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## An evaluation of the relative utility of two demand assessments for identifying negative reinforcers

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An Evaluation of the Relative Utility of Two Demand Assessments  
for Identifying Negative Reinforcers

A Thesis Presented

By

Carly Cornelius

In Partial fulfillment of the requirements  
for the degree of  
Master of Science  
in the field of  
Applied Behavior Analysis

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for Identifying Negative Reinforcers

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An Evaluation of the Relative Utility of Two Demand Assessments  
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A Thesis Conducted

By

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Master of Science in Applied Behavior Analysis  
in the Bouve College of Health Sciences Graduate School  
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### Table of Contents

An Evaluation of the Relative Utility of Two Demand Assessments for Identifying Negative Reinforcers

A. Abstract..... 6

B. Introduction

    1. Prevalence and Definition of Escape-maintained Problem Behavior..... 7

    2. Current Treatment Methods..... 7

        a. Antecedent-based Interventions..... 7

        b. Differential Negative Reinforcement..... 8

        c. Extinction..... 8

    3. Demand Assessments..... 10

    4. Negative Reinforcer Assessments..... 14

    5. Purpose..... 16

C. Method

    1. Participants and Setting..... 16

    2. Materials..... 17

    3. Response Measurement and Reliability..... 17

    4. Pre-Assessment for Selection of Demands..... 18

        a. Indirect Demand Assessment..... 18

    5. Experimental Design..... 19

    6. Demand Assessment 1..... 19

    7. Demand Assessment 2..... 21

    8. Functional Analysis..... 21

    9. Negative Reinforcer Assessment..... 22

        a. Baseline..... 22

        b. Functional Communication Training..... 23

        c. Reinforcement..... 24

D. Results..... 25

E. Discussion..... 27

F. References..... 32

G. Table..... 35

H. Figures..... 36

I. Appendices..... 39

The purposes of the current study were (1) to evaluate the utility of an indirect assessment for identifying tasks for use in demand assessments, (2) to assess the reliability of demand assessments, and (3) to assess the validity of the identified demands in a functional analysis and a negative reinforcer assessment. A 16-year-old individual with an autism spectrum disorder, who exhibited self-injury maintained by escape from demands, participated. The study included four phases: an indirect assessment, two different demand assessments, a functional analysis, and a negative reinforcer assessment. Both demand assessments yielded consistent outcomes and identified the same low-preference (LP) and high-preference (HP) demands. However, the LP demand identified from the demand assessments was not consistent with that identified in the indirect assessment. The functional analysis and negative reinforcer assessment demonstrated that the LP demand identified from the demand assessments was a potent negative reinforcer than the LP demand identified from the indirect assessment.

## **Introduction**

A negative reinforcer is a stimulus whose termination or postponement increases the probability of responding (Catania, 2007). In the case of negatively reinforced (or escape-maintained) problem behavior, the behavior (e.g., self-injury) produces termination of a stimulus (e.g., teacher instruction) and results in a subsequent increase in the future probability of that behavior. Teachers and caregivers may inadvertently shape escape-maintained problem behavior, such as self-injury and aggression (Iwata, 1987). Hanley, Iwata, and McCord (2003) reviewed results of 536 functional analyses and found that 34.2% showed patterns suggestive of maintenance by social-negative reinforcement. In an analysis of the functions of self-injury, Iwata, Pace, Dorsey, Zarcone, Vollmer, and Smith et al. (1994) found that social-negative reinforcement accounted for 38.1% of 152 functional analyses, the largest proportion of the sample. Results from these studies indicate that escape-maintained problem behavior is prevalent among individuals with developmental disabilities. It is therefore of utmost importance that behavior analysts identify effective methods to treat escape-maintained problem behavior.

Current treatment methods for escape-maintained problem behavior include antecedent-based interventions, differential reinforcement procedures, and extinction. An example of an antecedent-based intervention was illustrated by Vollmer, Marcus, and Ringdahl (1995), who evaluated noncontingent escape (NCE) as a treatment for self-injury maintained by negative reinforcement. During NCE, a therapist presented escape from learning activities on a fixed-time schedule independent of participants' behavior. For one participant, the authors evaluated differential negative reinforcement of other behavior (DNRO). During this condition, the therapist removed tasks contingent on the absence of SIB for a pre-specified duration. Results

showed that NCE resulted in significant reductions in self-injury for both participants and that DNRO was also an effective treatment for the participant who received this intervention.

Another intervention for escape-maintained problem behavior is differential reinforcement of alternative behavior, often referred to as differential negative reinforcement (DNR). Marcus and Vollmer (1995) evaluated two forms of DNR for increasing participants' communication or compliance. During DNR (communication), the therapist delivered a break contingent on a communication response (e.g., saying "all done"). During DNR (compliance), the therapist delivered a break contingent on compliance. During both conditions, disruptive behavior resulted in extinction. Both forms of DNR decreased disruption and increased appropriate behavior, although compliance was low during DNR (communication).

In both of the examples above, the authors evaluated reinforcement-based interventions that were combined with extinction. Although authors have evaluated escape extinction alone as a treatment for self-injurious behavior (SIB), it may be associated with extinction bursts (e.g., Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990). In addition, extinction can cause an initial increase in the force or intensity of the response (Lerman & Iwata, 1996). Escape extinction procedures are also only effective when implemented with a high degree of integrity and teacher, caregivers, and therapists often report that withholding reinforcement consistently is the most difficult part of an extinction procedure (Cooper et al., 2007). Another reported side effect of extinction is the possibility of extinction-induced aggression or other emotional behavior (e.g., Goh & Iwata, 1994). When evaluating extinction for a participant's negatively reinforced SIB, Goh and Iwata observed increases in aggression. Thus, extinction may be associated with bursts, changes in the magnitude of the response, and increases in inappropriate collateral responses. In light of these limitations, extinction may not always be a preferred treatment method.

Given the problems inherent with the use of escape extinction, caregivers may need to rely on the use of differential reinforcement procedures without extinction. For this reason, researchers have evaluated differential reinforcement procedures alone, when extinction is not in effect (e.g., DeLeon, Neidert, Anders, & Rodriguez-Catter, 2001; Kodak, Lerman, Volkert, & Trosclair, 2007; Lalli et al., 1999). For example, Piazza et al. (1997) evaluated the effects of differential reinforcement for compliance using positive reinforcement, negative reinforcement, or a combination for participants whose problem behavior was maintained by positive and negative reinforcement. The authors evaluated differential reinforcement when extinction was and was not in effect for problem behavior. Results indicated that, for two out of three participants, differential reinforcement without extinction was effective.

