THE EFFECTS OF THE PREMACK PRINCIPLE ON ON-TASK BEHAVIOR, CHALLENGING BEHAVIOR, AND CORRECT RESPONDING

by

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(Under the Direction of Kevin Ayres)

ABSTRACT

The Premack principle states that any Response A can reinforce any other Response B if the independent rate of A is greater than the independent rate of B (Premack, 1959). Applying the Premack principle involves arranging the environment to restrict access to certain responses based on relative probabilities of a set of given responses (Timberlake & Farmer-Dougan, 1991). Practitioners may apply the Premack principle when arranging contingencies, such as first – then statements. Though there is literature to support that arranging contingencies based on the Premack principle can increase engagement in low probability responses, further evaluation is needed to examine the impact these contingencies have on other behaviors. The present stud evaluates the impact of arranging activity schedules according to the Premack principle on on-task behavior, challenging behavior, and correct responding. Results suggest that there is no differentiation on these other behaviors when arranging contingencies according to the Premack principle when compared to other arrangements.

INDEX WORDS: Premack principle, on-task behavior, challenging behavior, correct responding

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DEDICATION

I would like to dedicate this endeavor to my family. Mom, Dad, and David – I could not have done this without you. You have made me the person, scholar, practitioner, friend, colleague, and learner that I am today. Thank you for everything. I love you with my whole heart.

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CHAPTER 1

INTRODUCTION

Some students with autism spectrum disorder (ASD) and other developmental disabilities may engage in challenging behaviors that impede their learning, disrupt their environment, and increase social isolation (Nicholls et al., 2020). These challenging behaviors may lead to greater restriction in educational placement and reduce future opportunities for independence (Hodgetts et al., 2013). A review by Machalicek et al. (2007) identified four categories of interventions for reducing challenging behavior in school settings for students with ASD including antecedent manipulations, change in instructional context, differential reinforcement, and self-management techniques. Further, some studies reviewed by Machalicek et al. (e.g., Massey & Wheeler, 2000; O'Reilly et al., 2005) identified interventions that not only decrease problem behavior but also increase engagement or on task behavior.

Instructional engagement is an integral component of effective intervention for learners with ASD (Steinbrenner & Watson, 2015). Educators may target increasing on-task behavior as a preventative approach to minimize likelihood of disruptive behavior and increase academic engagement (Richards et al., 2010). Instructional engagement is a prerequisite for learners with ASD to acquire skills related to increased independence such as communication, academics, or leisure activities (Steinbrenner & Watson, 2015).

Many educational strategies for increasing instructional engagement are based in the practices of applied behavior analysis (ABA; Collins, 20212). Use of ABA in classrooms

involves arrangement of environmental conditions to evoke desired student behavior (Alberto & Troutman, 2013). Trump et al. (2018) identified first-then statements as one example of a behavior analytic strategy educators may implement to increase appropriate student behavior (e.g., on task behavior, skill acquisition, etc.) and reduce challenging behavior.

First - then statements describe a behavioral contingency where the “first" component specifies the targeted behavior and the “then” component specifies the consequence contingent upon the targeted behavior occurring (Mechner, 2008). Practitioners use first - then statements prior to placing a demand that specifies the response requirement to gain access to a reinforcer (Trump et al., 2018). This contingency arrangement may be presented using a visual support, such as a first-then board or a visual schedule (e.g., Warren et al., 2021). Some could consider this approach an antecedent strategy, which describes a manipulation of the environment prior to an individual’s opportunity to engage in targeted behavior (Cooper et al., 2020). Arranging an activity sequence in this order and presenting contingency specifying stimuli may serve as an antecedent manipulation, however the practice is effective because of the reinforcing properties of the “then” component.

Premack Principle

The effectiveness of contingencies arranged in this manner can be explained by the probability-differential hypothesis, or Premack principle. The Premack principle describes that any response A can reinforce any other response B if the independent rate of A is greater than the independent rate of B (Premack, 1959). In other words, responses with a higher probability of occurring can serve as a reinforcer for responses with a lower probability of occurring (Jacobs et al., 2017). Timerlake and Allison (1974) expanded on Premack’s work to describe the response-deprivation hypothesis. The response-deprivation hypothesis suggests that any response,

regardless of free operant probability, can serve as a reinforcer if interventionists are able to restrict access to it (Timberlake & Farmer-Dougan, 1991). Therefore, lower probability Response B could also serve as a reinforcer for higher probability Response A if access to Response B can be restricted.

The practice of first - then contingency statements typically employs the Premack principle with the response-deprivation hypothesis when arranging a contingency and uses the opportunity to engage in a high probability response to reinforce a lower probability response. By restricting access to the "then" activity, this activity can serve as a reinforcer for the "first" activity, and therefore increases the likelihood it will occur in the future. Contemporary texts such as Cooper et al. (2020) informally refer to the Premack principle as "Grandma's Law" to highlight its practicality in applied situations. For example, if a child spends more time playing outside (i.e., the higher probability response) than cleaning their bedroom (i.e., the lower probability response), the Premack principle would suggest that access to playing outside will reinforce bedroom cleaning and consequently increase the likelihood the child will clean their bedroom in the future. The response-deprivation hypothesis would suggest that to reinforce the behavior of bedroom cleaning, access to playing outside must be restricted until the bedroom cleaning occurs. Arranging contingencies in this way suggests access to engaging in a specific response or activity is serving as a reinforcer as opposed to delivery of a specific stimulus serving as a reinforcer (e.g., tangible or edible items; Cooper et al., 2020). For example, the stimulus of a preferred food itself does not necessarily serve as a reinforcer, but access to the response of eating a preferred food may (Killeen & Jacobs, 2017).

First - then contingency statements utilizing the Premack principle would require engagement in a lower probability response prior to accessing a higher probability response. For

example, if identifying numbers was identified as a higher probability response for a student than identifying letters, the Premack principle would suggest that practitioners first place letter identification demands prior to number identification demands so that the activity of number identification functions as a reinforcer for completing letter identification demands. This contrasts with other antecedent strategy instructional arrangements sometimes used in educational settings whereby high probability demands may be placed before low probability demands.

The Present Evaluation

Premack's initial demonstration of the Premack principles evaluated participants' rate of responding between two concurrently available responses during 15 min sessions (Premack, 1959). Premack then restricted access to the participants' high probability behavior until they engaged in the low probability behavior. Premack demonstrated that by restricting access to the high probability behavior, participants' rate of responding in the low probability behavior increased (Premack, 1959). Though this experiment is the basis for the contemporary utilization of first-then statements, further evaluation is necessary to determine best practices when arranging contingencies this way in applied settings. Simply evaluating the increase of engagement in the low probability behavior may not provide a complete picture of an individual's responding when contingencies are arranged in this manner, considering the practitioner often has control over an individual's access to both behaviors (e.g., the practitioner could restrict access to number identification materials until the designated amount of letter identification tasks have been completed). Evaluation of additional dependent variables may help practitioners understand the impact of using first-then contingency statements on responding. Therefore, present evaluation sought to evaluate additional components of participant behavior

when activity sequences were arranged in accordance with the Premack principle, such as on-task behavior, challenging behavior, and correct responding. The present study's research questions are described below.

1. How do students with developmental disabilities respond (i.e., on-task behavior, challenging behavior, correct responding) when the order of activities starts with a low probability response activity followed by a high probability response activity (i.e. arranged according to the Premack principle) compared to when the order of activities starts with a high probability response activity followed by a low probability response activity?
2. How does the inclusion of edible reinforcement embedded within an activity sequence impact student behavior when the order of activities starts with a low probability response activity followed by a high probability response activity (i.e. arranged according to the Premack principle)?
3. Do rates of obtained reinforcement (i.e. edible reinforcers) differ between the activity sequence based on Premack principle (i.e., low to high probability activity) compared to a comparison activity sequence (i.e., high to low probability)?

CHAPTER 2

REVIEW OF THE LITERATURE

The following is currently under review at Behavior Modification. Premack's probability-differential provided behavior analysts an alternative perspective to program for reinforcement. Structural descriptions of positive reinforcement have traditionally described it as access to a stimulus in temporal relation to a response (Skinner, 1938), whereas Premack made the distinction that reinforcement could be achieved through access to engaging in a response (Premack, 1959). This led to the Premack principle, which involves arranging the environment to restrict access to certain responses based on relative probabilities of a set of given responses (Timberlake & Farmer-Dougan, 1991). This theory capitalizes on reinforcer relativity, which suggests the relative probabilities of responses can be more impactful than preference. The Premack principle states that any Response A can reinforce any other Response B if the independent rate of A is greater than the independent rate of B, which is greater than the independent rate of response C (Premack, 1959). Thus, a response can serve as a reinforcer in some environmental circumstances, but not others. For example, Response A will Reinforce Response B and Response C. Response B will reinforce Response C, but Response C will not reinforce Responses A or B. Therefore, Response B both is and is not a reinforcer depending on the other available responses available in a situation (Premack, 1959). The Premack principle focuses on two separate responses. The first response, the one that serves as the reinforcer, is referred to as the “contingent response” and the second response, the one that grants access to the

contingent response, is referred to as the "instrumental response." In the example above, Response A is a contingent response to reinforce the instrumental Response B.

