted) responded correctly, both observers recorded a "+" on the datasheet). Agreement for initial-link selection was scored if both the experimenter and the second observer independently recorded the same initial-link selection. Interobserver agreement was calculated by dividing the number of agreements by the total number of trials and converting the result to a percentage.

During baseline for Tyson, interobserver agreement was calculated for 100% of sessions and averaged 100% agreement. During the efficacy evaluation, interobserver agreement was calculated for 100% of sessions, with an average score of 97.97% (range, 87.5%-100%) agreement across all sessions. During the preference evaluation, interobserver agreement was calculated for 100% of sessions with an average score of 100% agreement. During baseline for Tanner, interobserver agreement was calculated for 100% of sessions and averaged 100% agreement. During the efficacy evaluation, interobserver agreement was calculated for 47% of sessions, with an average score of

99.34% (range 91.7%-100%) agreement across all sessions. During the preference evaluation, interobserver agreement was calculated for 100% of sessions with an average score of 100% agreement. During baseline for Dane, interobserver agreement was calculated for 100% of sessions and averaged 100% agreement. During the efficacy evaluation, interobserver agreement was calculated for 91% of sessions, with an average score of 100% agreement across all sessions. During the preference evaluation, interobserver agreement was calculated for 100% of sessions with an average score of 100% agreement.

Procedural Fidelity

Procedural fidelity data were collected for a minimum of 34% of sessions within each phase. Procedural fidelity was calculated for each session by dividing the number of correctly implemented trials by the total number of trials and converting this ratio to a percentage. Procedural fidelity data were collected on variables such as presentation of the correct antecedent stimulus, correct implementation of prompting procedures, and providing reinforcement contingent on independent correct responses.

During baseline for Tyson, procedural fidelity data were collected during 100% of sessions and averaged 100%, as all sessions were conducted with 100% fidelity. During the efficacy evaluation, procedural fidelity data were collected for 69% of sessions and scores averaged 99.6% (range, 87.5%-100%) fidelity across all sessions. During the preference evaluation, procedural fidelity data were collected during 100% of sessions with an average score of 100%, as all sessions were conducted with 100% fidelity. During baseline for Tanner, procedural fidelity data were collected during 50% of sessions and averaged 100%. During the efficacy evaluation, procedural fidelity data

were collected for 41% of sessions and scores averaged 100% across all sessions. During the preference evaluation, procedural fidelity data were collected during 100% of sessions with an average score of 100%, as all sessions were conducted with 100% fidelity. During baseline for Dane, procedural fidelity data were collected during 61% of sessions with an average score of 100%. During the efficacy evaluation, procedural fidelity data were collected for 89% of sessions, with an average score of 99.74% (range, 87.5%-100%) across all sessions. During the preference evaluation, procedural fidelity data were collected during 100% of sessions with an average score of 100%, as all sessions were conducted with 100% fidelity.

Preference Assessments

Paired stimulus preference assessment (PSPA) procedures used in the current study were similar to those described by Fisher et al. (1992). A paired stimulus preference assessment was conducted with each participant to identify their highly preferred (i.e., chosen at least 80% of opportunities for Tanner and Dane and 75% or greater for Tyson), moderately preferred (i.e., chosen between 40% and 70% of opportunities for Dane and Tyson and 35%-65% for Tanner), and low-preferred edible items (i.e., chosen during 20% or fewer opportunities). Items identified as preferred in the varying levels (high, moderate, low) were used as the edible reinforcer choices during treatment. Approximately 8 to 12 items were available to choose from for each participant. Available items were chosen based on previous behavior technicians' and parental reports of preference. During the assessment, the experimenter systematically rotated through all of the items and presented two at a time, on a plate, one item on each side of the plate, and said, “Pick your favorite.” Each item was presented with every other

item at least once. Experimenters recorded data on which items were chosen during each pairing. The number of selections of each item was then added up and divided by the total number of opportunities in which the item is presented, then was multiplied by 100 to calculate a percentage.

A color preference assessment was also conducted for each participant. The purpose of this assessment was assessment identify the colored stimuli (i.e., placemats) to be used as the initial-link stimuli presented during the intervention as well as the colored shirts to be worn during each condition to promote participants' discrimination between conditions. The preference assessment consisted of eight different colored sheets of paper and was conducted using multiple stimulus without replacement (MSWO) preference assessment procedures, similar to those described by DeLeon et al. (2001). A minimum of three series of the assessment were conducted for each participant. The four colors identified as moderately preferred during the MSWO served as the initial-link stimuli (i.e., colored placemats) in the preference evaluation. The colored placemats were also presented during the efficacy evaluation. During the efficacy evaluation, the participant was physically prompted to touch the colored placemat before each trial during the session. During the preference evaluation, participants were also required to touch the initial-link stimulus before the terminal link was delivered, but no prompts were provided. Data for the MSWO preference assessments were collected by trained observers on a data sheet.

Targeted skills

Target skills for each participant, broken down by condition, are shown in Table 1. The skills targeted for each participant consisted of either Listener Responding Feature

Function and Class (LRFFC) tasks presented in an array of four (Tyson and Dane) or intraverbal fill-in-the-blank statements (Tanner). LRFFC tasks required the participant to select a card, from an array presented in front of them, that directly corresponded with a vocal statement presented by the experimenter (e.g., Experimenter says, "Moo says a _____," then the participant selects the picture of the cow). Whereas intraverbal fill-in-the-blank statements required the participant to vocalize a word that completes the vocal statement presented by the experimenter (e.g., The experimenter says, "Bananas are ____," then the participant says "yellow"). Skills targeted for skill acquisition were chosen based on the participant's current academic goals identified by the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, 2008).