Lalli et al. (1999) compared differential reinforcement of compliance with either a break or an edible when extinction was and was not in effect for participants with escape-maintained problem behavior. Results showed that differential reinforcement of compliance without extinction was more effective when an edible reinforcer was used than when a break was used. Because escape was identified as the maintaining reinforcer for participants' behavior in a pre-treatment functional analysis, it is surprising that edibles were more effective than escape. Given this outcome, it is unclear whether negative reinforcers may be as effective as positive reinforcers in differential reinforcement interventions for escape-maintained problem behavior.

It is important to identify demands that may function as motivating operations (MOs) for individuals with escape-maintained problem behavior. When functionally analyzing problem behavior hypothesized to be maintained by negative reinforcement, it is essential that the demands used in the demand condition function as establishing operations (EOs) for escape. If demands are arbitrarily chosen, there may be no EO in place during the demand condition, which

can lead to false negative or undifferentiated outcomes (Roscoe, Rooker, Pence, & Longworth, 2009). In addition to the role that negative reinforcement plays in the assessment of problem behavior, it can also be used to strengthen desirable behavior. Iwata (1987) cited several examples of this, including the use of negative reinforcement procedures in teaching toilet training and treating incontinence and the role of negative reinforcement contingencies in overcorrection procedures and functional communication training. Therefore, it is important for clinicians to consider the use of negative reinforcers when assessing and treating problem behavior and when attempting to increase appropriate behavior.

One way to identify potential negative reinforcers is through the use of task or demand assessments. Although authors have evaluated demand assessments (e.g., Kodak, Lerman, Volkert, & Trosclair, 2007; Zarcone, Iwata, Mazaleski, & Smith, 1994; Roscoe et al., 2009), there are a number of procedural differences that may have affected their potential utility. Cooper et al. (1992) conducted a task preference assessment by presenting each participant with sets of three examples of math and reading tasks and asking the participant which task they liked to do most and which they liked to do least. Tasks were ranked from least preferred to most preferred. Thus, the dependent variable measured in this assessment was selection. The authors then measured appropriate, inappropriate, and off-task behavior across conditions in which task difficulty, task preference, and quality of attention were manipulated. For 8 of 10 participants, variables associated with increased appropriate behavior were identified.

Kodak et al. (2007) evaluated a demand assessment (referred to by the authors as a task preference assessment) that involved a trial-based procedure. This assessment included tasks that were used during the demand condition of the functional analysis. During each trial, the therapist presented two photos depicting two different tasks, asked the participant to select one of

the two photos. Contingent on selection, the therapist prompted participants to complete three responses from the task depicted in the selected photo, and the therapist delivered no consequences for problem behavior. The dependent variable measured was selection, and those tasks selected on a high percentage of trials were categorized as high preference and those selected on a low percentage of trials were categorized as low preference. Following the demand assessment, the authors evaluated participants' response allocation across two response options, one that was associated with a contingent break and one that was associated with contingent edible. The authors examined how shifts in participants' response allocation across the two options across varying schedule requirements, tasks (low versus high preference task), and reinforcers (low versus high preference edible). As was previously mentioned, participants almost always selected the response option associated with contingent edible over escape, even though escape was identified as the maintaining variable of their problem behavior.

Zarcone et al. (1994) conducted a demand assessment (referred to by the authors as a compliance assessment) in which a series of demands was singly presented in a trial-based format. During each trial, the therapist presented demands using a three-prompt sequence and terminated prompts contingent on SIB. The authors defined high preference (or high probability of compliance) and low preference (or low probability of compliance) demands based on two dependent variables: compliance and SIB. Subsequently, the authors included the identified demands in a treatment, referred to as the high-probability sequence, for escape-maintained problem behavior. The high-probability sequence involved the delivery of three high-p instructions followed by a low-p instruction. The authors evaluated this treatment with and without extinction on escape-maintained SIB and compliance. Results showed that the high-p instructional sequence alone had no effect on SIB or compliance and was only effective when

SIB was placed on extinction.

Call, Pabico, and Lomas (2009) evaluated the utility of a demand assessment for informing the demand condition of a functional analysis. First, the authors asked caregivers to rate several categories of potential negative reinforcers. During their demand assessment, the therapist continuously presented a single demand for a maximum of 10 min. When the target behavior occurred, the therapist withdrew instructions and ended the session. The dependent variable measured was latency to problem behavior, and high preference demands were defined as those associated with long latencies and low preference demands were defined as those associated with short latencies. The authors subsequently included high and low preference demands in the demand condition of a functional analysis. Results indicated that functional analysis outcomes were clearer when the low preference demands rather than the high preference demands were included.

In a similar study, Roscoe, Rooker, Pence, and Longworth (2009) evaluated the utility of a demand assessment procedure for identifying tasks for inclusion during the functional analysis demand condition. Similar to Call et al. (2009), the demand assessment involved continuously presenting a single demand for 5 min and delivering a break contingent on problem behavior. However, the dependent variable measured was frequency of problem behavior and percentage of compliance. In addition, sessions were 5 min even if problem behavior occurred. Roscoe et al. defined high preference (referred to by the authors as high probability) demands as those associated with high levels of compliance or low levels of problem behavior and low-preference (referred to by the authors as low-probability) demands as those associated with low levels of compliance or high levels of problem behavior. During a subsequent functional analysis that included both low-preference and high-preference demand conditions, clearer outcomes were

obtained for three of four participants when only the low-preference demand was included. Therefore, both Call et al. (2009) and Roscoe et al. (2009) demonstrated the utility of demand assessments for informing the demands to include in functional analyses.

Although the purpose of demand assessments is to identify aversive or nonpreferred tasks or demands, it is unclear whether procedural differences among demand assessments may affect their utility in informing a functional analysis or treatment. In the studies reviewed above, one of the main procedural differences was the dependent variable used to define high versus low preference tasks. Some authors defined preference value based on participant selection (e.g., Cooper et al., 1992; Kodak et al., 2007) and some based preference on percentage of compliance or frequency of problem behavior (e.g., Zarcone et al., 1994; Roscoe et al., 2009; Call et al., 2009). Although stimuli identified as high preference during preference assessments typically function as reinforcers (e.g., Pace, Ivancic, Edwards, Iwata, & Page, 1985), they may not always function as reinforcers (e.g., Higbee, Carr, & Harrison, 2000). In addition, it is unclear whether preference assessments of potential negative reinforcers will have similarly high predictive validity for identifying negative reinforcers for use during a functional analysis or treatment. Because identifying negative reinforcers may require selection of motivating operations, demand assessments that include the target behavior of interest (e.g., problem behavior) may be more accurate in identifying negative reinforcers than demand assessments that include response selection as the target behavior of interest. Although authors have conducted demand assessments based on selection, they did not determine the extent to which low preference demands informed functional analysis outcomes or whether they were more effective negative reinforcers than were high preference demands. Therefore, it may be informative to systematically compare demand assessments to determine which format is most effective for

clarifying the outcomes of a functional analysis and for identifying negative reinforcers for increasing an appropriate target response (e.g., a mand).