The introduction of the Premack principle was widely popular, as it made identification of reinforcers convenient and unintrusive (Timberlake & Farmer-Dougan, 1991). Though a prominent development in the field, the Premack principle has some limitations. Premack described that the only way to determine response probability was collecting duration data on unrestricted responding, but this creates challenges when determining probability of discrete behaviors (Konarski et al., 1981). Additionally, the responses possible to serve as reinforcers are limited in that the contingent response must always be of higher probability than the instrumental response. If not, Premack suggested that the subject being forced to engage in the lower probability response would theoretically serve as a punisher (Premack, 1959).

Timberlake and Allison (1974) expanded upon Premack's work with the response deprivation hypothesis, which subsequently introduced the disequilibrium model (Timberlake & Farmer-Dougan, 1991) for effective use of the Premack principle. This suggests that an instrumental response, even if it is the lower probability behavior, will still serve as the contingent response if the schedule of reinforcement satisfies response-deprivation below independent levels of responding (Timberlake & Allison, 1974). This differs from Premack's initial work in which he described that for a response to be a reinforcer, independent levels of responding of the contingent response had to be higher than the instrumental response.

Timberlake and Allison (1974) present their approach using the equation $I/C > O_I/O_C$. In this equation, I represents the scheduled amount of instrumental responding required to obtain C amount of the contingent response. O represents the operant levels of instrumental and contingent responding during an independent baseline with no contingencies in place. Similarly,

they present the equation $I/C > O_I/O_C$. to demonstrate that the environment can be arranged so that, through restricting access to the lower probability behavior, the lower probability can serve as a reinforcing, contingent response with the high probability behavior as the instrumental response. With this essential component, researchers can manipulate the schedule of reinforcement and adapt to motivation that changes based on the imposed contingency schedule (Timberlake & Allison, 1974).

Timberlake and Farmer-Dougan (1991) reported that the Premack principle was described in a variety of textbooks used by the behavior analytic community since the 1970s (e.g. Donnellan et al., 1988; Kazdin, 1980; Sulxer-Aseroff & Mayer, 1977). However, Konarski et al. (1981) cited a lack of empirical support for the Premack principle at that time. Furthermore, the extant data often selected the contingent response to be a reinforcer based on anecdotal reports, not on the probability of a response (Konarski et al., 1981). The gap in the literature that Konarski et al. identified is relevant to both practitioners and researchers and warrants further investigation given that the Premack principle is still described in many contemporary behavior analytic texts, such as Cooper et al. (2020) and Alberto and Troutman (2013). The purpose of the current review of the literature is to assess the extent to which researchers have evaluated Premack principle and re-examine the data supporting its applied use in the 40 years since Konarski et al.'s reported the lack of published, empirical evidence. Further, this review weighs the rigor of the extant literature in an effort to identify best practices for future evaluation by researchers and practitioners.

Method

Search Procedures

The first author conducted a search of the databases PsychINFO, ERIC, PsychARTICLES, and PubMed in March 2020. They used the search terms “premack principle” in quotation marks and “response deprivation” in two separate searches. Neither truncation nor wildcards were used in the search. Studies were included in the review based on the following criteria: (a) human participants, (b) contains the word “premack,” (c) written in English. After duplicates were removed, this initial search yielded 79 studies. The first author evaluated the 79 studies using the additional inclusion criteria of (d) applied research (evaluating behaviors of importance to man or society as opposed to theory; Baer et al., 1968; Cooper et al., 2020) and (e) experimental (comparison of a phenomenon of interest under 2 or more conditions; Cooper et al., 2020). The additional inclusion criteria reduced the included studies to a total of 33. These studies included both published articles as well as unpublished theses and dissertations to reduce the likelihood of publication bias influencing review findings (King et al., 2020).

The first author then conducted an ancestral search on the references of the 33 studies from the initial search that added 12 more studies in the review. Next, the first author conducted a forward search of Premack’s 1959 article on PsychINFO. This yielded 76 studies; of these 7 studies met all inclusion criteria and were added to the review. Additionally, the authors completed a hand search of the two journals most represented in the 52 included studies, Journal of Applied Behavior Analysis and Behavior Therapy. After reviewing the tables of contents of these journals from the years 2000 to 2020, no additional articles were added to the review. This resulted in a total of 52 studies with 61 separate experiments to be evaluated in the current review of the literature.

Coding Procedures

The reviewers coded descriptive participant and experiment characteristics for all experiments. Participant characteristics included gender, age, diagnosis, setting, and intellectual ability. Experiment characteristics included experimental design, dependent variable, evidence of independent responding, and potential of a causal relation. Additionally, coders evaluated the appropriateness of each article for inclusion considering the following criteria: (a) human participants, (b) contains the word "premack," (c) written in English, (d) applied research, and (e) experimental. All coders were trained on procedures and provided with operational definitions for each coding category.

Participant and Setting Characteristics

Reviewers coded participant and setting characteristics to examine the variety of circumstances in which researchers applied the Premack principle. Participant and setting characteristics included gender, age, diagnosis, setting, and intellectual ability. Reviewers coded any age description of the participants or if the specific ages were not reported. Participant diagnosis codes included autism spectrum disorder (ASD), intellectual disability (ID), developmental delays (DD), multiple diagnoses (coded separately from other diagnoses that might have been part of their multiple diagnoses), other diagnoses, or none (i.e., participants were typically developing). Experimental settings included hospital rooms, therapy rooms, classrooms, vocational settings, or living spaces.

Experimental Characteristics

Experimental characteristics included experimental design, dependent variable, evidence of response probability, and ability to demonstrate a causal relation. Reviewers coded the experimental designs as multiple probe/multiple baseline, alternating treatment design, group

design, or other design. Dependent variables were coded in the categories of problem behavior, academic responses, communicative response, vocational skills, activity allocation, and "other" variables that did not fit the definitions of the other, specific dependent variable categories.

Reviewers coded for evidence of response probability to if researchers presented baseline data to support the identified high and low probability responses. To accomplish this, researchers had to conduct a free operant paired baseline where the responses evaluated were simultaneously available without restriction (Timberlake & Allison, 1974). Experiments were coded as "with evidence" if the researchers presented data demonstrating independent levels of responding and coded "without evidence" if researchers did not have data on independent levels of responding or assumed probability based on preference or anecdotes.

Reviewers coded for the potential of a causal relation demonstration based on criteria described by Gast and Ledford (2018), which involves replication of experimental effects at least 3 times. If experiments met these criteria, they were scored as potentially demonstrating a causal relation. If not, the study was coded as not having the potential to demonstrate a causal relation. If an experiment met the criteria for the probability of a causal relation, reviewers used the Single Case Analysis and Review Framework (SCARF; Ledford et al., 2016) to evaluate the rigor of experiments. The SCARF data collection template specifies that its use is to evaluate rigor of studies designed with at least 3 potential demonstrations of effect, similarly to the qualifications for a causal relation as described by Gast et al. (2018). For those familiar with What Works Clearinghouse (WWC) standards for single case design (Kratochwill et al., 2010), SCARF was designed to build on the strengths of those standards and address some of the WWC omissions (e.g. requirement of procedural fidelity). The SCARF template uses response options of yes/no/not applicable or scaled responses from 0-4 to systematically code information about

each individual experiment in a study. The information collected from SCARF is displayed graphically to present a scatter plot of the included studies' quality and rigor.

Interrater Reliability

Interrater reliability (IRR) was conducted by the second, third, and fourth authors on all components of the review's search and coding procedures. All coders were graduate students who received training on the search procedures, coding procedures, and coding definitions. The second author conducted an independent initial search following the search procedures described above. The third author then analyzed the articles retrieved from the initial search and used the inclusion criteria to determine if they were appropriate for review. The second, third, and fourth authors coded 100% of the included studies for inclusion criteria, participant descriptions, and experiment characteristics. Additionally, the second author conducted an independent SCARF coding of 100% of the articles which met the criteria to be coded in SCARF.

IRR results

IRR was calculated by dividing agreements by the number of agreements plus disagreements and multiplying by 100. The independent literature search, conducted by the second author, resulted in 100% agreement (i.e. identical 79 studies to the first author's initial search). Additionally, the third author's evaluation of these 79 studies meeting inclusion criteria removed 43 studies, which was identical to the first author's evaluation resulting in 100% IRR. The second, third, and fourth authors took IRR data on the studies included from the initial, ancestral, and forward search results meeting inclusion criteria (a) - (e) with 100% agreement compared to the first author's assessment. Participant and experiment characteristics IRR, also conducted by the second through fourth authors, resulted in 97.42% agreement when averaged across articles and 96.55% agreement as well when averaged across coding categories. The

second author's SCARF scoring resulted in 98.21% IRR when compared to the first author's scoring.