Procedure

Skill acquisition was evaluated using a multielement design embedded within a nonconcurrent multiple baseline design. Before each session, a colored placemat that corresponded with each condition was placed on the table in front of the participant. For Tanner, each condition consisted of six skill acquisition targets. However, due to time constraints, for Tyson and Dane, each condition consisted of only four skill acquisition targets. Each target was presented twice per session. Thus, each condition session for Tanner consisted of 12 trials, and sessions for Tyson and Dane consisted of 8 trials. Targets were taught using a progressive time delay to a prompt, starting at 0 s. The prompt delays were 0 s, 2 s, 5 s, 7 s, and 10 s. During sessions conducted at the 0-s time delay, a prompt was immediately provided following the instruction. All participants experienced only one session conducted at a 0-s prompt delay, as providing an immediate prompt does not allow for an opportunity to independently respond. The second session

for all participants was conducted at a 2-s delay. Prompt delays were increased (5 s, 7 s, 10 s) in subsequent sessions if at least 50% of unprompted incorrect responses were errors of omission. The efficacy evaluation for each participant was concluded after the participant had met mastery criteria in at least one of the conditions. To meet mastery criteria for a condition, the participant needed to demonstrate independent correct responding during a minimum of 60% of trials for two consecutive sessions of a condition.

Treatment Efficacy Evaluation

Baseline

During the baseline condition (BL), the experimenter presented the instruction (e.g., "You sleep in a _____") and allowed the participant 5 s to respond. No consequences were provided for correct or incorrect responding.

Top Preference Choice Condition

During the top preference choice condition (TP choice), the participant was provided with the opportunity to choose an edible reinforcer from their top three highest preferred reinforcers contingent on correct responding.

During this condition, the experimenter physically guided the participant to touch the relevant initial-link stimulus (i.e., colored placemat) and then presented the instruction (e.g., "You clap your ___"). An additional prompt (e.g., vocal, gestural, physical) was provided using the progressive prompt delay. The exact type of prompt used was dependent on the type of skill being targeted. For example, if the participant was expected to touch a card in an array, the experimenter first used a gestural prompt at the time delay, before moving to a more intrusive prompt such as a physical prompt, if

needed. After a correct response, the experimenter provided vocal praise (e.g., “That’s right!”) and then presented a plate containing an array of the participant’s top three highest-preferred edible items, from which the participant was allowed to select one. Any attempts to select more than one were blocked if they occurred. The experimenter delivered reinforcement (edibles and vocal praise) for both unprompted and prompted correct responses until the participant demonstrated two consecutive sessions with at least 50% unprompted correct responses. After that, the experimenter delivered reinforcement for unprompted correct responses, only. If the participant made an error, the experimenter prompted the participant to engage in the correct response (i.e., vocally modeled correct response or used hand-over-hand prompting to touch the correct card) before moving on to the next trial.

Varying-Level Preference Choice Condition

The varying-level preference choice condition (VP choice) was identical to the top preference choice condition, except contingent on correct responding, the participant was provided with vocal praise followed by the opportunity to choose their reinforcer from an array made up of one low-preferred item, one moderately preferred item, and one highly-preferred item.

No Choice

The no-choice condition (NC) was identical to the other two conditions, except that contingent on correct responses to a task, the participant was provided with an edible reinforcer, but they were not given the opportunity to choose from an array. Instead, the experimenter provided the participant with a plate containing only one edible item of the experimenter’s choosing. This choice in edible was yoked to the top preference condition.

That is, whatever item the participant chose in the previous top preference choice condition was the item provided in this condition. In the event that there were more reinforced trials in a no-choice condition session than in the previous session (due to discontinuation of reinforcement for prompted responses after the preset criterion), the experimenter repeated the delivery of items based on the sequence of item selections. During the no-choice condition, following correct responding, the experimenter provided vocal praise followed by the edible item like in the choice conditions.

Control

The control condition was conducted identical to baseline, except that the therapist presented the relevant initial-link stimuli (i.e., condition-specific colored placemat), and no edible reinforcers were delivered, regardless of correct responding.

Preference Evaluation

Following the treatment efficacy evaluation, a preference evaluation was conducted with each participant. This evaluation was conducted in a concurrent-chains arrangement embedded within an MSWO. A concurrent-chains arrangement involves a participant selecting an initial link (i.e., colored placemat) that results in access to a terminal link (i.e., an array of three HP edibles (TP choice condition), an array of one HP, one MP, and one LP edible item (VP choice condition), plate with one HP edible item (NC condition) or social praise (Control condition). Further, preference was evaluated using MSWO procedures similar to those conducted during the initial color preference assessment during the pre-assessment phase, for each participant. During this evaluation, the experimenter placed all four initial-link stimuli (i.e., colored placemats) in front of the participant with the corresponding terminal-link stimuli placed directly below each

placemat and instructed them to “pick one.” After the participant selected an initial link, the experimenter then provided the participant with the terminal-link (plate with a condition-specific array of edible items, from which they could choose one (TP and VP conditions), plate with one high preferred item (NC condition only), or praise alone, such as "nice job!" (control condition only)). After the participant experienced the terminal link that corresponded with the initial link, the experimenter removed that initial link from the array, rearranged the array, and re-presented the participant with the instruction to "pick one." This process was continued until all initial links had been selected. A minimum of three series of the assessment were conducted with each participant and the level of preference was calculated by averaging the percentages of preference from all series.