One way to identify if stimuli function as effective negative reinforcers is by conducting a negative reinforcer assessment. However, very little research exists on negative reinforcer assessments. Fisher et al. (1994) conducted a similar type of assessment, a stimulus avoidance assessment, for the purposes of identifying an effective punisher for automatically reinforced pica. During this assessment, a therapist singly presented nine potential punishers (e.g., facial screen, water mist, hands down) 10 times each while measuring avoidance and escape responses (e.g., negative vocalizations such as crying, avoidance movements such as turning away). For each participant, three stimuli (each associated with either low, medium, or high levels of avoidance movements and/or negative vocalizations) identified from the avoidance assessment were subsequently used in a punisher assessment. During this assessment, the authors compared potential punishers using a multielement design. During each session, the therapist presented a reprimand combined with a potential punisher contingent on a target maladaptive response. The procedure that produced the greatest reduction in responding was determined to be the most effective punisher. Next, the authors assessed the effects of the identified punisher in a treatment assessment that included punishment for pica and contingent positive reinforcement for appropriate eating. Although the avoidance assessment was found effective in identifying punishers, because non-target responses (i.e., avoidance responses) were measured, it is unclear whether the stimuli functioned as motivating operations for pica specifically. In addition, because no programmed consequences were provided for avoidance or escape responses, it is unclear whether this method may identify negative reinforcers.

Based on the procedures used by Fisher et al. (1994), Zarcone, Crosland, Fisher, Worsdell, & Herman (1999) developed a procedure to identify effective negative reinforcers. The authors conducted a negative reinforcer assessment of six tasks or stimuli that were included based on caregiver report. During this assessment, the therapist presented each task for one 10-min session. During each session, the therapist delivered a 30-s break contingent on manding (e.g., handing the therapist a stop sign). The dependent variable measured was latency to manding, and the task associated with the shortest latency to manding was identified as the most effective negative reinforcer. For one participant, the results of this assessment informed a punishment intervention in which the task associated with the shortest latency was presented contingent on problem behavior. This treatment effectively decreased this participant's problem behavior. An important limitation of this negative reinforcer assessment is that each stimulus or task was only presented once. In other words, no replications of the sessions were conducted. The authors of this study noted that this brief exposure may be insufficient to accurately identify negative reinforcers.

In summary, escape-maintained problem behavior is prevalent among individuals with developmental disabilities and it is therefore important that we identify effective treatment methods. Current treatment methods include antecedent-based interventions, differential reinforcement procedures, and extinction. However, extinction may not be a preferred treatment due to its potential side effects. Therefore, researchers have evaluated differential reinforcement procedures without extinction. In comparing differential reinforcement procedures, Lalli et al. (1999) found that differential reinforcement using positive reinforcers (e.g., an edible) was more effective than using negative reinforcers (e.g., a break). Therefore, it is unclear whether differential negative reinforcement without extinction can be effectively used to treat escape-

maintained problem behavior. Although researchers have shown the utility of conducting demand assessments for identifying negative reinforcers, there are a number of important variations across procedures, making it unclear which demand assessment will be most effective for informing treatment. Furthermore, few researchers have conducted negative reinforcer assessments to determine whether aversive or nonpreferred stimuli actually function as negative reinforcers. Thus, an important area of research involves the identification and assessment of negative reinforcers for individuals with escape-maintained problem behavior. The purposes of the current study were (1) to evaluate the utility of an indirect assessment for identifying tasks for use in demand assessments, (2) to assess the reliability of demand assessments, (3) to assess the utility of the demand assessments for informing a functional analysis, and (4) to assess the predictive validity of the identified demands in a negative reinforcer assessment.

## **Method**

### **Participants and Setting**

One adolescent, who exhibited SIB maintained by escape from demands based on a functional analysis, participated in this study. Matthew was a 16-year-old male who exhibited several topographies of problem behavior, including aggression, SIB, and property destruction. Matthew's target behavior was SIB, which was defined as Matthew using any part of his body to hit his face, head, or any other body part, or hitting his head against an object. Sessions were conducted in a small research room at Matthew's school. All sessions were videotaped for data collection purposes.

### **Materials**

Materials included 10.2 cm-by-15.2 cm laminated photographs of the participant performing each task and materials necessary for completing tasks included in the assessments, such as a toothbrush, plate and silverware, and face cloth.

### **Response Measurement and Reliability**

During demand assessment 1, observers collected data on participants' photograph selections during each trial and summarized these data as percent selection. Selection was defined as the participant touching or pointing to a photograph. High-preference (HP) and low-preference (LP) tasks were identified based on visual inspection of the data. During demand assessment 2, observers collected data on compliance and frequency of problem behavior and these data were used to determine HP and LP demands based on this assessment. Compliance was defined as completion of the task before the physical prompt. HP tasks were identified as those associated with differentially higher rates of problem behavior and LP tasks were identified as those associated with differentially lower rates of problem behavior. During the functional analysis, observers recorded frequency of problem behavior. During the negative reinforcer assessment, observers recorded the frequency of an appropriate break response and frequency of problem behavior.

For demand assessment 1, interobserver agreement (IOA) was calculated by dividing the number of trials in which both observers agreed on the participant's selection by the total number of trials scored by both observers. For all other assessments, IOA was calculated by dividing the session length into 10 s intervals, dividing the smaller number of responses by the larger number, and averaging the intervals. For Matthew, a second observer independently recorded data from video during 33% of trials for demand assessment 1, 28% of sessions for demand assessment 2, 30% of functional analysis sessions, and 30% of negative reinforcer assessment sessions. The

mean agreement for selection during demand assessment 1 was 98.2% (range not applicable). During demand assessment 2, mean agreement for SIB was 95.3% (range, 78.5% to 100%) for compliance was 82.7% (range, 77.4% to 100%). During the functional analysis, mean agreement for SIB was 98% (range, 91.8% to 100%). During the negative reinforcer assessment, mean agreement for mands was 96.3% (range, 83% to 100%) and for SIB was 97.8% (range, 90% to 100%).

### **Pre-Assessment for Selection of Demands**

**Indirect Demand Assessment.** The experimenter conducted an indirect assessment with staff members who worked as participants' teachers. The purpose of this assessment was to identify appropriate demands to include during subsequent analyses. During the open-ended portion of the assessment (see appendix A for complete form), the experimenter asked the staff members (subsequent referred to as respondents) to list several tasks that the participant came into contact with within four different content areas, including self-care, domestic, academic, and physical. The experimenter then reviewed the tasks that were listed and included those that would be appropriate for the demand assessments in the close-ended portion of the indirect assessment (see appendix B for complete form). During this portion, the experimenter asked the teachers to rank each task on a 5-point scale, with a rank of 1 indicating that the task was one that the participant enjoyed or readily engaged with to 5 indicating that the task was one that the participant strongly disliked, avoided, or did not independently engage with. In addition, the experimenter asked respondents to include and rank any additional tasks that the participant frequently encountered that were not already listed.