Results

The review included 52 studies containing 61 experiments spanning the years 1959 to 2017. Tables 1 and 2 present participant information, dependent variables evaluated, setting, and research design per study. To address Konarski et al.'s (1981) concern regarding the lack of baseline responding prior to intervention in the Premack literature, we divided studies based on whether they established response probability in prior to implementation of Premack. The reviewed studies were separated into tables by those with evidence of response probability in Table 1 and those without evidence of response probability in Table 2. Figure 1 displays the assessment of rigor of the studies with evidence of response probability that had the potential to demonstrate causal relation as generated by SCARF.

With Evidence of Response Probability

Of the evaluated studies, 46% (n=24) met the criteria of providing evidence of response probability from participants before intervention. This means that researchers reported data demonstrating one response as high probability and another as low probability before arranging intervention based on the Premack principle. Many researchers collected these data through a free operant evaluation of response allocation (e.g., Aeschleman & Williams, 1989) but others measured response outcomes, such as grams of food consumed in Levin and Carr (2001). For all 24 studies, interventions involved restricted access to the high probability response and contingent access to it based on participant exhibition of the low probability response.

The participants in these studies ranged in age from 3 years to 60 years. Participant diagnoses included a range of intellectual functioning from severe intellectual disability to

typically developing. Studies also applied the Premack principle to individuals with a variety of other diagnoses, such as ASD, epilepsy, schizophrenia, language delay, depression, and Down's Syndrome. The Premack principle was applied on a wide variety of behaviors in diverse settings: classrooms (37.5%, n=9), therapy rooms (33.33%, n=8), hospital rooms (12.5%, n=3), vocational settings (8.33%, n=2), living areas (4.17%, n=1), and one did not report the setting (4.17%, n=1). Dependent variables evaluated in these studies included communication (20.83%, n=5), allocation between activities (20.83%, n=5), vocational skills (12.5%, n=3), academic skills (20.83%, n=5), problem behavior (8.33%, n=2), and other (16.67%, n=4). The "other" category included variables such as food consumption (Amari et al., 1995) or participation in exercise (Allen & Iwata, 1980). These variables were evaluated using withdrawal/reversal designs (50%, n=12), group designs (12.5%, n=3), multiple probe/baseline designs (8.33%, n=2), alternating treatment designs (8.33%, n=5), and other designs (20.83%, n=5). Examples of "other" designs included having AB design, such as Premack (1959) and Roberts (1969).

SCARF

Seven of the studies with evidence of independent responding met the criteria to be coded in SCARF. The six included studies contained 15 separate experiments that were evaluated individually. The SCARF graphic display is separated into four quadrants. The top left quadrant represents experiments with low rigor and positive effects, the top right quadrant represents experiments with high rigor and positive effects, the bottom left quadrant represents experiments with low rigor and negative or minimal effects, and the bottom right quadrant represents experiments with high rigor and negative or minimal effects (Ledford et al., 2016).

Figure 1 displays the experimental outcomes of studies included in the SCARF coding (n=15). Though all researchers indicate an increase in the instrumental response after application

of the Premack principle, the SCARF scatterplot allows for further analysis of the evidence of these results. The majority of the data points are in the top left quadrant, representing experiments with low quality evidence of positive effects. Additionally, some data points are in the bottom left quadrant, representing low quality evidence of negative or minimal effects, and there are 3 data points in the top right quadrant, which represents the experiments with high quality evidence of positive effects. Overall, the evaluation of studies included in SCARF suggest that the majority of studies do demonstrate positive effects of the Premack principle, however they lack quality evidence of findings.

Without Evidence of Response Probability

The remaining studies (54%, n=28) included in the review did not provide evidence of participant response probability prior to beginning intervention. Though researchers described that they used the Premack principle in their evaluation, these studies did not demonstrate baseline, independent performance to establish high probability versus low probability behaviors. This was often demonstrated by the assumption of a high probability behavior without data to support it. Geiger, for example, used recess as the contingent response but did not provide baseline responding that would empirically establish this as a high probability response (1996). Other studies, such as Browder et al. (1984), selected the contingent response based on anecdotal participant preference, but did not collect data to establish the preferred activity as a high probability response.

As with the studies with evidence of independence of responding, this group of studies also report to evaluate the Premack principle in diverse circumstances. The age range of participants in these studies was 3 years to 43 years. Participant diagnoses included a range of intellectual functioning from severe intellectual disability to typically developing as well as a

variety of other diagnoses, such as attention deficit hyperactivity disorder, anorexia nervosa, learning disability, deafness, and Down's Syndrome. These studies took place in classrooms (53.57%, n=15), living spaces (14.28%, n=4), vocational settings (7.14%, n=2), hospital rooms (7.14%, n=2), therapy rooms (10.71%, n=3), and some did not report the study setting (7.14%, n=2).

The dependent variables evaluated included: academic skills (41.67%, n=10), problem behavior (33.33%, n=8), vocational skills (7.14%, n=2), activity allocation (3.57%, n=1), and "other" (29.17%, n=7), such as weight loss (Blinder et al., 1970), stealing (Guidry, 1974), and tooth brushing (Lattal, 1969). Experimenters evaluated these dependent variables using withdrawal/reversal designs (29.17%, n=7), group designs (17.86%, n=5), multiple baseline/probe designs (14.28%, n=4), and "other" designs (45.83%, n=11). Studies coded as "other" for design included AB designs, such as McNamee-McGrory & Cipani (1995) or no experimental design at all, such as Homme et al. (1963).

Discussion

Many of the most comprehensive texts used to train behavior analysts include the Premack principle. For example, Cooper et al. (2020) discuss how Premack principle describes that the opportunity to engage in a behavior that occurs at a high free operant rate contingent on a lower frequency behavior will function as a reinforcer. They continue to explain how the Premack principle is informally referred to as "Grandma's Law" to help practitioners understand how to arrange contingencies, such as "when you finish your vegetables, you can have desert." Though this kind of contingency arrangement follows the premise of Premack principle, this example from Cooper et al. (2020) reflects concerns raised by Konarski et al. in their 1981 review. Konarski et al. (1981) described that published data on Premack relied heavily on

anecdotes about perceived preferences of participants. They suggested further research was needed with comprehensive data establishing probabilities of responding before implementing a contingency based on the Premack principle. Yet, approximately 40 years later, little has changed, and this review draws a similar conclusion. To the end that practitioners may use Premack, they may benefit from a more thorough explication of the process. However, to provide a description of the most efficient process may require further study.

This review of the literature identified a variety of strengths in the extant applied research. Most notably, the Premack principle has been examined with a variety of participants in a range of circumstances. This finding suggests that Premack's advancement in the construction of schedules of reinforcement has utility in diverse situations, which supports the idea that the Premack principle is a practitioner friendly manipulation of reinforcement schedules and can be conveniently utilized with existent resources in one's environment.

The current review also identified some weaknesses in the current literature. Over half of the studies identified as applied usages of the Premack principle did not collect data to establish the probability of behaviors prior to intervention. Additionally, the SCARF assessment identified that even in the studies that established behavior probability prior to intervention, the majority experiments with positive outcomes have low quality evidence of findings. If one were to weigh the use of Premack as an evidence-based practice, consider the quality of these findings. With such a parsimonious procedure, researchers could easily construct more robust investigations that would allow for more convincing conclusions.

Despite the findings that failed to fully implement Premack principle with baseline assessment of unrestricted responding, the data are largely promising and suggest that Premack principle, if implemented as first described, should result in behavior changes. Advances on

Premack's underlying idea (i.e., disequilibrium theory) may provide the quantitative model that would allow more careful high-fidelity implementation. Ultimately, much of the research that reflects Konarski et al.'s original concern suffers from a lack of procedural fidelity.

Future Directions

Researchers should continue to evaluate applications of the Premack principle with humans to expand the literature base of studies with probability of responding established as well as improve the rigor or the evaluations. Establishing a strong evidence base adds credibility to recommendations for using the Premack principle in practice. Further, those investigations should consider providing clear documentation of unrestricted baseline responding to communicate that they are in fact evaluating Premack (or disequilibrium theory). Doing so would represent an advancement in what fundamentally amounts to improving procedural fidelity and communicating that to readers. When practitioners are programming contingencies for the individuals they work with using Premack principle, they should first demonstrate baseline probability of responding prior to selecting the instrumental and contingent responses.