Results

Preference Assessments

Paired Stimulus Preference Assessment for Edibles

Results of the paired stimulus preference assessments (PSPA) for each participant are depicted in Figure 1. Two separate PSPAs for edibles were conducted with Tyson, due to unclear preferences demonstrated during the first PSPA. Preferred items used during the intervention were selected based on the results of the second PSPA conducted with Tyson. Highly preferred items for Tyson were identified to be pretzels, fruit snacks, and Ruffles chips. For Tyson, moderately preferred items were identified to be Fudge Stripe cookies, Gummy Bears, and Fruit Loops. Tyson’s low-preferred items were identified to be Chips Ahoy cookies and Goldfish crackers. Items were selected for use in each choice condition based on the level of preference Tyson had for the items. For the

TP choice condition, pretzels (82%), fruit snacks (82%), and Ruffles chips (73%) were selected. Next, items selected for use in the VP choice condition were Ruffles (73%), Fruit Loops (46%), and Chips Ahoy cookies (18%). Items used in the NC condition varied based on which item Tyson chose most often in the previous TP choice condition. The control condition did not involve any edible items.

Results of the PSPA for edibles for Tanner are depicted in the middle panel of Figure 1. Two PSPAs were also conducted for Tanner due to unclear demonstration of preference derived from the first PSPA. As with Tyson, the preferred items used during the intervention were selected based on the results of the second PSPA conducted with Tanner. Highly preferred items for Tanner were identified to be pretzels, Fruit Loops, and Skittles. For Tanner moderately preferred items were identified to be gummy bears, "Berry" Welch's fruit snacks, M&Ms, and Fudge Stripe cookies. Tanner's low-preferred items were identified to be Ruffles chips and Chips Ahoy cookies. Items were selected for use in each choice condition was based on the level of preference Tanner had for the items. For Tanner, Pretzels (90%), Skittles (82%), and Fruit Loops (82%) were selected for use in the TP choice condition and Skittles (82%), M&Ms (46%), and Chips Ahoy cookies (18%) were used in the VP choice condition. Items used in the NC condition varied based on which item Tanner chose most often in the previous TP choice condition but was most often Skittles. The control condition did not involve any edible items.

Results of the PSPA for edibles for Dane are depicted in the bottom panel of Figure 1. Highly preferred items for Dane were identified to be ginger cookies, Fruit Loops, crackers, and Ruffles chips. For Dane, moderately preferred items were identified to be Cheerios and Goldfish crackers. Dane’s low-preferred items were identified to be

Cheetos. Items were selected for use in each choice condition was based on the level of preference Dane had for the items. For Dane, ginger cookies (91%), Ruffles (82%), and Fruit Loops (82%) were selected for use in the TP choice condition, and ginger cookies (91%), Cheerios (64%), and Cheetos (9%) were used in the VP choice condition. Items used in the NC condition varied based on which item Dane chose most often in the previous TP choice condition but was most often ginger cookies. The control condition did not involve any edible items.

Multiple Stimulus Without Replacement (MSWO) Preference Assessment for Colors

Results of the color preference assessments for each participant are depicted in Figure 2. Results of the MSWO for colors for Tyson are depicted in the top panel. Tyson selected orange during 53% of trials, black during 53% of trials, purple during 53% of trials, and pink during 55% of trials. Thus, orange, black, purple, and pink placemats and colored shirts were used as condition-specific stimuli during the intervention and as initial-link stimuli during the preference assessment for Tyson. Tyson experienced orange during the TP choice condition, black during the VP choice condition, purple during the no-choice condition, and pink during the control condition. Pink was chosen to be used during the control condition because he had a slightly higher preference for that color, thus it was used in the control condition to control for potential bias effects.

Results of the MSWO for colors for Tanner are depicted in the middle panel of Figure 2. Tanner selected red during 45% of trials, pink during 43% of trials, yellow during 43% of trials, and green during 53% of trials. Red, pink, yellow, and green were used during the intervention for Tanner. Green was used during the control condition because he had a slightly higher preference for that color.

Finally, several trials of the MSWO for colors were conducted with Dane, but no clear preference was demonstrated. During each trial, Dane repeatedly selected more than one color in the array. For this reason, experimenters chose to conduct a PSPA for colors, instead. Results of these assessments were also inconclusive, as Dane engaged in the same behavior of selecting more than one color during each trial and tacting the colors by name. For example, if the two colors purple and black were presented in a pair, Dane would touch both colors and vocally state "purple…black." Experimenters continued to attempt to conduct a PSPA for colors for Dane, but after several attempts at doing so, anecdotally, the procedures appeared to become aversive to him. He stopped touching any of the colors and instead, began physically pushing the experimenter's arms away when they attempted to present pairs. For this reason, experimenters chose to discontinue the preference assessments for colors. It was hypothesized that he may not have any differential preferences for specific colors. As a result, the experimenters arbitrarily chose the colors to be used in the conditions for Dane. Dane experienced red during the TP choice condition, blue during the VP choice condition, yellow during the no-choice condition, and green during the control condition.

Treatment Efficacy Evaluation

Results of the treatment efficacy evaluation are depicted in Figure 3. During baseline, all three participants engaged in zero rates of independent responding during all four conditions. One exception to this was session nine for Tyson. During this session, Tyson repeatedly chose the same card for seven of the eight trials during the session, inevitably resulting in one correct response for that session. Treatment efficacy

evaluation sessions began on sessions 12, 16, and 28 for Tyson, Tanner, and Dane, respectively.