After three respondents completed the indirect assessment, we calculated IOA across each set of respondents for each task. More specifically, we calculated IOA across respondents

A and B, respondents B and C, and respondents A and C to determine which pair had the highest agreement. We collected exact agreement IOA and defined it as both respondents assigning the same rank to a task (e.g, if respondents A and B both ranked toothbrushing as a 4). We also collected partial agreement IOA and defined it as a difference of one between the two ranks (e.g., if respondent B ranked toothbrushing as a 3 and respondent C ranked it as a 4). The number of agreements (either exact or partial) was divided by the total number of tasks and multiplied by 100. The data from the pair of respondents with the highest IOA across tasks were used to inform the stimulus array during the subsequent demand assessments. Specifically, we identified two tasks from each content area and tasks from different ranks (those associated with a 1 or a 2 and those associated with a 4 or a 5).

### **Experimental Design**

Demand assessments 1 and 2 were conducted concurrently to control for sequence effects. The therapist alternated 14 trials of demand assessment 1 with one to three 5-min sessions of demand assessment 2. Demand assessment 1 trials were always conducted before demand assessment 2 sessions to prevent potential exposure effects associated with continuous presentation of a specific demand for 5-min. After demand assessment 1 and demand assessment 2 (one session per demand) were completed, we conducted at least one additional series of each assessment until stability within demands could be determined.

### **Demand Assessment 1**

This assessment was similar to that used by Kodak et al. (2007) and the paired stimulus preference assessment procedure by Fisher et al. (1992). The eight tasks (and their corresponding photographs) identified through the indirect demand assessment were included. During this assessment, the experimenter simultaneously presented pairs of photos, such that

every photo was paired with every other photo. Prior to each trial, the therapist conducted two forced exposure trials. During the first forced exposure trial, the therapist presented one of the photos from the upcoming trial, manually guided the participant to touch the photo, and then prompted (vocal, model, physical) the participant to complete the task for 12 s. We used a 12-s duration of exposure because this was the maximum duration that the participant took to complete one of the tasks. During the second forced exposure trial, the therapist presented the other photo from the upcoming trial, manually guided the participant to touch it, and then prompted the participant to complete the corresponding task for 12 s. For example, if tasks 1 and 2 were to be presented in the first trial, the therapist would present the photo of task 1, manually guide the participant to touch the photo, and then prompt the participant to complete the depicted task. Then the therapist would present the photo of task 2, manually guide the participant to touch the photo, and prompt the participant to complete the task. The order of the two forced exposure trials was determined quasi-randomly. After the two forced exposure trials, the therapist simultaneously presented the two photos and instructed the participant to “pick one.” Upon selecting one, the participant was prompted (vocal, model, physical) to complete the depicted task for 12 s. If the participant attempted to select both photos, the photos were removed and then represented. If the participant did not select a photo within 5 s, the therapist conducted the forced exposures again and then represented the two photos. If the participant selected one, he or she was prompted to complete that task. If the participant still did not select, the photos were removed and the therapist moved on to the forced exposure for the next trial. During the assessment, the therapist delivered no consequences for problem behavior.

## **Demand Assessment 2**

This assessment was based on the procedures by Roscoe et al. (2009). The same eight tasks used in demand assessment 1 were used in this assessment, and the sequence of task presentation was quasi randomly determined. During each 5 min session, the therapist presented a single task continuously, using three-step prompting (vocal, model, physical). Contingent on compliance, the therapist provided brief praise and continued presenting the task. Contingent on the target behavior, the therapist delivered a 30-s break. After the 30-s break, the therapist presented the same demand again, using the three-step prompting sequence.

### **Functional Analysis**

A functional analysis (FA) similar to that described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) was conducted to identify the function of the participant's problem behavior. The FA included no interaction, attention, control, and three different demand conditions. We included multiple demand conditions to evaluate whether inclusion of the LP versus HP demand conditions differentially affected the FA outcome. For Matthew, we included a LP demand condition (according to both demand assessments), a HP demand condition (according to all assessments), and a LP demand condition (according to only the indirect demand assessment). All sessions were 10 min in duration. During the LP demand condition (according to both demand assessments), the therapist continuously presented the LP demand identified during the demand assessments by using a three-step prompting hierarchy (vocal, model, physical). If the participant engaged in the target behavior, the therapist removed the task and turned away for 30 s. If the participant completed the task before the physical prompt, the therapist delivered brief praise and then represented the demand. Procedures were identical for the HP demand condition (according to all assessments) and the LP demand condition (according

to the indirect assessment), except that the demand used was that identified as HP during the demand assessments and that identified as LP during the indirect assessment, respectively.

### **Negative Reinforcer Assessment**

A negative reinforcer assessment was conducted to determine if escape functioned as a negative reinforcer for an appropriate response across different LP (e.g., the LP demand identified by Demand Assessment 1 versus the LP demand identified by Demand assessment 2) and HP demands (identified from both assessment methods). For each participant, an appropriate break response (e.g., vocally requesting a break, pointing to a “break” picture) already in the participant’s repertoire was identified. The assessment included a baseline and reinforcement phase. Within each phase, the HP demand (according to both assessments), the two different types of LP demand conditions and the HP demand condition were alternated using a multielement design. In addition, during the reinforcement phase, we included a control condition to demonstrate experimental control. Because both demand assessments identified the same LP demand for Matthew, we included an LP demand condition (identified from only the indirect assessment) and an LP demand condition (identified from both demand assessments but not from the indirect assessment). All sessions were 5 min in duration.

**Baseline.** In order to expose the participant to the contingency in effect during baseline sessions, the therapist conducted two forced exposures prior to each session. During these forced exposures, the therapist vocally prompted the participant to complete the specific demand (associated with the upcoming session) and immediately prompted the participant to engage in the appropriate communication response. For Matthew, the therapist stated, “Matthew, brush your teeth,” then immediately stated, “Say, ‘I want a break.’” Next, the therapist stated, “Breaks aren’t available right now” and continued with the demand presentation and prompting. After

the participant completed the task, the therapist began the session and continually presented the demand using the same three-step prompting hierarchy (vocal, model, physical). No programmed consequences were delivered contingent on the appropriate communication response or on problem behavior. The therapist delivered brief praise contingent on compliance. During the HP demand condition (according to both demand assessments), the therapist presented the HP demand identified in both demand assessments. During the LP demand condition (according to both demand assessments), the therapist presented the LP demand identified during the demand assessments, and during LP demand condition (according to only the indirect assessment), the therapist presented the LP demand identified from the indirect assessment.