We recommend consulting Jacobs et al. (2017) prior to arranging environmental contingencies using the Premack principle or response deprivation hypothesis Jacobs et al. provide operationalized practitioner friendly procedures for utilizing the disequilibrium theory model, which combines the probability-differential hypothesis and response deprivation hypothesis. Additionally, they provide resources to help practitioners or researchers utilize Heth and Warren's (1978) model to predict the effectiveness of a contingency arrangement. This extends the utility of Premack in such a way that can allow for a most systematic and faithful application. Adding more work in this area would allow for a more nuanced understanding of the benefits and limits of response deprivation-based models.

Table 1

Studies With Evidence of Response Probability

Citation	N	Diagnosis	DV	Setting	Research Design
Aeschleman & Williams (1989)	2 males 1 female Ages 17-19 yrs	ID	Duration engagement in low probability tasks	Therapy room	MB/MP
Allen & Iwata (1980)	6 males 4 females Mean age 42 yrs	ID	Exercise completion	Classroom	Other
*Amari et al. (1995)	1 female Age 15 yrs	ID, Epilepsy	Ketogenic food consumption	Not reported	ATD
Bateman (1975)	1 male 1 female Ages 28 and 3 yrs	ID, Downs Syndrome	% of time in less preferred activity	Vocational	W/R
Birch et al. (1982)	5 males 7 females Preschool age	Not reported	Juice preference	Therapy room	Other
Dougher (1983)	2 males Ages 41 yrs	Schizophrenia	Frequency of social responses	Hospital room	W/R
Eddy (1975)	1 male 1 female Ages 6 and 9 yrs	ID	% of intervals with communication	Therapy room	W/R
Gupton & LeBow (1971)	2 males Ages not reported	Not reported	% of sales	Vocational	W/R

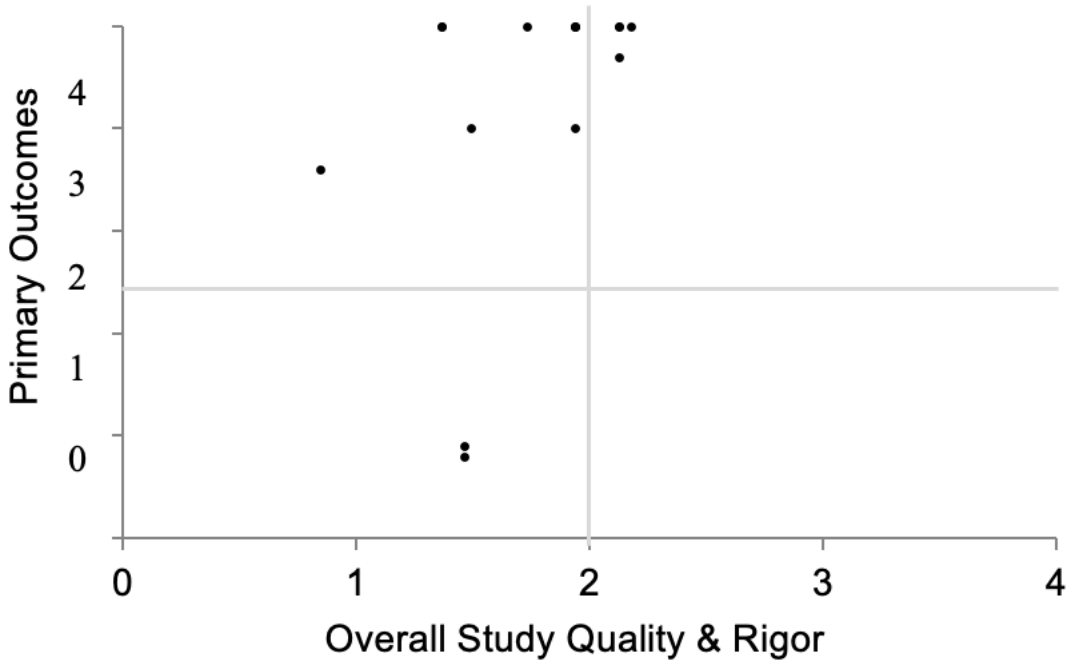
*Hanley (2003)	4 males Ages 23, 26, 42, 50 yrs	ID, ASD	% of interaction	Therapy room	W/R
Holburn & Dougher (1986)	1 female Age 21yrs	ID	Frequency of problem behavior	Therapy room	Other
Hosie et al. (1974)	Experiment 1 14 participants 6th grade Experiment 2 20 participants 5th and 6th grade	Not reported	Time to complete written report	Classroom	Group design
Konarski et al. (1982)	4 males Ages 7-10 yrs	ID	Duration of on task behavior	Classroom	W/R
Konarski et al. (1980)	Experiment 1 & 2 2 participants 1st grade	Typically developing	Duration of activity engagement	Classroom	W/R
*Levin & Carr (2001)	Experiment 1& 2 2 males 1 female Ages 5, 6, 6 yrs	ID, ASD	Grams of nonpreferred food consumed	Classroom	MB/MP
Love (1977)	8 participants Ages 7-8 yrs	Not reported	Academic responding	Classroom	W/R
*Mitchell & Stoffelmayr (1973)	2 participants Ages 55-60 yrs	Schizophrenia	Frequency of intervals working	Therapy room	W/R
*Noell et al. (2003)	2 males 3 females	ASD, Language	% academic tasks correct	Classroom	ATD

	Ages 3, 4, 4, 5 yrs	delay			
Premack (1959)	33 participants Average age 6 yrs	Not reported	Response allocation	Classroom	Other
Roberts (1969)	1 male Age 40 yrs	Schizophrenia	Rate of positive and negative statements	Hospital room	Other
Robinson & Lewinsohn (1973)	20 females Undergraduate college students	Depression	Rate of low frequency verbal behavior	Therapy room	Group design
Roemmich et al. (2004)	11 males 7 females Ages 10-11 yrs	Not reported	Rates of physical activity	Living space	Group design
Whitehurst (1972)	6 males 2 females Ages 6-7 yrs	Not reported	Number of correct academic responses	Classroom	W/R
Whitmarsh (2002)	Experiment 1 & 2 4 males Ages 5-18 yrs	ID, ASD	% of accurate academic responses	Therapy room	W/R
*Williamson (1984)	1 female Age 73 yrs	Depression	% of time engaging in relevant topics	Hospital room	W/R

Note. *potential to demonstrate experimental control, N = number of participants, ID = intellectual disability, ASD = autism spectrum disorder, ADHD = attention deficit hyperactivity disorder, DV = dependent variable, ATD = alternating treatment design/ W/R = withdrawal/reversal, MB/MP = multiple baseline/multiple probe.

Figure 1

SCARF Scatterplot



Note. This graph displays the SCARF scatterplot of experiment quality and rigor of the 15 experiments with evidence of response probability that had the potential to demonstrate experimental control.

Table 2

Studies Without Evidence of Response Probability

Citation	N	Diagnosis	DV	Setting	Research Design
Andrews, (1970)	Experiment 1 1 male Age 13 yrs Experiment 2 Unspecified participant number 7th grade	Not reported	Experiment 1 % correct Experiment 2 Frequency of problem behavior	Classroom of residential facility	Other
Azrin et al. (2007)	2 males Ages 13 yrs	ADHD, ID	% of activity calm	Classroom	Other
Blinder et al. (1970)	4 females Ages 15, 17, 20, 22 yrs	Anorexia nervosa	Weight gain	Hospital room	Other
*Browder et al. (1984)	8 participants Ages 24, 25, 29, 30, 36, 36, 40, 43 yrs	ID	Sight word and functional skill acquisition	Vocational	MB/MP
*Brown et al. (2002)	1 male Age 7 yrs	Learning disability	Food consumed per session	Living space	MB/MP
Charlop et al. (1990)	Experiment 1 4 males Ages 6, 7, 7, 8 yrs Experiment 2 3 males Ages 8, 8, 9 yrs	ASD	% correct task performance	Therapy room	ATD

	Experiment 3 3 males Ages 6, 6, 9 yrs				
Geiger (1996)	67 participants 6th, 7th, and 8th grade	Not reported	Work completion	Classroom	Group design
Guidry (1974)	1 male Age 20 yrs	Typically developing	Stealing behavior	Not reported	Other
Hartje (1973)	108 participants 5th grade	Not reported	Task preference	Classroom	Group design
Homme et al. (1963)	3 participants Age 3 yrs	Not reported	Problem behavior	Classroom	Other
Horan & Johnson (1971)	80 females Undergraduate college students	Not reported	Weight lost	Therapy room	Group design
Houtz & Feldhusen (1976)	Approximately 240 participants 4th grade	Not reported	Test scores	Classroom	Group design
Kumchy & Kores (1981)	1 participant Age not reported	ID	Duration of problem and appropriate behavior	Hospital room	Other
Lattal (1969)	8 males Ages 10-12 yrs	Not reported	% of subjects brushing teeth	Living space	Other