Tyson

Results of the efficacy evaluation for Tyson are depicted in the top panel of Figure 3. As previously stated, during baseline, Tyson demonstrated zero rates of independent responding during all sessions and across all four conditions, with the exception of one session during which he selected the same card repeatedly, resulting in one independent correct response. At the beginning of the efficacy evaluation, Tyson quickly began demonstrating steady increases in independent responding across all conditions, including the control condition. However, his responding was variable across all conditions. During session 30, Tyson responded independently to 37.5% of trials, and this rate of responding remained stable for two subsequent VP choice sessions and then increased to 50% during session 46. After this session, Tyson's responding in the VP choice condition decreased once again to lower rates of independent responding in the VP choice condition but instead began to increase in the TP choice condition. Tyson met mastery criteria in the TP choice condition during sessions 58 and 61 where he demonstrated independent responding during 75% and 62.5% of trials, respectively. Results of the efficacy evaluation for Tyson suggest that the opportunity to choose his reinforcer may be more effective, but it is unclear due to elevated rates of responding across all conditions.

Tanner

Results of the efficacy evaluation for Tanner are depicted in the middle panel of Figure 3. During the beginning of the efficacy evaluation, Tanner demonstrated low rates

of responding across all four conditions. However, his rate of responding increased at a stable rate in the TP choice condition between sessions 25 and 41. Differential reinforcement procedures were implemented in the TP choice condition starting at session 45, following Tanner's demonstration of independent correct responding during 50% of trials for two consecutive sessions of the TP choice condition. During the first session involving the implementation of differential reinforcement procedures, Tanner demonstrated an immediate reduction in independent responding from 50% in the previous session, down to 16% during session 49. However, during the next session conducted using differential reinforcement procedures, Tanner's responding returned to 50% independent correct responding. Tanner's responding remained variable for several of the following sessions and across all conditions but began to stabilize in the VP choice condition during sessions 70 and 74 when Tanner demonstrated independent responding during 50% of trials. At this time differential reinforcement procedures were implemented during all subsequent VP choice condition sessions. Tanner's responding remained stable at 50% in the VP choice condition for five subsequent sessions. Ultimately, although his rates of responding were highly variable, Tanner met mastery criteria in the TP choice condition during sessions 93 and 97 after demonstrating independent responding during 75% of trials during both of those sessions. Results of the efficacy evaluation for Tanner suggest that the opportunity to choose his reinforcer was effective, due to higher rates of independent responding during both choice conditions (TP and VP) compared to the no choice and control conditions.

Dane

Results of the efficacy evaluation for Dane are depicted in the bottom panel of Figure 3. Efficacy evaluation sessions for Dane began during session 25 and were continued until session 84. Throughout the efficacy evaluation, Dane demonstrated variable rates of independent responding across all conditions. Unfortunately, Dane demonstrated low rates of attending to trials, thus resulting in low rates of independent responding. To alleviate this issue, modifications such as the addition of a tacting procedure (i.e., requiring him to label the picture on each card in the array before each trial) starting after session 61 and requiring him to pick up the target card and place it in the experimenter's hand instead of pointing to the card in the array, which was introduced during session 73. Unfortunately, none of the modifications resulted in higher rates of attending or independent responding, and because attending was not one of the primary goals of the current study and due to time constraints, the experimenters choose to terminate the efficacy evaluation for him.

Preference Evaluation

Results of the preference evaluation are depicted in Figure 4. The efficacy evaluation was concluded for Tyson, Tanner, and Dane following sessions 61, 97, and 84, respectively. Following the efficacy evaluation, all participants experienced the preference evaluation, during which they were given the opportunity to select the condition they most preferred within an MSWO format. The preference evaluation aimed to assess whether the condition under which the participant acquired skills the fastest, was also their most preferred.

Tyson

Results of the preference evaluation for Tyson are depicted in the first panel of Figure 4. For Tyson, five series of an MSWO preference evaluation were conducted. Results of the evaluation suggest that Tyson has moderate and similar levels of preference for all conditions. However, his most preferred was the control condition, which he selected during 62% of opportunities. Tyson's second most preferred condition was the VP choice condition, which he selected during 52% of opportunities. Levels of preference for the no-choice and TP choice conditions were very similar and were selected during 48% and 47% of opportunities, respectively. The results of the preference evaluation for Tyson suggest that while he acquired skills at the highest rate in the TP choice condition during the efficacy evaluation, the TP choice condition was not his highest preferred.

Tanner

Results of the preference evaluation for Tanner are depicted in the second panel of Figure 4. For Tanner, three series of the MSWO preference evaluation were conducted. . He demonstrated the highest preference for the TP choice condition, which he selected during 83% of opportunities, followed by the VP choice condition which he selected during 61% of opportunities, further followed by the NC condition which he selected during 39% of opportunities. Finally, Tanner's lowest preferred condition was demonstrated to be the control condition. Results of the preference evaluation for Tanner suggest that he prefers the opportunity to choose his reinforcement from an array of his highest preferred edibles, but overall, he prefers the opportunity to choose his reinforcer in general, regardless of the level of preference he has for the items. Results of the

preference evaluation for Tanner suggest that skill acquisition rates may have been increased in the TP choice condition, as it was also his most preferred condition.