**Functional Communication Training (FCT).** When we first initiated the reinforcement phase of the negative reinforcer assessment, Matthew exhibited frequent severe aggression and sessions had to be terminated for safety reasons. In addition, he did not exhibit the appropriate communication response even though we conducted forced exposure trials. Because his communication attempts had contacted extinction during the previous baseline phase, we hypothesized that the therapist's presence may have served as a discriminative stimulus for the unavailability of breaks. For this reason, we conducted functional communication training sessions.

During FCT training, the therapist presented a demand that differed from those included during baseline and reinforcement phases to prevent potential history effects that could occur from using one of the demands from the treatment analysis. More specifically, for Mathew, the therapist presented the set table demand, identified as moderately preferred (i.e., it was associated with moderate rates of SIB according to Demand Assessment 1 and was selected on

an average of 70% of trials during demand assessment 2). During each FCT training session, the therapist conducted 10 trials. During each trial, the therapist delivered the demand, “Matthew, set the table” and then prompted, “say I want a break” according to a progressive time-delay prompt (e.g., the therapist began with a 0-s delay prompt, then increased to a 1-s delay, 2-s delay, etc.). Contingent on either an independent or prompted response, the therapist delivered a 30-s break. If Matthew engaged in SIB before the appropriate response was prompted, the therapist prompted Matthew to complete the task and then initiated another trial. FCT training sessions continued until the participant met a mastery criterion of 90% correct and independent across two consecutive sessions.

**Reinforcement.** During the reinforcement phase of the assessment, the order of sessions was as follows: a control (play) condition, a brief FCT training session, and then reinforcement sessions. We conducted sessions in this order because, during previous sessions, Matthew exhibited aggression to the experimenter before any demands were presented. One hypothesis that may explain his aggression is that the therapist had become a conditioned aversive stimulus due to frequent pairings with demand presentation. Therefore, we conducted the control (or play) condition prior to all reinforcement condition sessions in an attempt to reduce the aversive properties associated with the therapist. During this condition, the therapist presented highly preferred toys and told the participant “here are some toys you can play with if you want to. Let me know if you want me to come and play.” The therapist then sat in a chair across the room. After the control condition, the therapist conducted a brief FCT training session to expose the participant to the contingency in effect during reinforcement sessions. If the participant correctly and independently asked for a break during at least 80% of trials during the FCT training session, the therapist initiated reinforcement sessions. If the participant did not meet this criterion, the

therapist conducted another control condition and then conducted the FCT training session again. If the participant met the criterion, the therapist initiated reinforcement sessions. If the participant did not meet the criterion for the second time, sessions were terminated for the day. During reinforcement sessions, the therapist continuously presented a single demand using three-step prompting. If the participant exhibited the appropriate communication response, the therapist delivered a 30-s break. After the break, the therapist continued to present demands. However, if the participant engaged in the appropriate break response at any point, the therapist delivered another 30-s break. The therapist delivered no programmed consequences for problem behavior.

### **Results**

The results of Matthew's indirect demand assessment are depicted in Table 1. The table shows the tasks included during the indirect assessment, their corresponding ranks, and obtained from each of the respondents, and the IOA from the pair of respondents with the highest agreement. The HP, LP, or neutral (based on the ranks given by the respondents) demands included during the demand assessments are highlighted in yellow.

The results of demand assessment 1 (top graph) and demand assessment 2 (middle and bottom graphs) for Mathew are shown in Figure 1. For both demand assessments, we conducted multiple series to assess stability. We graphed each of the demand assessment series separately to visually inspect stability of the outcomes across replications (the numbers above the bars indicate the series displayed and the letter A above the last bar indicates the average across series). In demand assessment 1, the stamp name demand was identified as the HP demand because it was selected on the highest percentage of trials ( $M = 88\%$ ), whereas the sit on floor demand was identified as the LP demand because it was selected on the lowest percentage of trials ( $M = 2\%$ ).

In demand assessment 2, the stamp name demand was identified as an HP demand because it was associated with the lowest rate of SIB ( $M = 0.2$  rpm), whereas the sit on floor demand was identified as the LP demand because it was associated with the highest rate of SIB ( $M = 1.4$  rpm). All tasks were associated with high levels of compliance. Therefore, demand assessments 1 and 2 identified the same HP and LP demands.

The results of Matthew's functional analysis are shown in Figure 2. Matthew exhibited differentially higher levels of SIB during the attention condition and the LP demand (identified from the demand assessments) condition. Therefore, we concluded that Matthew's SIB was maintained by both attention and escape from the LP demand (identified from the demand assessments).

Results of Matthew's negative reinforcer assessment are shown in Figure 3. Appropriate communication is depicted in the top panel and SIB is depicted in the bottom panel. During baseline, Matthew did not exhibit the appropriate communication response (i.e., a mand for a break) during any of the demand conditions. Matthew exhibited moderate-to-high levels of SIB with an increasing trend across all baseline conditions. However, the highest levels of SIB occurred during the LP demand (identified from the demand assessments) condition. During reinforcement, Matthew exhibited the highest levels of appropriate communication during the LP demand (identified from the demand assessments) condition, suggesting that this demand was the most effective negative reinforcer. Although Matthew also exhibited mands during the LP (identified from the indirect assessment) and the HP demand (according to all assessments) conditions, the level was lower than that observed during the LP demand (identified from the demand assessments condition), suggesting that these demands functioned as less potent negative reinforcers. Mands occurred at near-zero levels during the control condition, demonstrating that

all of the demands functioned as negative reinforcers relative to the control condition. Matthew did not exhibit SIB during any of the reinforcement conditions except for a single session during the LP demand (identified from the demand assessments) condition.

During FCT training, which was conducted between the baseline and reinforcement phases of the negative reinforcer assessment, mastery criterion was 90% correct and independent mands across two consecutive sessions. Matthew met this criterion after six training sessions.

### **Discussion**

Several conclusions can be made based on Matthew's results. First, results of the indirect demand assessment were inconsistent with those obtained from the demand assessments. Although the indirect assessment identified the sit on floor demand to be neutral (i.e., not high or low preference), both demand assessments 1 and 2 identified this demand to be low preference. In addition, the results of the functional analysis and negative reinforcer assessment indicated that the LP demand functioned as a negative reinforcer, demonstrating the validity of the demand assessments and questioning the validity of the indirect assessment. The indirect assessment identified the brush teeth demand to be a low preference demand, whereas the demand assessments identified this demand to be moderate-to-high preference demand (i.e., it was associated with low rates of SIB during demand assessment 1 and moderate percentages of selection during demand assessment 2). The inconsistency between the indirect assessment and demand assessment results is not surprising, as previous research (e.g., Green et al., 1988) has shown that results of indirect assessments may be unreliable. The indirect demand assessment was, however, beneficial in identifying tasks that the participant contacts on a regular basis and these results were used to inform the demand assessments.