*Lyon (1976)	1 female Age 25 yrs	ID	Duration spent in classroom	Classroom	W/R
Makin & Hoyle (1993)	4 males Age not reported	Not reported	Engineer performance	Vocational	Other
McCullough & Southard (1972)	56 participants Ages 12-18 yrs	Not reported	Frequency of problem behavior	Living space	Other
McMorrow et al. (1978)	2 males 1 female Ages 22, 28, 30 yrs	ID, Schizophrenia	Frequency of activities attended	Living space	MB/MP
McNamee-McGrory & Cipani (1995)	1 female Age 4 yrs	Not reported	Occurrence of problem behavior	Classroom	Other
*Mithaug & Mar (1980)	1 male 1 female Ages 19 and 20 yrs	ID, Downs Syndrome	% choice of task	Classroom	W/R
Osborne (1969)	6 females Ages 11, 12, 12, 13, 13, 13 yrs	ID, Deaf	Mean out to seat responses per class segment	Classroom	W/R
Ramer (1980)	Experiment 1 12 participants Ages 17 – 40 yrs Experiment 2 105 participants Ages not reported Experiment 3 30 participants Ages not reported	Not reported	Oral hygiene	Therapy room	W/R

Slate & Jones (2003)	30 males 6th grade	Not reported	Subject grades and disciplinary referrals	Classroom	Group design
Turcios et al. (2017)	11 males 4 females Mean age 9 yrs	ASD	Completion of familiarization protocol	Not reported	Other
Van Hevel & Hawkins (1974)	12 participants 7th, 8th and 9th grade	Not reported	Correct responses	Classroom	W/R
Wasik (1970)	11 males 9 females 2nd grade	Typically developing	% of time engaging in desirable behavior	Classroom	W/R
*Welsh et al. (1992)	4 males 4 females Average age 20 yrs	Not reported	Frequency of food preparation errors	Vocational	Other
Yawkey & Le Penna Griffith (1974)	2 females Ages 5 yrs	Not reported	Operant crying behaviors	Classroom	W/R

Note. *potential to demonstrate experimental control, N = number of participants, ID = intellectual disability, ASD = autism spectrum disorder, ADHD = attention deficit hyperactivity disorder, DV = dependent variable, ATD = alternating treatment design/ W/R = withdrawal/reversal, MB/MP = multiple baseline/multiple probe.

CHAPTER 3

METHOD

Participants

The study included 5, five-year-old participants. The researcher recruited all five participants from the same classroom serving kindergarten through second grade students. Legal guardians provided informed permission for each child to participate. Students were enrolled in this classroom specifically to address challenging behaviors they exhibited including aggression, disruption, and elopement. Inclusion criteria consisted of (a) a history of successfully participating in academic instruction for at least 10 minutes at a time and (b) a history of mastering expressive or receptive academic skills. Individual participants are described below. The researcher acknowledges and respects the preference of many autistic individuals to be referred to using identify-first language. Since this preference was not communicated by the participants of this study, person-first language will be used.

Simone was an African American female with autism spectrum disorder (ASD) and speech or language impairment (SLI) eligibilities. Simone's Individualized Education Program (IEP) goals consisted of receptive and expressive identification and independent living skills (e.g., dressing, feeding). Simone communicated vocally using three-to-four-word phrases. Simone scored a 59.0 on the Verbal Behavior Milestones Assessment and Placement Program (VB - MAPP; Sundberg, 2008), which placed her in the Level 2 range, suggesting that she was beginning to demonstrate some learning and language skills. When evaluated using the Developmental Profile 3 (DP - 3; Alpern, 2007), Simone scored <50% of same aged peers in the

areas of cognition, communication, and adaptive behavior. Simone preferred teacher attention (e.g., tickles and hugs), dinosaurs, cars, and swings.

Jamar was an African American male with eligibilities of ASD and SLI. Jamar's IEP goals consisted primarily of receptive and expressive identification and communication skills. Jamar communicated using vocal language consisting of two-to-three-word phrases. Jamar's scores from the DP - 3 suggest that he exhibited delays in the areas of cognition, communication, and adaptive behavior when compared to peers of the same age. Jamar's classroom preferences included animals, Legos, and arts and crafts.

Emmett was a Caucasian male with eligibilities of ASD, significant developmental delay, and SLI. Emmett's IEP goals consisted primarily of receptive identification and independent living (e.g., dressing, feeding) goals. Emmett communicated using vocal approximations, a speech generating augmentative and alternative communication (AAC) device, and Picture Exchange Communication System (PECS; Bondy & Frost, 1994) at the Phase IV proficiency level. Emmett received an overall score of 31.0 on the VB - MAPP which fell in the Level 1 area. This suggested that Emmett's instruction should include carefully arranged contingencies and focus on establishing basic language skills. Additionally, Emmett's scores from the DP - 3 suggest that he exhibited delays in the areas of cognition, communication, and adaptive behavior when compared to peers of the same age. Emmett had a strong preference for all stimuli that included numbers and letters.

Shantel was an African American, female with ASD and SLI eligibilities. Shantel's IEP goals consisted primarily of receptive identification and independent living skills (e.g., dressing, feeding). She had a limited vocal repertoire consisting of one syllable utterances (e.g., "tih" for "tickles" or "ohh" for "open") and communicated using PECS at the Phase IIIB proficiency

level. Shantel scored an overall 25.5 on the VB - MAPP, which falls in the Level 1 range, suggesting she receive specialized instruction with carefully arranged contingencies including prompting, fading, shaping, and differential reinforcement. Additionally, Shantel scored a 54 on the DP - 3 for General Conceptual Ability, which met or exceeded the scores of less than 1% of her same-aged peers. Shantel's preferences included teacher attention (e.g., tickles and hugs), stuffed animals, and dancing.

Miguel was a Latino male with eligibilities of ASD, visual impairment, and SLI. Miguel's IEP goals consisted primarily of receptive identification and independent living (e.g., dressing, feeding) goals. Miguel communicated using a speech generating AAC device and used many adapted tactile supports in classroom instruction. Miguel's overall score on the VB - MAPP was 22.0, falling in the Level 1 range. This suggested that many of Miguel's instructional targets should focus on fine motor, gross motor, and self-help skills. Additionally, Miguel scored <50% of same aged peers when evaluated using the DP - 3 on cognitive, communication, and adaptive skills. Miguel's most preferred activities were watching videos on the iPad and eating snacks.

Setting

All five participants received special education services for seven hours per day in a self-contained, university-operated classroom for students with intellectual and developmental disabilities. Classroom staff consisted of university graduate students pursuing certification in behavior analysis or special education. Participants spent approximately 50% of their school day in 1:1 student to staff instructional sessions and the other 50% of their school day in small and whole group instruction. All conditions took place in the students' classroom which measured to be approximately 9 m x 4.5 m. Researchers conducted all sessions at a rectangle shaped table in

the middle of the classroom typically used for IEP instruction measuring 121 cm x 61 cm x 61 cm. The experimenters were two Board Certified Behavior Analysts and certified special education teachers; one who currently served as the participants' teacher of record and another who had the previous school year.

Materials

Materials used in each session included individualized IEP instructional materials, data collection materials, and visual activity schedule (VAS) materials for Simone, Jamar, and Emmett. Instructional materials include the individual instructional tasks per participant (described more specifically in Table 3). Instructional tasks in the study were selected based on a participants' IEP, but included novel targets per task to ensure the only exposure participants had to study specific targets was during study sessions and not standard classroom IEP time. For example, Miguel had an IEP goal of imitating motor movements. The researcher selected target motor movements for the study that Miguel was not learning in standard classroom IEP instruction. Additionally, each of the three study conditions (Premack Pure, Premack Prime, and Comparison Condition) had different targets per activity per condition. For example, Mateo's motor movement targets differed in each of the three study conditions. This allowed the researcher to evaluate skill acquisition in each condition separately. In addition, the researcher attempted to counterbalance the difficulty of targets across conditions. For example, Miguel did not have all motor movements using both arms in one condition, but spread across all conditions with other, less effortful motor movements only requiring one arm.

Additional study materials included those used in data collection. The researcher collected all session data by scoring video recordings of sessions collected using a GoPro camera. The application Countee (Peic & Hernández, 2016) was used on an iPad to measure

participants' on-task behavior, challenging behavior, and edible reinforcer delivery. Researchers used paper and pencil data to monitor correct responses and skill acquisition data per participant.