Dane

Results of the preference evaluation for Dane are depicted in the third panel of Figure 4. For Dane, five series of the MSWO preference evaluation were conducted. Dane demonstrated clear, differential preferences across conditions. He demonstrated the highest preference for the TP choice condition, which he selected during 75% of opportunities, followed by the control condition which he selected during 56% of opportunities, further followed by the NC condition which he selected during 42% of opportunities. Finally, Dane's lowest preferred condition was demonstrated to be the VP choice condition. Results of the preference evaluation for Dane suggest that he prefers the opportunity to choose his reinforcement from an array of his highest preferred edibles and that the array from which he can choose impacts his level of preference for the opportunity to choose. Although the efficacy evaluation was not able to be completed with Dane, based on the current results of the efficacy evaluation for him, there does not appear to be a correspondence between his preference for a condition and an increased rate of skill acquisition within that condition.

Discussion

Results of the current study were consistent with those of Toussaint et al. (2016) for two participants. That is, skill acquisition occurred more rapidly when the opportunity to choose their reinforcer was provided. Both participants acquired skills faster in the top preference choice and varying-level preference conditions relative to the no choice and control conditions. Further, results of the preference evaluation suggest that participants

preferred conditions that allowed them an opportunity to choose their reinforcement rather than conditions where they were not given the opportunity to choose, regardless of the level of preference the participant had for the items available in the array to choose from. In conjunction, these findings support previous research suggesting that providing children with the opportunity to choose their reinforcer may be effective at increasing skill acquisition rates in children with ASD.

While the results of the current study were consistent with those of Toussaint et al. (2016), these results were demonstrated for only two of the three participants. It is important to note variables that may have impacted these findings. For instance, the age of the individuals for whom the intervention was effective. Providing choice effectively increased skill acquisition rates for both Tyson and Tanner. Both Tyson and Tanner were within the same age range as the participants evaluated by Toussaint et al. (2016). Dane, however, was much older than Tyson, Tanner, or any of the participants evaluated by Toussaint et al. (2016) and choice did not effectively increase skill acquisition for him. This is important to note, as these results suggest that age may play a role in the effectiveness of choice as an intervention for skill acquisition. While very little research has evaluated the use of choice during skill acquisition for older children and teenagers, even less research has evaluated the effects of choice within adults. Future research should evaluate the potential effects of age on the effectiveness of choice, by evaluating choice among individuals of different age ranges such as teenagers and adults.

It is important to provide children with opportunities to choose. Previous research has shown that choice can be used to decrease challenging behaviors and increase appropriate behaviors (Hanley et al., 1997; Hanley et al., 2005) such as compliance and

task completion (e.g., DeLeon et al., 2001; Tiger et al., 2010). Further, research has shown that providing choice can increase motivation to engage in tasks (e.g., Elliott & Dillenburger, 2016) resulting in stronger maintenance of skills and have shown that providing choice-making opportunities can increase the frequency of academic responding (e.g., Tiger et al., 2010) and increased rates of skill acquisition (e.g., Northgrave et al., 2019; Toussaint et al., 2016). Finally, and most importantly, providing choice allows children to express their autonomy, make their own choices, and take control in some areas of their life. Often for children with ASD, autonomy can be limited due to skill deficits and other barriers. Choice is an easy way to promote independence for children and adults alike, and thus should be explored when possible.

The results of the current study add to the literature on the effects and preference of choice in individuals with ASD. Specifically, the current study sought to evaluate whether providing a choice between items of varying levels of preference could be as reinforcing as providing a choice across only high-preferred items. Results of the current study suggest that both options are reinforcing and can improve skill acquisition. These results have important implications not only in terms of the feasibility of the procedures but also the generality of the procedures to other settings and implementers such as caregivers and teachers within a school setting. First, current results suggest that for some children, providing choices between preferred items may be effective at increasing skill acquisition rates, regardless of the level of preference the child has for items within the array from which they can choose. This is important to note, as it may not always be possible for teachers and caregivers to have high-preferred items on hand during all skill acquisition scenarios, thus halting a child's progress or resulting in a potential decrease in

skill acquisition during those times. Results of the current study suggest that providing choice during these times may be a simple way to alleviate this issue, as providing high-preferred items may not be necessary for choice to be effective. Second, because procedures involved in providing choice are very simple, they can be easily taught and implemented by clinicians, teachers, and caregivers alike. The simplicity of providing choice not only increases the generality of procedures but also greatly increases the feasibility of accurate and effective implementation of procedures aimed at increasing skill acquisition.

A few limitations should be noted within the current study. First, the number of targets taught within each of the conditions was not consistent across participants. For Tanner, all conditions consisted of six targets. However, due to time constraints, each condition consisted of only four targets for Tyson and Dane. Different results may have been achieved had all participants experienced the same number of targets. Future research should evaluate these potential effects by holding the number of target skills constant across participants.

Second, at the beginning of the treatment efficacy evaluation for Dane, a mistake was made regarding the order of conditions. For the first two series of the multielement design, the varying-level preference condition was not conducted. As such, Dane was only exposed to the TP choice condition, no-choice condition, and the control condition. After the mistake had been identified, two consecutive varying-level preference choice conditions were conducted during sessions 35 and 36, before returning to the correct order of conditions during the third series of the multielement design, beginning at session 37. Although the data do not depict this potential consequence, Dane's exposure

to the other conditions in an incorrect order could have affected his rates of responding across conditions. Future researchers should take note of this mistake and ensure that the order of conditions remains consistent across phases.

