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Evaluation of a Vocal Mand Assessment and Vocal Mand Training Procedures: A Systematic Replication

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Abstract

Numerous mand training procedures have proven effective in developing mand repertoires in children with developmental disabilities, but selection of treatments is usually arbitrary. Bourret et al. (2004) created and tested a vocal mand assessment to systematically determine an effective mand training procedure, thereby reducing the likelihood of implementing ineffective treatments. However, because a comparison between treatments was not completed, the validity of the assessment requires further investigation. This study sought to replicate and extend the findings of Bourret et al. (2004) by including a comparison between two treatments. Study 1 consisted of a replication of the vocal mand assessment and Study 2 consisted of a comparison of two vocal mand procedures, one suggested from the assessment (shaping) and one arbitrarily selected procedure from the original study (prompting and reinforcement). The participant emitted mands more reliably when the mand training procedure suggested by the assessment (Study 1) was implemented, compared to the randomly selected treatment.

Keywords: assessment, mand training, prompting, reinforcement, shaping, verbal behavior

Evaluation of a Vocal Mand Assessment and Vocal Mand Training Procedures: A Systematic Replication

The functional analysis (FA) methodology is the gold standard to determine the function of maladaptive behaviors (Iwata et al., 1982/1994) and within the last few years, researchers have applied this methodology to determine the function of verbal behavior (e.g., mand, tact, intraverbal, echoic; Kelley et al., 2007; LaFrance et al., 2009; Lerman et al., 2005; Normand et al., 2011; Plavnick & Normand, 2013). Knowing the function can identify deficits in other verbal operants, but additional assessments are necessary to identify an effective intervention. For example, if the function of all responses for one participant was tacting (labeling), then treatment should focus on increasing a different operant, such as manding (requesting). Many effective mand training procedures (such as manipulating motivating operations, manipulating schedules of reinforcement, prompting, and shaping) have been determined, but an analysis for determining how to increase mands has not been identified, which leaves a margin for error in selecting one (Bourret et al., 2004; Chambers & Rehfeldt, 2003; Drash et al., 1999; Kodak & Clements, 2009; Plavnick &Vitale, 2016; Seaver & Bourret, 2020; Shafer, 1995; Thomas et al., 2010; Valentino et al., 2019; Wallace, 2007).

Manipulating Motivating Operations

Shafer (1995) and Wallace (20070 conducted literature reviews of procedures to increase mand repertoires and found manipulating establishing operations to be the most effective procedure. Recommendations were made to “capture and contrive” establishing operations (EOs) by arranging the everyday environment and employing incidental teaching and choice making as a treatment package. Drash et al. (1999) conducted mand training to increase echoic and tacting repertoires. Mand training consisted of manipulating EOs and shaping vocalizations. EOs were

manipulated by using preferred items (identified via caregiver interviews) and withholding food for 1-2 hours prior to the start of sessions. In addition, the items used varied throughout sessions to prevent satiation. Seaver and Bourret (2020) manipulated EOs to increase mands in a concurrent environment by withholding items prior to the session, except they implemented denied access for 23 hours before. Mand repertoires of all participants in all abovementioned studies increased.

Manipulating Schedules of Reinforcement

Seaver and Bourret (2020) compared the effects of two schedules of reinforcement for target and non-target mands. Target mands were reinforced on a fixed-ratio (FR) 1 schedule of reinforcement and non-target mands were reinforced on a random-interval (RI) 30-s schedule of reinforcement or extinction. Three participants target mands increased when placed on a FR 1 schedule of reinforcement. One participant required manipulating the schedule of reinforcement after manipulating prompting to increase her mand repertoire.

Prompting

Plavnick and Normand (2013) compared in-vivo and video-based mand training procedures to determine which would be more effective to increase mand repertoires in four participants. A vocal prompt was delivered in the in-vivo method and a visual prompt was delivered in the video-based method. A progressive time delay was used to fade prompts in both conditions. All participants increased their mand repertoires in both conditions, but they emitted them at a faster rate in the video-based condition. Seaver and Bourret (2020) also manipulated prompts for target and non-target mands to increase mands in a concurrent environment. They provided non-specific prompts at the start of the trial and full model prompts after the participants consumed the reinforcer and after 30 s elapsed without a mand. Independent and

prompted mands resulted in access to the item for 30 s. Four participants increased their mand repertoires after prompts were delivered. Valentino et al. (2019) created and tested a prerequisite assessment to identify the most effective mand modality (sign language, picture exchange communication system, or vocal) to teach mands. They implemented least-to-most prompting across all modalities but because vocal mands could not be physically prompted, the least-to-most hierarchy consisted of a partial verbal prompt and a full verbal prompt. All 13 participants increased mand repertoires in sign language and PECS but only 1 in vocal.