For Simone, Jamar, and Emmett, the researcher arranged the participants' VAS based on the condition being evaluated per session. The VAS pieces were 2.5 cm x 2.5 cm pictures of the materials used in each instructional task. These squares were arranged in different orders on a colored, laminated 5 cm x 10 cm strip to provide a visual schedule of the order of instructional conditions in three arrangements: Premack Pure, Premack Prime, and Comparison Conditions. In the Premack Pure and Premack Prime schedule arrangement, the visual schedule pieces were arranged on a yellow/blue schedule strip, respectively, in the order low probability activity to high probability activity. In the Comparison Condition schedule arrangement, the visual schedule pieces were arranged on a red schedule strip in the order high probability activity to low probability activity. A VAS component was included to evaluate the inclusion of a discriminative stimulus to represent the first, then contingency presented in each condition.

Dependent Variables, Response Definitions, and Measurement

The primary researcher collected data on the following responses: on task behavior, challenging behavior, correct responding, and rate of reinforcement per session. Table 4 displays dependent variable definitions.

On-Task Behavior

Percentage of session on-task was the primary dependent variable. To be considered engaging in on-task behavior, participants were located within an arm's reach of their chair (standing or seated) with their face oriented towards the instructor or instructional materials. On-task behavior was recorded using a timer on Countee to record total duration. Measurement procedures included a 2 s onset and offset criteria, so data collectors knew when to start and end

the on-task timer (i.e., a participant needed to meet the definition of on-task for 2 s before the data collector started the timer and the participant needed to stop meeting the on-task definition for 2 s before the data collector stopped the on-task timer). To calculate the percentage of the session on-task, the researcher divided the total duration of on-task behavior by the total session duration and multiplied by 100.

Challenging Behavior

All five participants engaged in the challenging behaviors of aggression, disruption, and elopement. The researcher used the same topographical definitions of these behaviors as were used in the participants' classroom. The data collection application Countee was used to measure the frequency and duration of challenging behavior as well as session duration.

The definition of aggression included hitting/kicking/head butting, defined as when a participant's hand, foot or head moved in the direction of another person within 2 s, and biting, defined as when a participant's mouth opened and closed around another person's skin resulting in teeth marks or redness of the skin. All attempts were scored as instances of aggression. Rate of aggression was measured by collecting a count of aggression occurrence and dividing that count by session duration.

The operational definition of disruption included throwing items, when a participant held an item in one or both hands and released the item through the air 7 cm or greater outside of appropriate toy play. Additionally, the disruption included hitting surfaces, defined as when a participant's hand, arm, foot, or item in hand came into contact with a surface from at least 7 cm away resulting in an audible sound or displacement of an item from its natural state; outside of appropriate toy play. All attempts were scored as instances of disruption. Rate of disruption was

measured by collecting a frequency count of disruption occurrence and dividing that count by session duration.

Elopement was defined as any instance in which the participant moved away from their designated area by more than 30 cm in any direction. This included any instance in which the participant's body went from standing or sitting to lying down without instruction to do so or any instance in which a participant placed their foot or torso on a piece of furniture. Duration of elopement per session was measured by collecting a timing duration per occurrence and dividing that measurement by session duration.

Correct Responding

Academic responses were scored correct when a participant engaged in the target response within 10 s of the initial task direction during a probe trial. Correct responses per activity are specified in Table 6. Percentage of correct responding will be calculated the percentage of correct responding per session per task. This was calculated by scoring the number of correct responses during probes per session, dividing that by the total number of targets per session, and then multiplying that by 100.

Rate of Reinforcement

The researcher collected data on the rate of delivery of reinforcement in the Premack Prime and Comparison Conditions. Reinforcement was defined as an instance when the researcher delivered an edible item to a participant. Rate of reinforcement was measured by collecting a count of reinforcer delivery and dividing that count by session duration. The data collection application Countee was used to measure both frequency of reinforcer delivery and session duration.

Reliability and Procedural Fidelity

Reliability and procedural fidelity data collection was completed by trained graduate students. Training on data collection procedures were conducted using behavior skills training (BST) which consists of explanation, demonstration, practice, and feedback (Parsons et al., 2012). Because the sessions were recorded, reliability and procedural fidelity data were collected for 100% of the sessions for all dependent variables across conditions. Additionally, reliability and procedural fidelity data were collected for 100% of all screening sessions per participant. IOA was calculated per session using the gross method for on-task behavior and correct responding and using the point-by-point method for challenging behavior and rate of reinforcement. For calculation of IOA for on-task behavior using the gross method, the primary researcher divided the smaller percentage of on-task behavior by the larger percentage of on-task behavior and multiplied by 100. When calculating IOA for challenging behavior and rate of reinforcement using the point-by-point method, an agreement between observers occurred when both observers scored an instance of behavior happening within 5 s of each other. IOA was calculated by dividing agreements by disagreements plus agreements and multiplying by 100 for each dependent variable. Procedural fidelity was calculated by calculating the number of steps correctly completed by the total number of procedural steps and multiplying that number by 100.

IOA and procedural fidelity were collected for 100% of pre-experimental sessions (present levels screening, matching VAS screening, concurrent schedule arrangement, and reinforcer assessment) for all 5 participants with overall results of 100% agreement and 100% fidelity of procedure implementation. IOA and procedural fidelity data were also collected during 100% of experimental sessions, with two exceptions. Agreement data on correct responding were not collected on Simone and Jamar's first three sessions due to an inability to

see or hear responding during the video recordings. Following these sessions, reliability data collectors collected correct responding IOA data in person to prevent this issue occurring for the remainder of the study. In sum, correct responding agreement data was only collected for 80% of Simone and Jamar's sessions.

Simone's sessions were implemented with an average of 97.3% fidelity (range 84.4% - 100%). Simone's on-task agreement data averaged to 94.3% (range 82.7% - 99.5%), challenging behavior agreement averaged 94.1% (range 71.4% - 100%), correct responding agreement averaged 100%, and rate of reinforcement agreement averaged 95.1% (range 87.2% - 100%). Jamar's sessions were implemented with an average of 97.2% fidelity (range 86.7% - 100%). Jamar's on-task agreement data averaged to 96.6% (range 93.8% - 100%), challenging behavior agreement averaged 98.9% (range 93.3% - 100%), correct responding agreement averaged 100%, and rate of reinforcement agreement averaged 91.5% (range 84.2% - 97.4%). Emmett's sessions were implemented with an average of 99.4% fidelity (range 95.6% - 100%). Emmett's on-task agreement data averaged to 96.5% (range 84.4% - 99.8%), challenging behavior agreement averaged 100%, correct responding agreement averaged 100%, and rate of reinforcement agreement averaged 95.4% (range 89.2% - 100%). Shantel's sessions were implemented with an average of 97.5% fidelity (range 85.7% - 100%). Shantel's on-task agreement data averaged to 94.7% (range 84.7% - 99.9%), challenging behavior agreement averaged 100%, correct responding agreement averaged 100%, and rate of reinforcement agreement averaged 91.9% (range 84.1% - 100%). Miguel's sessions were implemented with an average of 95.9% fidelity (range 88.5% - 100%). Miguel's on-task agreement data averaged 95.4% (range 85.3% - 100%), challenging behavior agreement averaged 94% (range 66% -

100%), correct responding agreement averaged 98.9% (range 83.3% - 100%), and rate of reinforcement agreement averaged 92.8% (range 81.3% - 100%).

Pre-Experimental Procedures

Concurrent Schedule Arrangement

The researcher conducted a concurrent schedule assessment (Cooper et al., 2020) to identify a high and low probability response activity for each participant. This evaluated participant responding during two IEP activities to determine which activity a participant was more likely to engage in. During a concurrent schedule session, the researcher presented a participant with two different IEP activities on different sides of the table separated by masking tape. Both activities' materials were placed approximately 15 cm in front of participants and the side of presentation was randomized per session to control for a side bias. To start the session, the therapist presented a participant with both activities by stating, "we can work on this activity (with the activity's name) on this side of the table or this activity (with the activity's name) on this side of the table. You can switch activities any time you want. Pick one." After the participant picked one activity the researcher placed demands in that activity. If the student moved to the other side of the table, the researcher began placing demands in the other activity. Sessions lasted 3 minutes. The researcher documented the duration spent in each activity.

Researchers conducted the concurrent schedule arrangement, comparing each IEP to activity to each other, until a differentiation of high and low probability response allocation was demonstrated across all activities evaluated. For a clear hierarchy to be established, the researcher needed to identify a high probability response selected at least 80% of sessions and a low probability response selected no more than 40% of sessions, as suggested by Mace et al. (1988). Activities evaluated in the concurrent schedule arrangement are described per participant

in Table 3. The researcher used the most frequently selected activity as the high probability response and the least selected activity as the low probability response.