Second, although demand assessments 1 and 2 yielded consistent findings for the LP and HP demands, the results of demand assessment 1 were much more stable across series than the results of demand assessment 2. Therefore, these results suggest that demand assessment 1 may be a more reliable method of assessing negative reinforcers than demand assessment 2.

Third, the results of the functional analysis indicated that only the LP demand (identified from the demand assessments) resulted in differentially higher levels of responding in the demand condition relative to the other functional analysis condition. These findings indicate that the LP demand (identified from the demand assessments) functioned as an MO whereas the other LP demand (identified from the indirect assessment) and the HP demand did not. The FA findings also indicate that the inclusion of the LP demand (identified from the demand assessments) was essential in determining the function of problem behavior because if this demand condition had not been included, we would have determined that Matthew's problem behavior was maintained by only attention. Therefore, the FA outcomes validated the utility of both demand assessments in identifying potential negative reinforcers for use during a functional analysis, supporting the utility of demand assessments and demonstrating that an indirect assessment may not be recommended.

Fourth, the results of the negative reinforcer assessment showed that escape from all demands functioned as a reinforcer for increasing an appropriate communication response. However, the LP demand (based on the demand assessments) resulted in the highest levels of the appropriate communication response, suggesting that escape from this demand was a more effective reinforcer than escape from the other LP demand and the HP demand. Although differentially higher levels of appropriate communication were observed in only the LP demand

(informed by demand assessments) condition, SIB occurred at near-zero levels across almost all conditions, most likely because extinction was in effect across all conditions.

The current study extends previous research in a number of ways. First, we empirically evaluated the utility of an indirect assessment for informing demand assessments. The LP demand identified from the indirect assessment differed from the one identified from the demand assessments, and the LP demand identified from the indirect assessment did not result in a clear FA outcome. However, the indirect assessment was helpful in identifying which demands to include in the demand assessments. Second, we compared two demand assessment methods for identifying negative reinforcers. For Matthew, both assessments identified the same LP demand, and this demand was shown to yield a clear FA outcome and to function as a negative reinforcer in our reinforcer assessment. Therefore, both methods were found to have good predictive validity. Third, we evaluated whether the demands identified functioned as negative reinforcers by conducting a negative reinforcer assessment. Although there is a well-established technology for identifying positive reinforcers, there is not such a technology for identifying negative reinforcers as only a few authors (e.g., Zarcone et al., 1999) have evaluated negative reinforcer assessments.

A limitation of this study is that some of our demands may have had poor ecological validity due to use of a controlled setting. For example, one of the low preference demands identified from the indirect assessment for Matthew was the brush teeth demand. In Matthew's natural environment, the brush teeth demand requires a complex response chain that includes going into the bathroom, putting toothpaste on the toothbrush, standing next to the sink, etc. Because demand assessment sessions were conducted in a controlled setting without a sink, the brush teeth demand included in our demand assessments included a modified chain of

responding (i.e., inserting a dry toothbrush into the mouth, touching it to the teeth, and removing the toothbrush from the mouth). Although brush teeth was reported to be a low preference demand by staff members during the indirect assessment, it was associated with low levels of SIB and moderate levels of selection during the demand assessments. A potential explanation for this discrepancy is that our modifications to the demand lessened its aversive properties such that it no longer functioned as low preference demand or as a motivating operation for escape-maintained problem behavior. Another limitation of the current study is we did not address the attention function for Matthew's problem behavior. Although the purpose of this study was not to evaluate a treatment for problem behavior, it is of clinical importance that both the escape and attention functions be addressed in treating Matthew's problem behavior. Additionally, we evaluated only demands as potential negative reinforcers, whereas Zarcone and colleagues (1999) included other potential aversive situations, such as a noisy environment, transitioning between environments, and remaining in seat, in their negative reinforcer assessment.

Based on the previously noted limitations, there are many research questions that could be evaluated in this area. First, researchers could replicate and extend the current study by conducting demand assessments in a more naturalistic setting to enhance external validity. Second, researchers could evaluate the utility of demand assessments in predicting potential negative reinforcers other than demands for use in increasing appropriate behavior and for decreasing problem behavior. For example, one could evaluate idiosyncratic types of aversive situations (e.g., noise, crowded environments) as potential negative reinforcers in addition to demand presentation. Third, it would be of clinical benefit to develop treatment packages for each participant based on the findings of their demand assessments and functional analysis.

Lastly, more research is needed on the utility of indirect assessments for informing demand assessments.

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*Table 1.* Results of Matthew's indirect demand assessment. Highlighted demands indicate those chosen for use in demand assessments.

<b>Tasks</b>	<b>Resp. A</b>	<b>Resp. B</b>	<b>IOA</b>	<b>HP/LP/ Neutral</b>
Brush teeth	5	4	P	LP
Put on jacket	3	3	E	
Wash face	4	4	E	LP
Put on deodorant	3	3	E	
Put on shoes	3	3	E	
Wipe table	1	1	E	HP
Sweep floor	3	3	E	
Set table	2	2	E	HP
Put kidbook on shelf	3	3	E	
Pack backpack	4	2	NO	
Identify numbers	1	5	NO	
Identify community helpers	3	1	NO	
Stamp name	1	2	P	HP
Touch head	3	2	P	
Clap hands	3	2	P	Neutral
Jumping jacks	4	2	NO	
Touch toes	3	3	E	Neutral
Throw ball	2	4	NO	
Sit on floor	3	3	E	Neutral
Stand up (from floor)	4	2	NO	
<b>% Agreement (E or P)</b>			70%	

Figure 1. Results of demand assessment 1 (top graph) demand assessment 2 (middle and bottom graphs) for Matthew.