Shaping

As briefly discussed above, Drash et al. (1999) conducted mand training to increase echoic and tacting repertoires by shaping vocalizations. The experimenter began the session by asking what the participant wanted then reinforced any vocalization that was not a scream or a cry. As sessions progressed, more acceptable verbal responses (successive approximations) were reinforced and inappropriate responses decreased. Thomas et al. (2010) shaped vocal mands in children with Autism Spectrum Disorder across four phases. The progression of phases was pointing, making eye contact, oral motor movement, then vocal utterances. All participants increased vocal mand repertoires and decreased immature mands.

In the abovementioned studies, the mand repertoires of all participants increased across all training procedures but the authors did not report how the mand training procedures were selected. In addition, the authors often reported the results were idiosyncratic across participants and other variations may have been more effective or efficient. Selection of the most effective procedure is crucial to the success of mand training. For example, as mentioned, Valentino et al. (2019) arbitrarily selected least-to-most prompting to teach mands across all modalities. Because vocal behavior cannot be physically prompted, this prompting method may have limited the

acquisition of vocal mand repertoires. Reducing the response effort and reinforcing successive approximations via shaping could have been more effective to teach vocal mands.

A systematic approach to determine the most effective and efficient treatment is necessary. An assessment for effective mand training procedures could eliminate variability caused by arbitrarily selected treatments, could narrow treatment options for practitioners (a clinical benefit), and could facilitate replication (a scientific benefit). Bourret et al. (2004) created and tested an assessment to determine what level of prompting was necessary to elicit mands with three participants and identify idiosyncratic treatment options. They then tested if the intervention indicated from the assessment was effective and efficient to teach mands. Although they demonstrated the treatment was effective, they did not demonstrate the relative effectiveness of an arbitrarily selected treatment. Seaver and Bourret (2014) implemented a similar assessment for teaching behavior chains then compared the most efficient and least efficient treatments, which alleviated this limitation.

The purpose of this study, then, is to replicate and extend the findings of Bourret et al. (2004) by adding a comparison between treatments similar to the comparison made by Seaver and Bourret (2014). Because the assessment is a flowchart of sequential steps rather than a comparison, the treatments are not ranked by most- to- least effective. Therefore, the treatment indicated from the assessment results (Study 1) were compared to an arbitrary, but common, mand training procedure (Study 2). As recommended in all previous studies, the motivating operation was manipulated by using preferred items (identified via preference assessments) and limiting access to those items outside of sessions.

General Method

Subject and Setting

Kayla, a 3-year-old diagnosed with Autism Spectrum Disorder and language delays, participated in this study. She started applied behavior analysis (ABA) therapy two months prior to the start of the study and scored at Level 1 on the Verbal Behavior Milestones Assessment and Placement Program (VB-MAPP; Sundberg, 2008). She expressed wants and needs primarily through gestures, leading, and maladaptive behaviors including aggressing, dropping, eloping, and screaming. She emitted some independent vocal verbal behavior, but it was not well understood by caregivers and peers. Because manding was a high priority treatment goal, she was included in this study.

All sessions were conducted in a quiet room at the participant's school. A table, chairs, and the targeted items were present; all other leisure items were unavailable and out of sight. Sessions were conducted one to five times per day, three to five days per week. Each session in Study 1 and sessions 1-9 in Study 2 consisted of ten 1-min trials and the remainder of sessions in Study 2 consisted of five 1-min trials. At least 10 min elapsed between sessions and access to targeted items were restricted. Other leisure items were provided during breaks.

Measurement

Sessions were video recorded when possible and data was collected on paper by the experimenter during sessions. The primary dependent variable was a correct response. In Study 1, a correct response was defined as a clear (i.e., well enunciated and understandable) utterance of the target mand before or within 10 s of the prompt. In Study 2, a correct response was defined as a full, clear utterance of the required target sound in each phase (shaping) and a full, clear utterance of the target mand in each trial (prompting and reinforcement). For each study, an

independent and a prompted response were considered correct responses since the goal was to teach the target utterance, not fade the prompt. For all of Study 1 and for the prompting and reinforcement condition in Study 2, each trial was broken down into six 10-s segments on the data sheet. The experimenter recorded if full or partial utterances occurred at any point during each 10-s block. A full utterance was emission of the entire target word with all sounds enunciated and a partial utterance was emission of any part of the word (i.e., "bub" instead of "bubble"). For shaping in Study 2, the experimenter recorded if independent (i.e., prior to the prompt) or prompted (i.e., following the prompt) target sounds occurred at any point during each 1-min trial.