Third, the efficacy evaluation for Dane was terminated after session 84 even though he never met mastery criteria in any of the conditions due to a lack of attending. However, several modifications were implemented to increase his attending. These modifications included implementation of a tacting procedure (i.e., requiring him to label the picture on each card in the array before each trial) and requiring Dane to pick up the target card and place it in the experimenter's hand instead of pointing to the card in the array. Unfortunately, neither of the modifications resulted in higher rates of attending or independent responding, and because attending was not one of the primary aims of the current study and due to time constraints, the experimenters choose to terminate the efficacy evaluation for him. Future researchers should take this issue into consideration and ensure that all participants have the prerequisite skill of attending. Further, future researchers should ensure that participants do not engage in problematic behaviors that may decrease their attending to work tasks and if they do, that these problematic behaviors are addressed and reduced before beginning implementation of the current procedures.

In summary, the results of the current study replicate and extend Toussaint et al. (2016), suggesting that providing choice-making opportunities as a consequence can effectively increase skill acquisition rates in children with ASD. In addition, the opportunity to choose from an array with only high preferred items and an array with a

variety of preferred items are both reinforcing. Future researchers should continue to evaluate the effects of choice with individuals with ASD.

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Table 1

Targets by Condition, Initial-Link Colors, and Condition-Specific Consequuences by Participant

Participant	Condition	Targets	Initial-Link Color	Terminal-Link
Tyson	Top Preference Choice	1. Meow says a (cat) 2. You wear a (shirt) 3. You drive a (car) 4. You write with a (pencil)	Orange	Array of 3 HP edibles (choose 1)
	Varying-Level Preference Choice	1. You dig with a (shovel) 2. You color with (crayons) 3. You ride a (bike) 4. You swim in a (pool)	Black	Array of 1 HP, 1 MP, 1 LP edible (choose 1)
	No Choice	1. You talk on the (phone) 2. You cut with (scissors) 3. You put food on a (plate) 4. You get clean in the (bathtub)	Purple	1 HP edible item (yoked to TP choice condition) presented by experimenter
	Control	1. You drink from a (cup) 2. You read a (book) 3. You watch the (TV) 4. You eat (chips)	Pink	Praise
Tanner	Top Preference Choice	1. You live in a (house) 2. Red, white, and (blue) 3. You taste with your (tongue) 4. You throw a (ball) 5. You swim in a (pool) 6. Socks and (shoes)	Red	Array of 3 HP edibles (choose 1)
	Varying-Level Preference Choice	1. You sit in a (chair) 2. Ice is (cold) 3. You see with your (eyes) 4. You write with a (pencil) 5. Bananas are (yellow) 6. Grass is (green)	Pink	Array of 1 HP, 1 MP, 1 LP edible (choose 1)
	No Choice	1. Fire is (hot) 2. You hear with your (ears) 3. Strawberries are (red) 4. Peanut butter and (jelly) 5. You sleep in a (bed) 6. You clap your (hands)	Yellow	1 HP edible item (yoked to TP choice condition) presented by experimenter
	Control	1. Snow is (white) 2. You smell with your (nose) 3. Macaroni and (cheese) 4. You color with (crayons) 5. The sky is (blue) 6. You play hide and (seek)	Green	Praise
Dane	Top Preference Choice	1. You live in a (house) 2. You wear a (shirt) 3. You drive a (car) 4. You write with a (pencil)	Red	Array of 3 HP edibles (choose 1)
	Varying-Level Preference Choice	1. You dig with a (shovel) 2. You color with (crayons) 3. You ride a (bike) 4. You wash your hands with (soap)	Blue	Array of 1 HP, 1 MP, 1 LP edible (choose 1)
	No Choice	1. Buzz buzz says a (bee) 2. You talk on the (phone) 3. You eat with a (spoon) 4. You cut with (scissors)	Yellow	1 HP edible item (yoked to TP choice condition) presented by experimenter
	Control	1. Choo choo goes a (train) 2. You read a (book) 3. You sit in a (chair) 4. You watch the (TV)	Green	Praise

Table 1. Target skills for each participant, separated by condition and initial- and terminal-links by condition.