For Simone, the high probability activity selected was typing letters and she allocated responding to this activity for 80% of five conducted concurrent operant sessions. Jamar's high probability activity selected was writing letters and he allocated responding to this activity for 99.1% of three concurrent schedule sessions. Emmett's high probability was typing consonant-vowel-consonant (CVC) words and he allocated responding in this activity 87.5% of four concurrent operant sessions. The high probability activity for Shantel was teacher identification and she allocated responding to this activity for 100% of three concurrent operant sessions. Miguel's high probability activity was motor imitation and he allocated responding to this activity for 80.2% of three concurrent schedule sessions.

Screening

Present levels. Once researchers established a high and low probability activity for each participant, they conducted screening assessments to establish unknown targets for each participant in both the low and high probability activities. During screening sessions, the therapist presented the participant with the task direction and waited 10 s to observe the participant's response to the task direction. If the participant responded correctly, the therapist provided a vocal praise statement and proceeded to the next trial. If the participant did not respond or responded incorrectly within 10 s, the therapist did not respond and presented the next trial. These procedures continued until researchers identified 15 unknown targets (for Simone, Jamar, Emmett, and Shantel) or 9 unknown targets (for Miguel) participants had responded incorrectly to across three trials. The researcher selected to reduce the number of targets for Miguel per condition based on prior classroom data regarding of Miguel's rate of skill

acquisition. The primary researcher conducted screening of targets in each activity per participant.

Each participant responded with 0% independence for all targets selected in both activities evaluated in the present study. The targets selected for each participant per condition are displayed in Table 5.

Matching VAS pictures. Screening procedures also included assessing participants' ability to match an activity's materials to the VAS picture used in its representation on the schedule. The researcher presented the different activity materials to each participant. The researcher then presented the participant with a VAS picture associated with one of the three and instructed the participant to "match." The researcher then collected data on the participants' correct matching of the VAS picture to the activity. Mastery criteria for matching VAS pictures to activity pictures included 3 independent, correct responses across 3 trials per activity. If participants did not engage in this matching skill independently, the researcher used simultaneous prompting to teach the skill until the participants reached mastery criteria.

Following the screening procedures to determine if participants could match the VAS images to the items used in the corresponding activity, only Simone, Emmett, and Jamar ever met mastery criteria for use of the VAS throughout the experiment. These three participants used a VAS as part of the experimental procedures, whereas Shantel and Miguel did not. Following ten sessions of teaching trials with no progress made towards mastery, the researcher continued the experiment without the VAS component for Shantel and Miguel.

Reinforcer Assessment

Researchers conducted an assessment to establish individualized preferred edible items as reinforcers for each participant. The reinforcer assessment was conducted in a concurrent operant

arrangement (DeLeon et al., 2001). Each participant was brought to the table for academic instruction with two sets of identical academic materials in front of them divided by a piece of masking tape. One side of the table held solely the academic materials and the other held the academic materials as well as various preferred edible items to the individual participant. The side of the table with preferred edible items was randomized per trial.

When the researcher brought the participant to the table, they explained the contingencies with each side of the table (i.e. one side with work and one side with work and edible items) then instructed to "pick a side of the table to do your work." The researcher recorded which side of the table participants selected per trial. If students selected the side with edible items, they were allowed to choose from the edible items on that side while completing the three demands.

During edible reinforcer assessment sessions, the primary researcher evaluated if participants would be more likely to select a workstation (i.e., side of a table) to complete work when earning preferred edible items as opposed to a workstation without preferred edible items. After following reinforcement assessment procedures, the primary researcher calculated that Simone selected the work station with edible items 88.8% of nine reinforcer assessment sessions, Jamar 85.7% of seven reinforcer assessment sessions, Emmett 83.3% of six reinforcer assessment sessions, Shantel 100% of five reinforcer assessment sessions, and Miguel 100% of five reinforcer assessment sessions.

Experimental Procedures

Sessions began with the researcher presenting the VAS and/or stating the order for the respective session type (i.e., Premack Pure, Premack Prime, or Comparison). The researcher would read the schedule order to the participant and then begin with the first activity in the schedule. Each session included probes and teaching trials. A session began with probing correct

responses, where the experimenter presented the instructional demand per activity with no prompting. Once all the condition targets were probed, the experimenter began teaching trials using simultaneous prompting (Collins, 2012). During simultaneous prompting trials, the experimenter would deliver the task direction and then immediately deliver the controlling prompt individualized per participant. Each target across conditions received three teaching trials per session. Apart from the Premack Pure condition, the experimenter delivered edible items on a fixed ratio of one edible item per response (FR1). The researcher selected an FR schedule because an FR1 schedule would theoretically allow the possibility of a dense rate of reinforcement and high response rates would permit rapid contact with reinforcement. The researcher delivered an edible reinforcer contingent upon responding, not upon correct responding. This procedural decision was made to ensure the schedule of reinforcement was consistent across each activity component and not different between probes and teaching trials. Once an entire activity was completed (i.e., probes and teaching trials), the researcher removed the first activity's image from the VAS and/or stated that the first activity was completed and began the session procedures with the next condition on the schedule until both activities were completed.

If participants engaged in any instances of challenging behavior during the session, the researcher responded as they typically would in the participants'classroom instruction. If a participant engaged in aggression, the researcher blocked the aggression and stated the contingency: "when you are sitting with your hands to yourself, we can finish our work." If the participant engaged in disruption, the researcher would retrieve the materials without providing any attention and continue with the session. If the participant engaged in elopement, the

researcher used three step prompting (verbal, model, physical; Collins, 2012) to guide the participant back to their seat and continue the session.

Premack Pure Condition. The purpose of this condition was to evaluate the participants' responding when the only programmed reinforcement for responding in the low probability activity was contingent access to the high probability activity. Sessions in this condition began with the researcher arranging the VAS pieces from low probability to high probability. There was no edible reinforcer delivered in this condition. The researcher presented the VAS to the participant and/or stated the order activities would be completed while pointing to each activity. Following the completion of the low probability activity, the researcher removed the corresponding picture from the VAS and/or began placing demands in the high probability activity.

Premack Prime Condition. Sessions in this condition were identical to the Premack Pure condition with the addition of the delivery of an edible reinforcer to participants on an FR1 schedule for responding. The edible reinforcers had been previously identified by classroom staff as preferred and demonstrated effectiveness as reinforcers during the reinforcer assessment. Participants were allowed time to consume the edible item before the researcher presented the next trial.

Comparison Condition. Sessions in this condition began with the researcher arranging the VAS pieces from high probability to low probability. The researcher presented the visual schedule to the participant and/or stated the order activities would be completed while pointing to each activity. Following the completion of the high probability activity, the researcher removed the corresponding picture from the VAS and/or began placing demands in the low

probability activity. This condition also included the delivery of an edible reinforcer to participants on an FR1 schedule for responding.

Research Design

The current experiment used an alternating treatment design (ATD) and an adapted alternating treatment design (AATD) to compare the dependent variables under various conditions. On task behavior, challenging behavior, and reinforcement rates comparisons were evaluated using an ATD. The ATD allowed for an efficient comparison to be made between conditions by rapidly alternating which conditions across sessions (Barlow & Hayes, 1979). The AATD evaluated correct responding between each condition. This design also rapidly alternates between experimental conditions and allows for efficient evaluation of acquired skills under the various schedule conditions (Sindelar et al., 1985). The researcher used block randomization to identify the order of conditions for each participant individually.

Data Analysis

The researcher used visual analysis to evaluate the data collected on each dependent variable (Gast & Spriggs, 2018). The researcher examined whole session data to compare the dependent variables of on-task behavior, challenging behavior, correct responding, and rate of obtained reinforcement. Additionally, the researcher evaluated participants' on-task behavior during only the low probability activity as Premack initially suggested this contingency arrangement would impact responding in the low probability response.

Table 3
Individual Participant IEP Goals

Participant		IEP Goal	Materials
Simone	High Probability	Typing Letters	Keyboard
	Low Probability	Matching Words to Pictures	7.62 cm x 12.7 cm cards w 5 cm x 5 cm text/image
Jordan	High Probability	Writing Letters	Dry erase board and marker
	Low Probability	Sounding Out CVC Words	7.62 cm x 12.7 cm cards w 5 cm x 5 cm text
Emmett	High Probability	Typing CVC Words	iPad with keyboard and speech generating application
	Low Probability	Writing Letters	Dry erase board and marker
Shantel	High Probability	Identifying Teachers	10 cm x 10 cm image of teacher
	Low Probability	Matching Words to Pictures	7.62 cm x 12.7 cm cards w 5 cm x 5 cm text/image
Miguel	High Probability	Motor Imitation	Yellow gloves
	Low Probability	Matching Objects to Pictures	Light box, 12.7 cm x 12.7 cm transparent common object images, 3 dimensional common objects

Note. Table 3 presents participant IEP goals evaluated in the present study.