Additional observers collected data in person and from the video recordings on 37% of sessions. Treatment integrity data were collected on prompt level used and if reinforcement was provided appropriately based on the response using a checklist. Interobserver agreement (IOA) was calculated for all four measures (partial utterance, full utterance, reinforcer delivery, and prompt delivery). This was calculated by dividing the total number of intervals with agreement by the total number of intervals and converting to a percentage. IOA was 98% agreement for Study 1 and 99% for Study 2. Treatment integrity data are still being collected.

Preference Assessment

Instead of conducting a free-operant preference assessment, as performed by Bourret et al. (2004), a multiple-stimulus-without-replacement (MSWO; DeLeon & Iwata, 1996) preference assessment was used. Two preference assessments were conducted; one before the assessment and one before treatment. Six preferred leisure items and six preferred edible items, determined via the Reinforcer Assessment for Individuals with Severe Disability (RAISD; Fisher et al., 1996), were used during each category-specific MSWO. As suggested by DeLeon et al. (1997),

the MSWO before the assessment contained only edible items and the MSWO before treatment contained only leisure items. The experimenter placed the six items in an array on the table and told the participant to pick one. The participant was allowed 30 s to consume the edible or have access to the selected leisure item; all other items were removed. The selected item was removed from the array and the remaining items were presented in the same order, but the last item on the participant's left was moved to the far-right side of the array. This process continued until all items were selected. The MSWO was conducted until a clear preference was apparent (five trials for Study 1 and six trials for Study 2). Kayla tacted one of the items during the second MSWO, so that item was removed and replaced with a new item.

Study 1: Vocal Mand Assessment

Procedure

The MSWO preference assessment results are considered baseline measures of independent mand responses but are not included in the graphed results. If the participant tacted or manded for an item in the preference assessment it was removed from the study. It is important to note they were never asked to name the items so it is possible the participant could emit the full utterance prior to training. Goldfish, the highest preferred item, was used as the target mand.

The assessment procedure was identical to that explained by Bourret et al. (2004). One session consisted of 10 trials. Each trial was 1 min in duration and the goldfish were visible. If the participant reached for goldfish without vocally manding, the item was blocked. If she manded for goldfish within 10 s, she would have been given free access to the reinforcer for the remainder of the trial. She did not mand within 10 s, so a nonspecific prompt (i.e., "If you want this, you can ask for it") was delivered 10 s into the trial. If she manded for goldfish after that

prompt, she would have had access to the reinforcer for the remainder of the trial. She did not mand within 10 s, so a model of the entire target word (i.e., “If you want this, say goldfish”) was delivered 10 s later (20 s into the trial). If she repeated the model, she would have had access to the reinforcer for the remainder of the session. She attempted to say goldfish but it was not clear, so a model prompt of the first phoneme of the target word (i.e., “If you want this, say guh”) was delivered 10 s later (30 s into the trial). If the participant repeated the first phoneme, she had access to the reinforcer for the remainder of the trial. If the participant did not respond, no other prompts were delivered, and a new trial started at the end of the 60 s. If she emitted a full utterance or repeated the first phoneme prompt within the last 30 s of the trial, she would have had access to the reinforcer for the remainder of the trial. It is important to note that the participant only received reinforcement for a partial utterance after the first phoneme prompt but data on any partial utterances emitted before that was collected. A visual timer was used to notify the experimenter when to deliver each prompt.

Bourret et al. (2004) created a flowchart to depict the steps involved in the assessment. Because this is a direct replication, it is included here for clarity (see Figure 1).

Results and Discussion

Figure 2 displays the results from the first MSWO using edible items. Goldfish was the most preferred item so that was used as the target mand during the study. Figure 3 displays the results from Study 1 for Kayla. She did not emit a clear, full utterance independently, after the nonspecific prompt, or after the whole model prompt in any of the sessions. However, she did emit a partial utterance after the first phoneme prompt consistently across sessions, which suggested shaping would be an effective treatment (to be examined in Study 2).

Kayla emitted “guh” before the first phoneme prompt by the second session and attempted a full utterance within 10 s in the seventh trial of Session 3. It is assumed Kayla attempted a full utterance based on the immediacy in which she imitated the intonation following the full model prompt, but her intention cannot be determined. She imitated the intonation after the full model prompt in 91% of trials but none of the attempted utterances were clear. If her speech was well understood, prompting and reinforcement would have been suggested as the most effective treatment.

It is important to note Session 3 consisted of only 7 trials instead of 10 due to medical complications with the participant but the data were included.