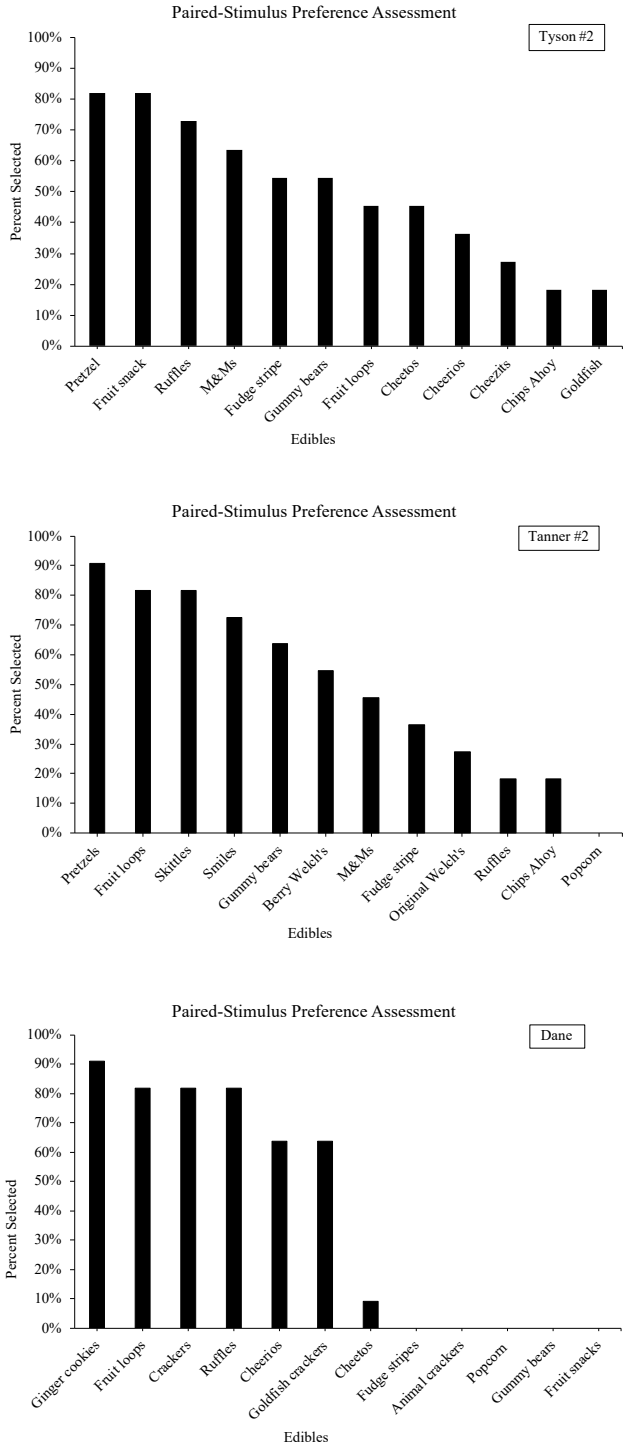

Figure 1. Results of the paired stimulus preference assessments for Tyson (top panel), Tanner (middle panel), and Dane (bottom panel). Black bars denote the relative percentage of selections the participants made for each edible item.

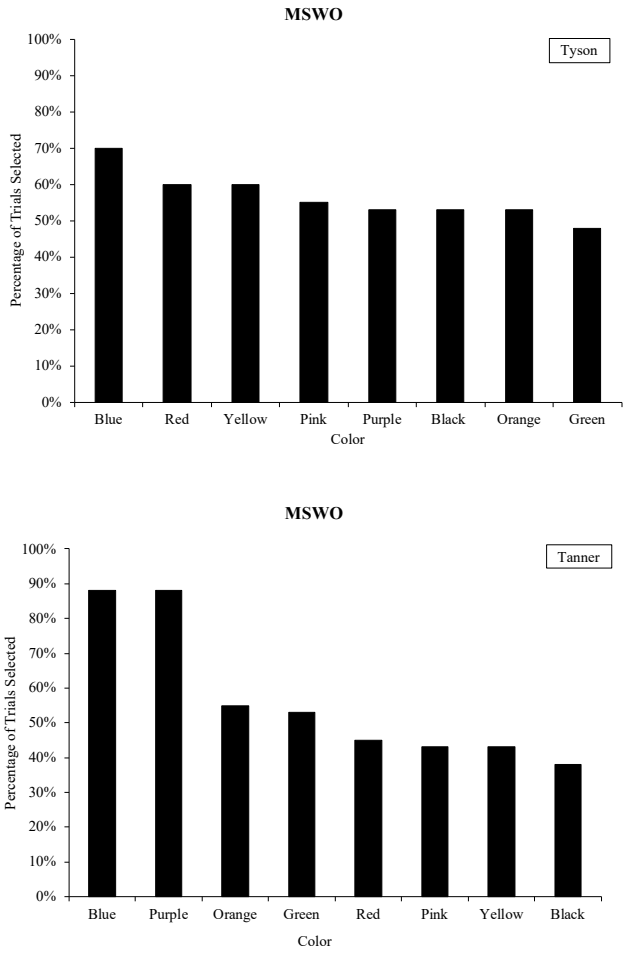

Figure 2. Results of the MSWO preference assessments for color for Tyson (top panel), Tanner (middle panel), and Dane (bottom panel). Black bars denote the relative percentage of preference the participants expressed for each color.