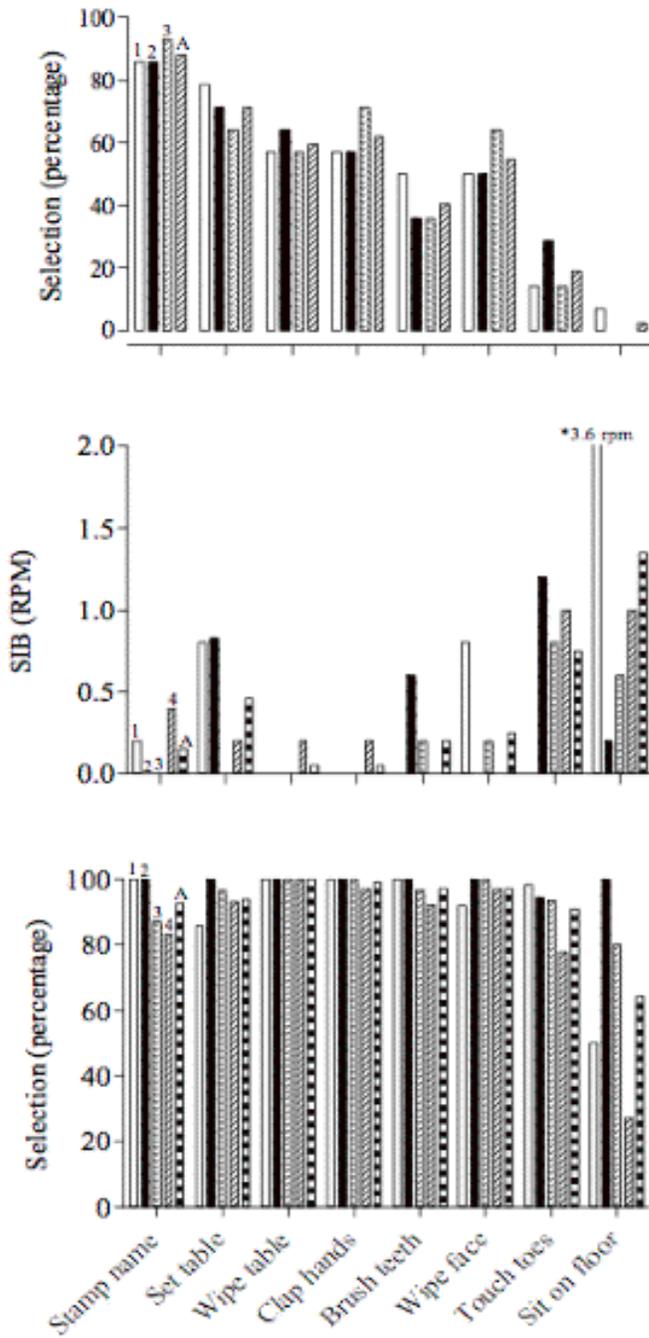


Figure 2. Results of Matthew's functional analysis.

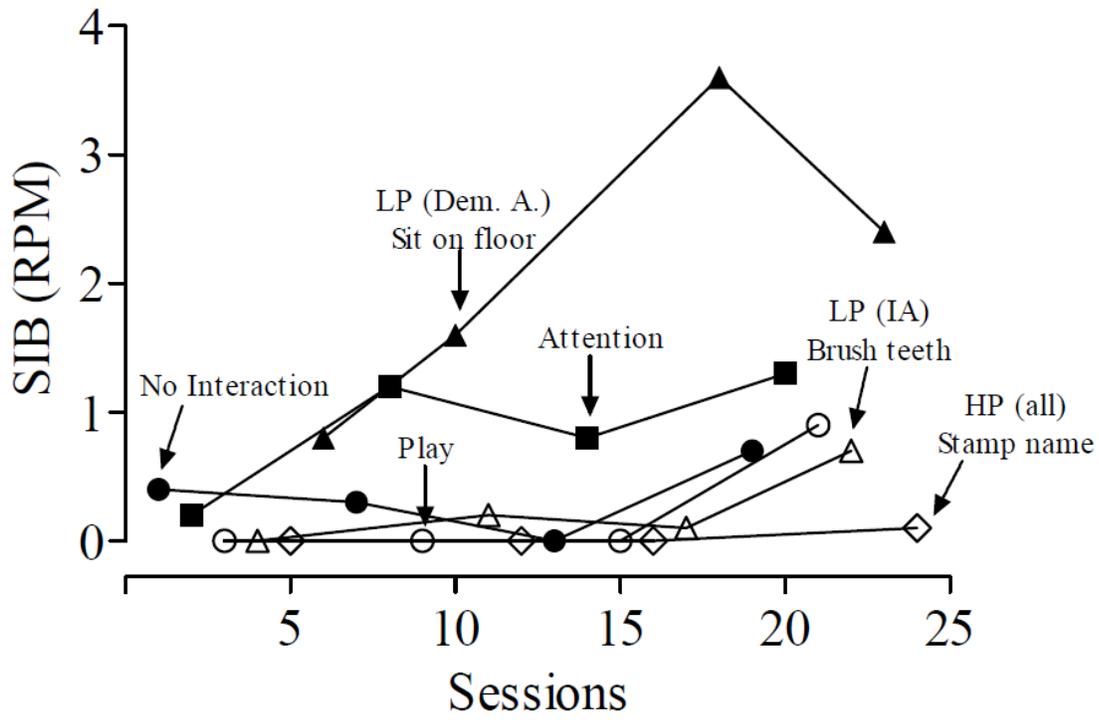
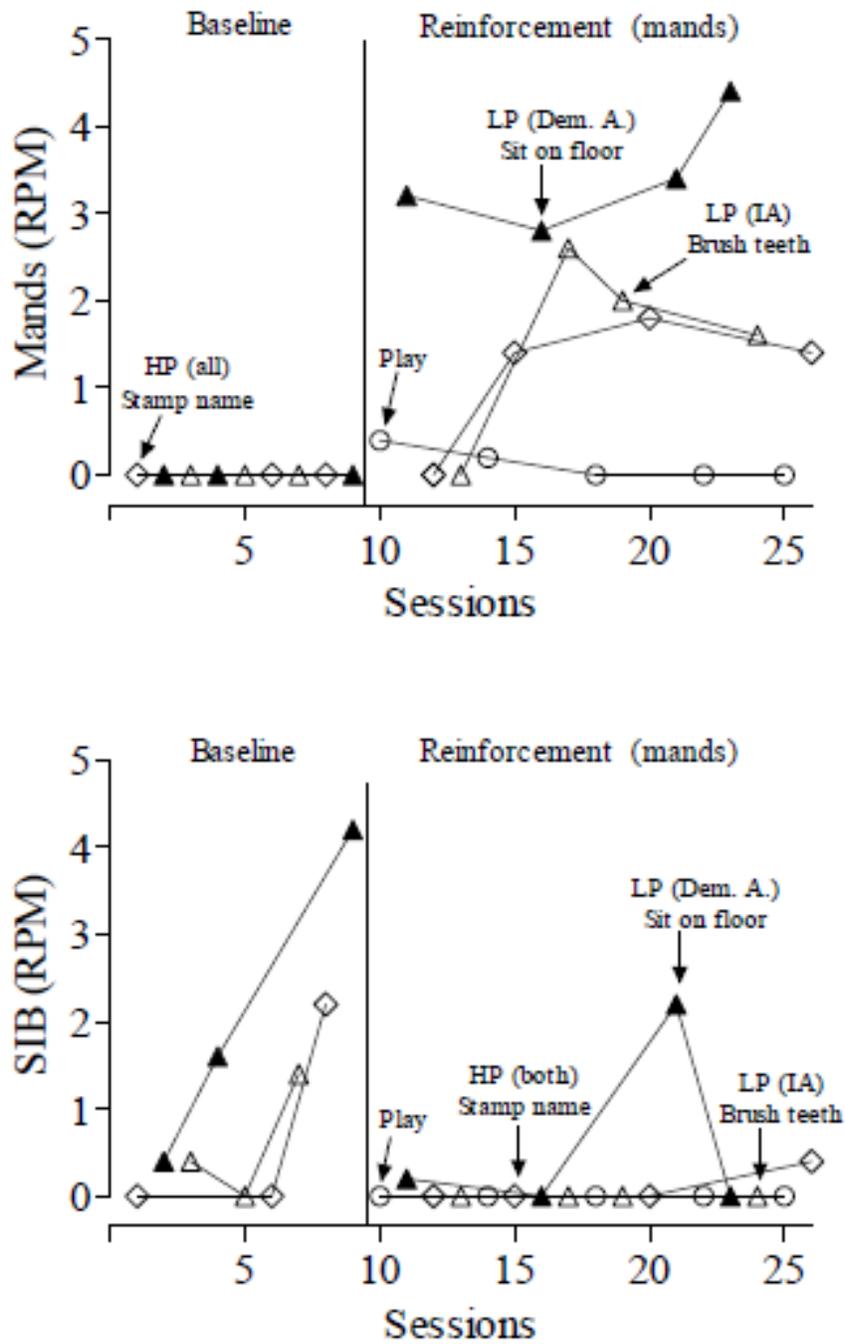