Study 2: Treatment

Experimental Design and Mand Training Procedures

Based on assessment results from Study 1, the suggested treatment (shaping) was used to teach one mand and a second treatment (prompting and reinforcement) was used to teach a second mand in a multiple schedule. The target mands were the highest preferred item (“pin board”) and a moderately preferred item (“bubble machine”) as determined by the MSWO. Bubble machine was assigned to the shaping mand training condition and pin board was assigned to the prompting and reinforcement mand training condition. Kayla had exposure to the word “bubble” in speech therapy, therefore the target mand for the shaping condition was “machine”.

Shaping

The shaping procedure was similar to the one used by Bourret et al. (2004) with some specific differences, such as the elimination of stimulus fading. Instead, the current procedure included eight different phases, in which one prompt was delivered 10 s after the start of the trial; no other prompts were delivered. Phase 1 was one session using a nonspecific prompt and Phase

2 was one session using a full model prompt of the target word. These were included to replicate the mand assessment results with the new target mand and are considered baseline measures. Phase 3 included a model prompt for the first phoneme (e.g., “If you want this, say mmm”), Phase 4 included a model prompt for the first two phonemes (e.g., “If you want this, say muh”), Phase 5 included a model prompt for the first three phonemes (e.g., “If you want this, say mush”), and so on until the whole word “machine” was required. The final phase will include a nonspecific prompt (i.e., “If you want this, you can ask for it”) to determine if the acquired mand could be emitted independently (i.e., without a model prompt). The participant progressed through subsequent phases when three consecutive sessions were at or above 80% of trials with responses. To ensure the participant did not learn the full target word through exposure alone, a control probe was conducted prior to the start of Phase 4, Phase 5, and Phase 6. The probe was a 1-min trial in which the experimenter delivered the full model prompt (e.g., “If you want this, say “machine”) 10 s after the start of the trial. Reinforcement would have been delivered if she emitted the full word during the probe and the final phase would have been implemented, but Kayla never did so.

Prompting and Reinforcement

The procedure for prompting and reinforcement was identical to the assessment procedure from Study 1, minus the first phoneme prompt. A nonspecific prompt was provided 10 s after the start of the trial then a full model prompt 10 s later. Reinforcement would have been provided if the participant emitted the target mand before or after the prompt was delivered, but Kayla never did so.

Results and Discussion

Figure 4 displays the results from the second MSWO using leisure items. The pin board was the most preferred item and the bubble machine was the second most preferred. As mentioned earlier, the item Kayla tacted was removed from the array, so it is not included in the graphed results.

Figure 5 displays the results from Study 2 for Kayla. The target word used in the shaping condition was “machine” and the target word used in the prompting and reinforcement condition was “pin board.” During the shaping condition, results from Study 1 were replicated in that the participant could not emit the target mand in Phase 1 or Phase 2 (non-specific and full model prompts). The target sound for Phase 3 was “mmm” and she emitted it at least 90% of trials in the first three sessions. During the first control probe, she was not able to repeat the full target word. The target sound for Phase 4 was “muh” and she emitted it during 40% and 60% of trials in the first two sessions. She will progress through the remainder of Phase 4 until mastery criteria has been met, then she will progress through all subsequent phases. During the probe trial and the first two trials of Phase 4, she independently emitted “mmm”, which was reliably reinforced in previous sessions.

During the prompting and reinforcement condition, a full utterance did not occur for the target mand in any sessions. She attempted to imitate the model 64% of trials, compared to 91% in Study 1. In the first two sessions, she said “guh”, which was reliably reinforced during Study 1 then began saying “mmm” after exposure to Phase 3 in the shaping condition. Other responses, such as “yes!” and “give me” when provided the nonspecific prompt, decreased to near zero levels and maladaptive behaviors including crying, verbal refusal, aggression, and elopement increased as sessions progressed. To reduce these effects and increase engagement, sessions were reduced from 10 to 5 trials in both treatment conditions in Session 9.

General Discussion

This study sought to replicate and extend the findings of Bourret et al. (2004). Small changes were made to the procedures, such as using an MSWO instead of a free-operant preference assessment, but these decisions were based on findings from articles published after Bourret et al. (2004). Seaver and Bourret (2020) found the arrangement of free-operant preference assessments may be similar to environments that maintain low-rate manding. Because the overall purpose of this study (and the treatment goal for Kayla) was to increase mand repertoires, the preference assessment was altered.

Adding a comparison between a commonly used treatment and the suggested treatment aids in the interpretation that the assessment is a vital tool to determine which intervention will be effective and efficient to teach mands. Although only partial data are represented, a differentiation between treatments is apparent, which suggests shaping is more effective than prompting and reinforcement. Kayla appeared to attempt to emit whole target words during the study but was never able to emit a clear utterance in the prompting and reinforcement condition. Therefore, prompting the whole target word was not an effective treatment for her even though she could emit some vocal verbal behavior.