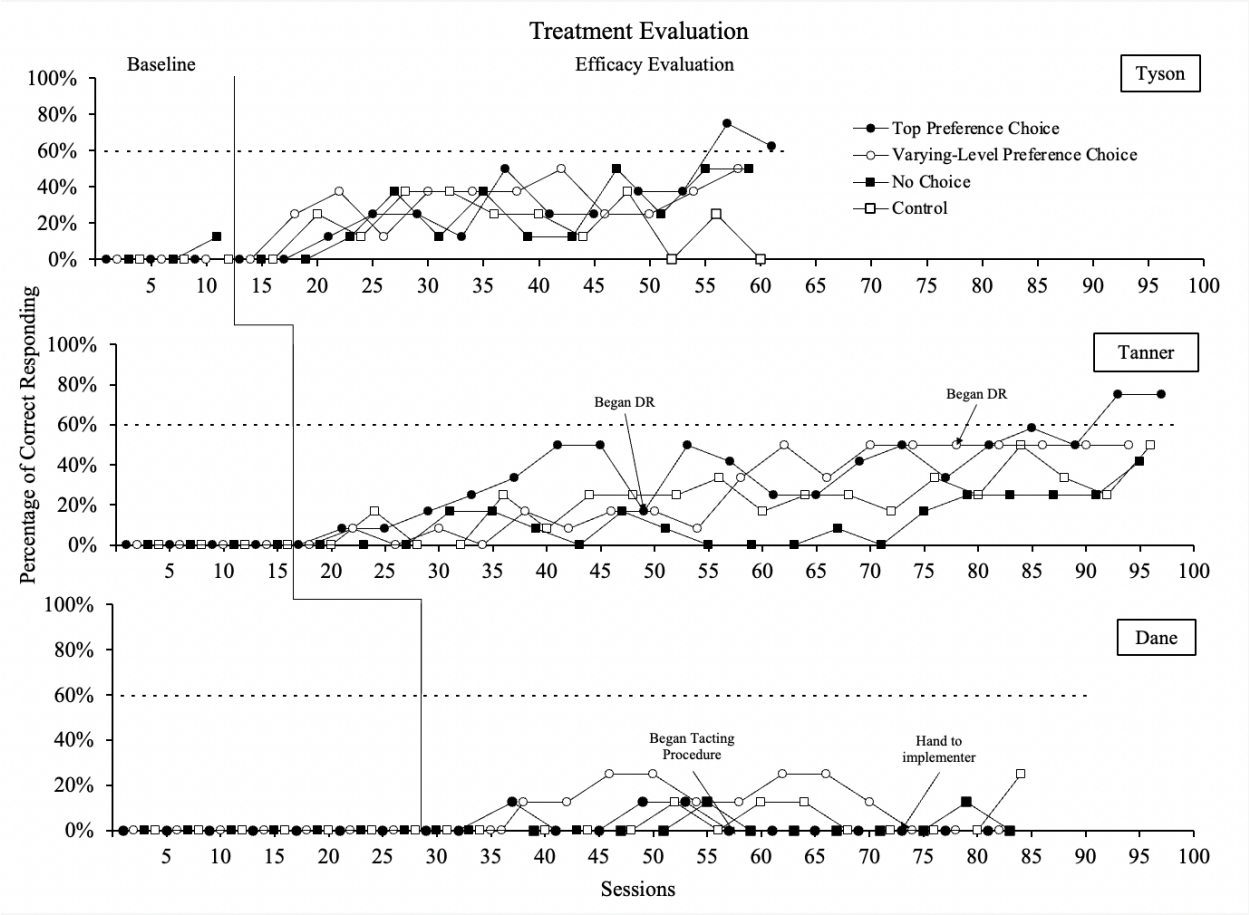

Figure 3. The percentage of correct responses during baseline (first phase) and instructional conditions (second phase) for Tyson (first panel), Tanner (second panel), and Dane (bottom panel) during the efficacy evaluation. The dashed line represents the mastery criterion.

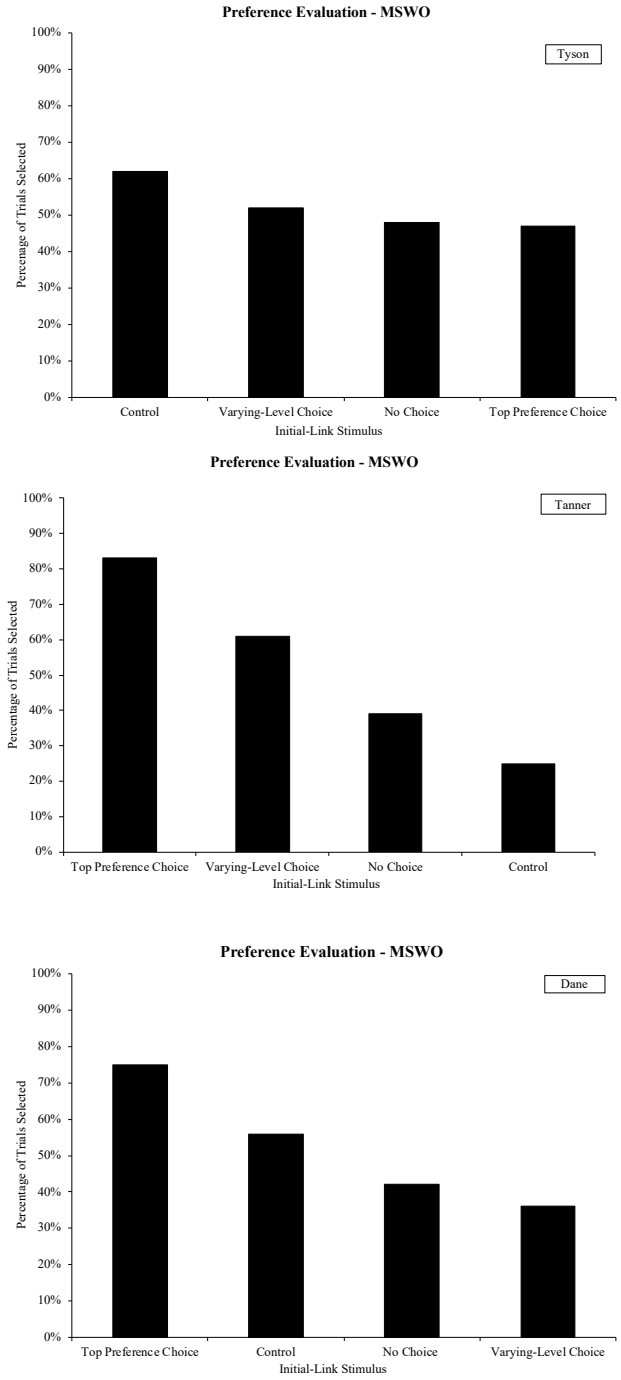

Figure 4. Results of the preference evaluation for Tyson (top panel). Tanner (middle panel), and Dane (bottom panel). Black bars denote the relative percentage of preference the participants expressed for each condition.