Figure 3. Responses per minute of mands (top graph) and SIB (bottom graph) during Matthew's negative reinforcer assessment.



*Appendix A*

**Indirect Demand Assessment Questionnaire**

STUDENT'S NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

NAME OF REPORTER: \_\_\_\_\_

The purpose of this questionnaire is to get information about certain tasks or demands that a student does or does not enjoy or readily engage with.

There are some self-care tasks/demands that students may or may not enjoy or readily engage with. Examples of self-care tasks/demands include putting on a jacket, tying a shoe, and brushing hair. What are some self-care tasks/demands that \_\_\_\_\_ comes into contact with?

Task/demand

There are some domestic tasks/demands that students may or may not enjoy or readily engage with. Examples of domestic tasks include folding a shirt, wiping a table, and sorting silverware. What are some domestic tasks/demands that \_\_\_\_\_ comes into contact with?

Task/demand

There are some academic tasks/demands that students may or may not enjoy or readily engage with. Examples of academic tasks include counting, match-to-sample, and doing a worksheet. What are some academic tasks/demands that \_\_\_\_\_ comes into contact with?

Task/demand

There are some physical tasks/demands that students may or may not enjoy or readily engage with. Examples of physical tasks include walking across the room, doing sit-ups, and touching toes. What are some physical tasks/demands that \_\_\_\_\_ comes into contact with?

Task/demand

Please list any other tasks/demands that may not have fallen into the previous categories. Include both tasks/demands that \_\_\_\_\_ enjoys and engages with most and those that she dislikes, avoids, or have led to problem behavior in the past.

Task/demand

*Appendix B***Indirect Demand Assessment Questionnaire**

STUDENT'S NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

NAME OF REPORTER: \_\_\_\_\_

The purpose of this questionnaire is to get information about certain tasks or demands that a student does or does not enjoy or readily engage with, and to rank these demands in terms of the degree to which the student enjoys completing the task and/or readily engages with the task.

There are some self-care tasks/demands that students may or may not enjoy or readily engage with. Examples of self-care tasks/demands include putting on a jacket, tying a shoe, and brushing hair. Please rank the following tasks on a scale of 1 (enjoys most/readily engages with most) to 5 (strongly dislikes/frequently avoids or fails to engage with).

Task/demand	Enjoys most/ engages with most	Enjoys somewhat/ engages with sometimes	Neutral	Dislikes somewhat/ sometimes avoids or fails to engage with	Strongly dislikes/ frequently avoids or fails to engage with
Brush teeth	1	2	3	4	5
Put on jacket	1	2	3	4	5
Wash face	1	2	3	4	5
Put on deodorant	1	2	3	4	5
Put on shoes	1	2	3	4	5

There are some domestic tasks/demands that students may or may not enjoy or readily engage with. Examples of domestic tasks include folding a shirt, wiping a table, and sorting silverware. Please rank the following tasks on a scale of 1 (enjoys most/readily engages with most) to 5 (strongly dislikes/frequently avoids or fails to engage with).

Task/demand	Enjoys most/ engages with most	Enjoys somewhat/ engages with sometimes	Neutral	Dislikes somewhat/ sometimes avoids or fails to engage with	Strongly dislikes/ frequently avoids or fails to engage with
Wipe table	1	2	3	4	5
Sweep floor	1	2	3	4	5
Set table	1	2	3	4	5
Put kidbook on shelf	1	2	3	4	5
Pack backpack	1	2	3	4	5

There are some academic tasks/demands that students may or may not enjoy or readily engage with. Examples of academic tasks include counting, match-to-sample, and doing a worksheet. Please rank the following tasks on a scale of 1 (enjoys most/readily engages with most) to 5 (strongly dislikes/frequently avoids or fails to engage with).

Task/demand	Enjoys most/ engages with most	Enjoys somewhat/ engages with sometimes	Neutral	Dislikes somewhat/ sometimes avoids or fails to engage with	Strongly dislikes/ frequently avoids or fails to engage with
Identify numbers	1	2	3	4	5
Identify community helpers	1	2	3	4	5
Stamp name	1	2	3	4	5
Touch head	1	2	3	4	5
Clap hands	1	2	3	4	5

There are some physical tasks/demands that students may or may not enjoy or readily engage with. Examples of physical tasks include walking across the room, doing sit-ups, and touching toes. Please rank the following tasks on a scale of 1 (enjoys most/readily engages with most) to 5 (strongly dislikes/frequently avoids or fails to engage with).

Task/demand	Enjoys most/ engages with most	Enjoys somewhat/ engages with sometimes	Neutral	Dislikes somewhat/ sometimes avoids or fails to engage with	Strongly dislikes/ frequently avoids or fails to engage with
Jumping jacks	1	2	3	4	5
Touch toes	1	2	3	4	5
Throw ball	1	2	3	4	5
Sit on floor	1	2	3	4	5
Stand up (from floor)	1	2	3	4	5

Please list and rank any other tasks/demands that you feel should be included in the previous categories (self-care, domestic, academic, physical) or that may not have fallen into the previous categories. Include both tasks/demands that \_\_\_\_\_ enjoys and engages with most and those that \_\_\_\_\_ dislikes, avoids, or have led to problem behavior in the past.

Task/demand	Enjoys most/ engages with most	Enjoys somewhat/ engages with sometimes	Neutral	Dislikes somewhat/ sometimes avoids or fails to engage with	Strongly dislikes/ frequently avoids or fails to engage with
	1	2	3	4	5
	1	2	3	4	5
	1	2	3	4	5

	1	2	3	4	5
	1	2	3	4	5