The noted differentiation is expected to continue as sessions progress. As more phonemes are added, an increase in the number of sessions required to reach mastery criteria in shaping phases is likely. If responding decreases as phonemes are added, the individual sounds can be broken down then combined (i.e., “mmm”- “uhh” before “muh”), we can revert to the previous phase for at least 1 session to contact reinforcement and avoid extinction effects, or an additional prompt can be added. If Kayla does not emit a full utterance in the prompting and reinforcement condition, the mand for pin board will be shaped in future sessions. If full utterances occur in the

prompting and reinforcement condition, the reinforcer would be provided and prompt fading would be targeted, and this would reduce the effectiveness of the assessment.

The current pandemic posed limitations not directly related to the study. Although there were no inclusion criteria for age or developmental disability of participants, young children with Autism Spectrum Disorder were the most accessible population for the experimenter prior to the pandemic. However, when the pandemic first occurred, new clients were not being accepted and centers were not allowing outside providers in. Therefore, the available pool of participants to recruit from was extremely limited. Once a participant was recruited, masks were required in all sessions which removed a visual model prompt of each targeted sound. Although Kayla was able to emit “mmm” it was noted her lips did not always close to make the sound. This can cause complications once more phonemes are added across shaping phases, which could be empirically evaluated in future studies. The effects of masks during training can also be empirically evaluated in future studies.

Additional limitations were participant specific. Kayla had gastrointestinal complications that prolonged the start of the study and limited how many sessions could be conducted a day. Once recruited, she was refusing food so the MO required for Study 1 could not be manipulated. Sessions were not conducted when complications were high, as her pain and discomfort resulted in confounding variables (increase in maladaptive behaviors and a decrease in attending). She also has difficulty emitting bilabial sounds (buh, mmm, puh) that could have limited the acquisition of target utterances. Future studies can evaluate if an echoic skills assessment could assist in the prediction of the most effective treatment when training vocal verbal behavior.

One weakness of the comparison was the unintended extinction effects of appropriate responding during prompting and reinforcement. When the pin board was presented in the first

session, her behaviors were similar to those observed in Study 1. She would say “Yeah” or “Alright” when provided the nonspecific prompt, she attempted to say the full model, and she was engaged for the duration of the session. However, by the third session of prompting and reinforcement, she did not emit intraverbal responses and extinction induced variability and aggression were observed. Instead of attempting the full target, she emitted the partial phonemes “guh” and “mmm” that were reinforced during Study 1 and the shaping condition as well as mands that have been reinforced in the natural environment (i.e., “I don’t want it” and “clean up”). To reduce these effects and increase engagement, sessions were reduced from 10 to 5 trials in both treatment conditions. Although the effects were unintended, they provide further evidence for the need for a mand training assessment such as the one tested in this study to be incorporated into practice.

In less than two hours an effective mand training procedure was identified but, in practice, it can take weeks to months. If clients in practice respond to ineffective treatments like Kayla did maladaptive behaviors could increase and preferred items and practitioners themselves could become aversive. Incorporating this assessment at the onset of services could reduce the likelihood of implementing ineffective treatments and avoid these unwanted, negative effects.

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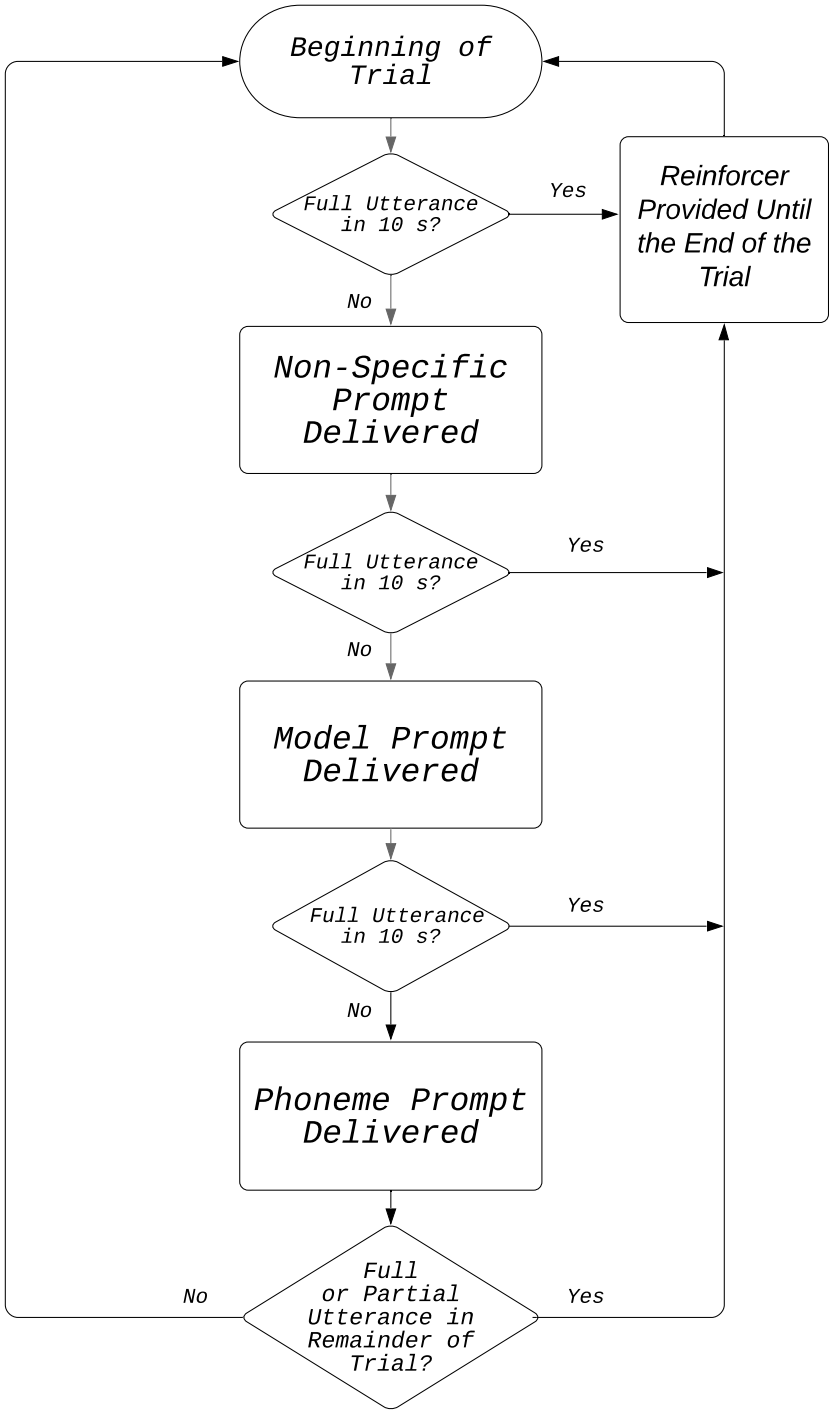
Figure 1

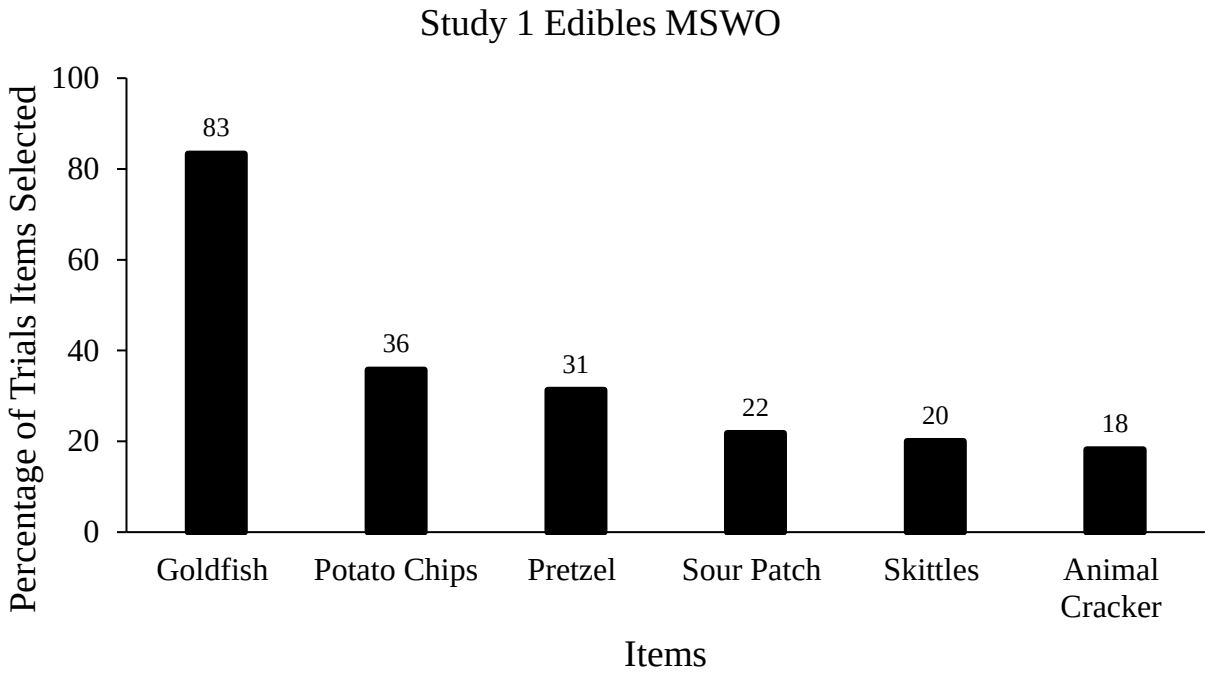
Assessment Flowchart from Study 1



Note. Flowchart created by Bourret et al. (2004) to depict the steps involved in the assessment.

Figure 2

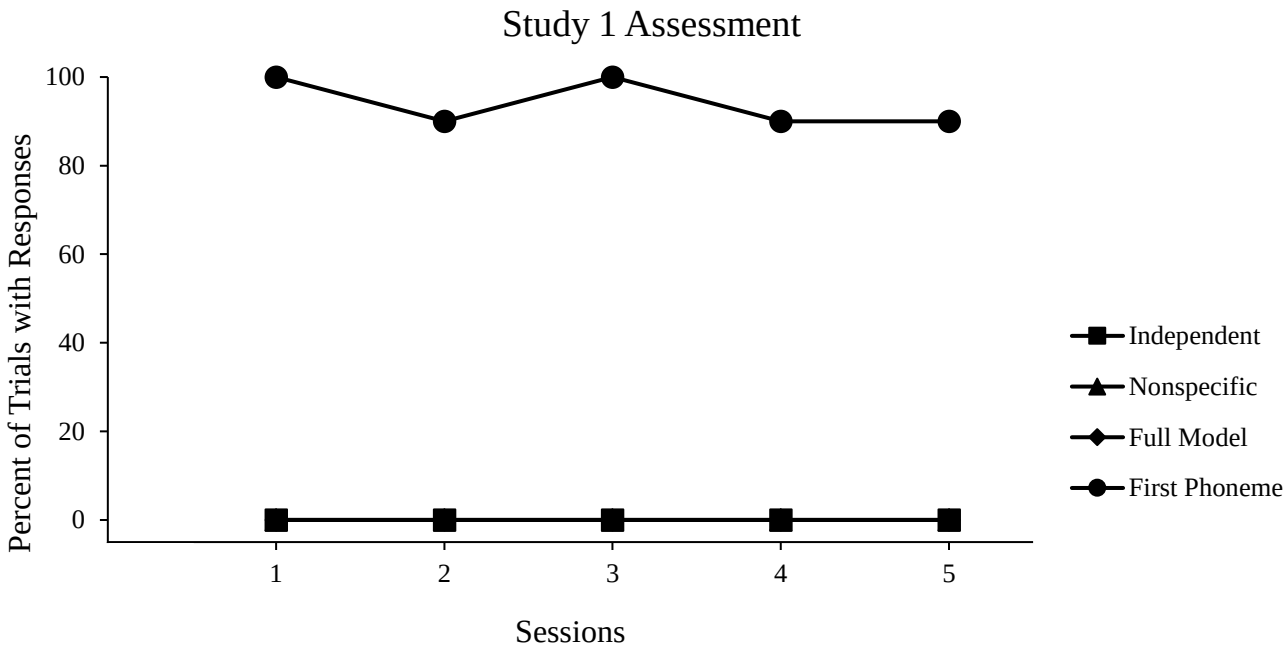
MSWO Results for Study 1



Note. Percentage of trials selected is written on top of each item.

Figure 3

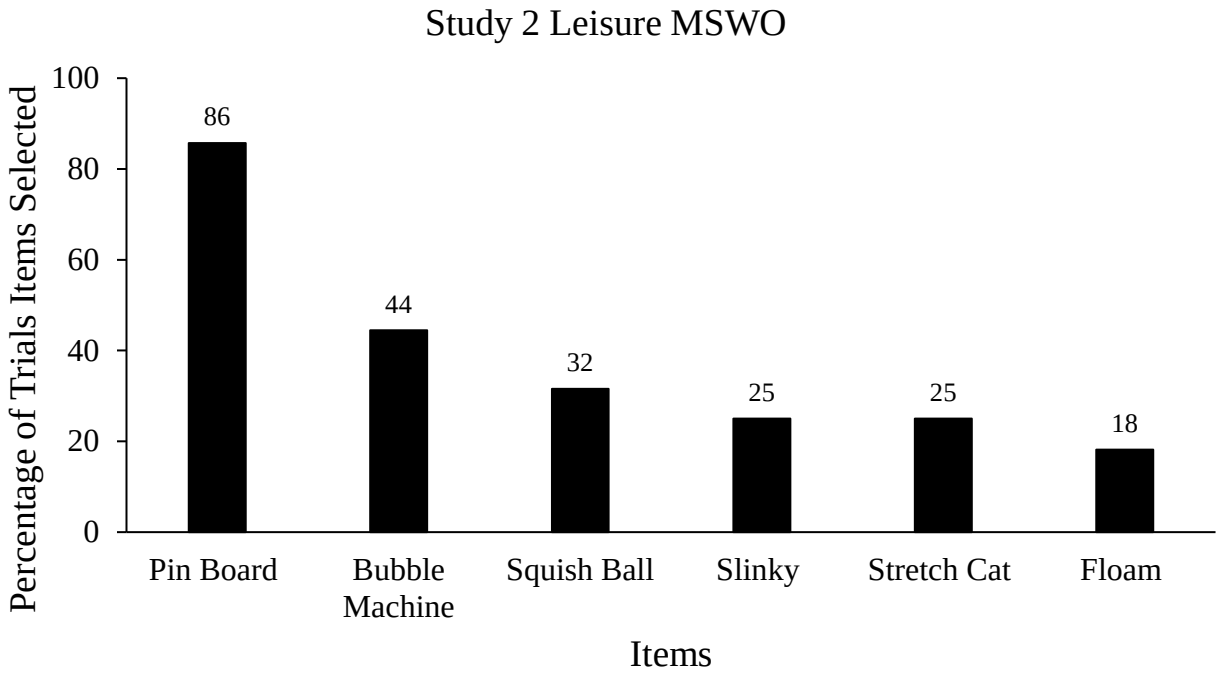
Assessment Results from Study 1 for Kayla



Note. Percentage of trials with responses for Kayla during the assessment.

Figure 4

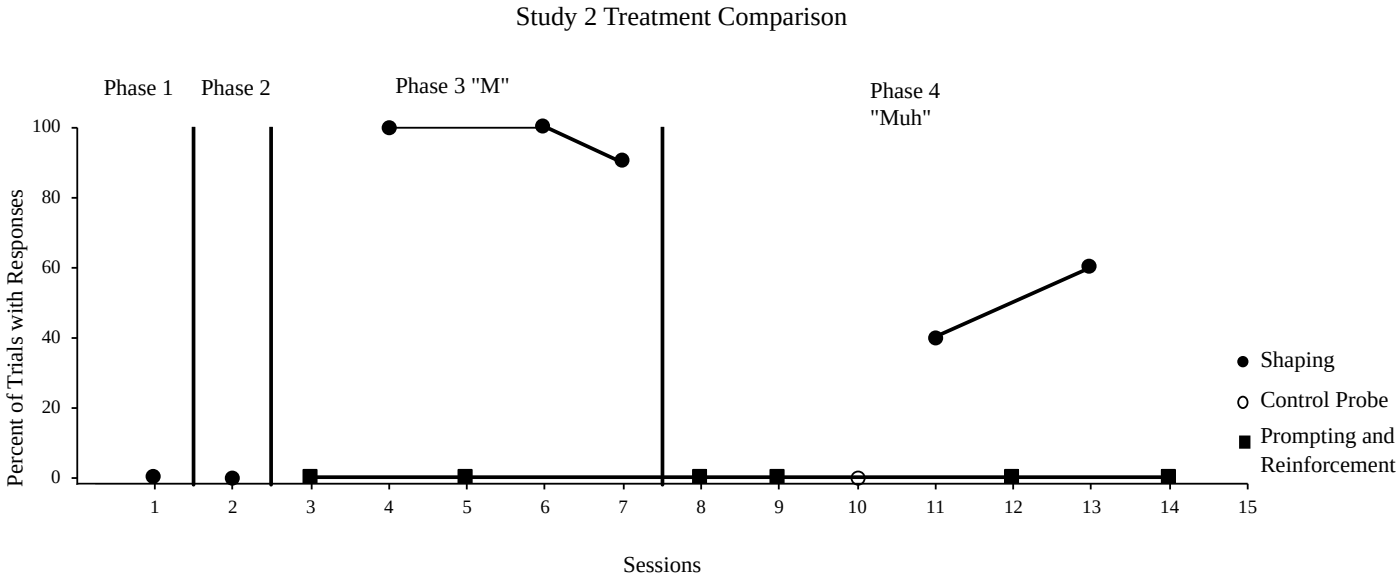
MSWO Results for Study 2



Note. Percentage of trials selected is written on top of each item.

Figure 5

Treatment Results from Study 2 for Kayla



Note. Percentage of trials with responses for Kayla when training “machine” using shaping and “pin board” using prompting and reinforcement. The phase change lines represent progression through the shaping condition and do not reflect changes in the prompting and reinforcement condition.