Table 4

Dependent Variable Definitions

Dependent Variable	Topographical Definition	Measurement
On-Task Behavior	Participants located within an arm's reach of their chair (standing or seated) with their face oriented towards the instructor or instructional materials	% of session
Challenging Behavior	Aggression:	Rate
	Hitting/kicking: when a participant's hand or foot moves in the direction of another person (each hand/foot is one instance) within 2 seconds	
	Biting - when a participant's mouth opens and closes around another person's skin	
	Disruption:	
	Throwing items: when a participant holds an item in one or both hands and releases the item through the air a distance of 3 inches or greater outside of appropriate toy play	
	Hitting surfaces: when a participant's hand, arm, foot, or item in hand comes into contact with surface from at least 3 inches away resulting in an audible sound or displacement of an item from its natural state; outside of appropriate toy play	Rate
	Elopement: any instance in which the participant moves away from their designated area by more than 12" in any direction, including any instance in which the participant's body goes from standing to seated/laying down without instruction to do so or any instance in which a participant placed their foot or torso on a piece of furniture	% of session
Correct Responding	When a participant engaged in the correct response within 10 s of the initial task demand during a probe trial	% of targets
Rate of Reinforcement	Any instance when the researcher delivered an edible item to a participant	Rate

Note. Table 4 describes the dependent variable definitions.

Table 5

Targets per Participant

Participant	High Probability Activity			Low Probability Activity		
Simone	Typing Letters			Matching Words to Pictures		
	Premack Pure	Premack Prime	Comparison Condition	Premack Pure	Premack Prime	Comparison Condition
	U	M	T	Door	Bowl	Toothbrush
	C	B	H	Pants	Pencil	Sink
	P	G	J	Table	Trash can	Chair
	D	F	O	Shoes	Microwave	Book
	R	L	E	Water bottle	Toilet	Shirt
Jamar	Writing Letters			Sounding Out CVC Words		
	Premack Pure	Premack Prime	Comparison Condition	Premack Pure	Premack Prime	Comparison Condition
	N	K	P	Sad	Ran	Cat
	E	G	M	Get	Wet	Pen
	V	S	D	Win	Fit	Big
	L	A	C	Dog	Cod	Hot
	B	O	H	Run	Tub	Mud
Emmett	Typing CVC Words			Writing Letters		
	Premack Pure	Premack Prime	Comparison Condition	Premack Pure	Premack Prime	Comparison Condition
	Man	Bat	Sad	O	F	A
	Led	Pen	Wet	H	L	J
	Sit	Win	Pig	P	E	B
	Got	Dog	Hot	C	M	K
	Tub	Hum	Fun	I	G	N
Shantel	Receptive Identification of Teachers			Matching Words to Pictures		
	Premack Pure	Premack Prime	Comparison Condition	Premack Pure	Premack Prime	Comparison Condition
	Prentiss	SK	Maddie	Door	Shirt	Toilet
	Nadya	Lydia	Leah	Pants	Water bottle	Bowl
	Emma	Amber	Anna	Chair	Table	Cup
	Ale	Jessica	Jazmynn	Pencil	Book	Shoes
	Hannah	Natalie	Chloe	Sink	Microwave	Trash can
Miguel	Motor Imitation			Matching Objects to Pictures		
	Premack Pure	Premack Prime	Comparison Condition	Premack Pure	Premack Prime	Comparison Condition
	Quiet mouth	Raise hand	Tap head	Car	Chair	Ball
	Arms in T	Clasp hands	Touch belly	Spoon	Girl	Dog
	Tap lap	Touch feet	Knock table	Cup	Box	Table

Note. Table 5 depicts the targets per participant, per activity, per condition in the present study.

CHAPTER 4

RESULTS

This study evaluated participants' on-task behavior, challenging behavior, and correct responding across various conditions designed around the Premack principle. Specifically, researchers investigated participant responding when tasks were sequenced from low to high probability (Premack Conditions) and high to low probability (Comparison Condition). Additionally, researchers evaluated the differences in participant responding when a "pure" application of the Premack principle was in place (i.e., only manipulating the high probability activity as a reinforcer for the low probability activity) compared to when a "prime" application of the Premack principle (i.e., when a schedule of edible reinforcement was included as well as manipulating the high probability activity as a reinforcer for the low probability activity) was in place.

Experimental Procedure Results

The researcher conducted 15 total sessions (5 of each condition) in a randomized order for Simone, Jamar, Emmett, and Shantel. The researcher conducted an additional 16th session of the Premack Pure condition for Miguel to establish stability in the trends of the data. Individual participant results are described in detail below.

On-Task Behavior

Researchers evaluated on-task behavior across entire sessions and within low probability activities to compare the effects of task sequence. Across all 5 participants, there was little to no differentiation in on-task behavior across the three experimental conditions.

Simone. Simone's on-task behavior is displayed in Figure 2. Across all 3 conditions, Simone was on-task between 74 and 95 % of sessions. There was no differentiation between conditions. Figure 3 displays Simone's on-task behavior during only the low probability activity (matching words to pictures) across conditions. There is no differentiation between on-task behavior in only the low probability activity, though the range (43 - 95%) was greater than in the overall sessions.

Jamar. Jamar's on-task behavior is displayed in Figure 4. There was no differentiation in Jamar's on-task behavior across conditions. Jamar engaged in on-task behavior between 84.3% and 97.9% of all 3 conditions with one exception in the first Comparison session, where he engaged in on-task behavior only 49.1% of the session. Similarly, there was no differentiation in on-task behavior in the low probability activity (sounding out CVC words) with a range of 74.2% to 99% with one exception in the first Comparison session where Jamar was on-task for only 47.8% of the low probability activity. Jamar's on-task behavior during the low probability activity is displayed in Figure 5.

Emmett. Emmett's on-task behavior for an entire session is displayed in Figure 6. There was no differentiation in on-task behavior across conditions. Overall, Emmett engaged in on-task behavior between 78.4% and 99.8% of sessions with one exception in one Premack Pure session where he engaged in on-task behavior for only 41.8% of the session. Figure 7 displays Emmett's on-task behavior during only the low probability activity (writing letters) portion of each session. This was also undifferentiated across conditions with on-task behavior ranging from 84.4% to 99.8% of sessions.

Shantel. There was no differentiation in Shantel's overall session on-task behavior across conditions as depicted in Figure 8. She engaged in on-task behavior between 77.7% and 96.5%

of sessions across conditions. Shantel's on-task behavior during the low probability activity (matching words to pictures) was also undifferentiated across conditions as depicted in Figure 9. Shantel engaged in on-task behavior between 83.3% and 95.6% of low probability activities.

Miguel. Miguel's on-task behavior is displayed in Figure 10. Miguel engaged in the highest level of on-task behavior during the Comparison condition, where he was on-task between 93.7% and 99.7% of sessions. During Premack Prime conditions, Miguel engaged in on-task behavior between 89.6% and 97.4% of sessions. Miguel engaged in the lowest levels of on-task behavior during the Premack Pure condition, ranging from 69.4% to 99.6% of sessions. During the low probability activity (matching objects to pictures) Miguel's on-task behavior followed similar trends to the on-task behavior during overall sessions. During the low probability activity only, Miguel engaged in the highest level of on-task behavior in the Comparison condition, ranging from 97.5% to 99.9%. During the Premack Prime condition, Miguel engaged in on-task behavior between 86.8% and 95.5% of sessions. Miguel engaged in on-task behavior between 63.6% and 99.1% of sessions in the Premack Pure condition. These data are depicted in Figure 11.

Challenging Behavior

Across all 5 participants, there was no differentiation in challenging behavior across the three experimental conditions.

Simone. Simone engaged in very few instances of challenging behavior across conditions. She engaged in aggression during 2 sessions, one Comparison Condition session with a rate of .2 instances per minute and one Premack Pure condition with a rate of .4 instances per minute. Simone engaged in disruption across all 3 conditions with a range of 0 to .5 instances per minute. Simone eloped once during one Premack Pure condition for 3.1% of the session and in

two Comparison sessions for 3% and 3.5% of sessions. These instances of challenging behavior are depicted in Figure 12.

Jamar. There was no differentiation in Jamar's challenging behavior across conditions. He engaged in aggression in only one session in the Premack Pure condition at a rate of 2.7 instances per minute. Jamar engaged in disruption across all conditions with a range of 0 to .6 instances per minute. Similarly, elopement was undifferentiated across conditions with a range of 0% to 4.2% of sessions with one exception in the first Premack Pure session, where Jamar engaged in elopement for 18.5% of the session. Figure 13 displays Jamar's exhibition of challenging behavior.

Emmett. Aggression was the only challenging behavior Emmett engaged in during the present study. He engaged in aggression during two Comparison Condition sessions at rates of .08 per min and .17 per min. These data are depicted in Figure 14.

Shantel. Elopement was the only challenging behavior Shantel engaged in across all conditions. There was little differentiation between elopement across conditions, but the level of elopement during the Premack Pure Condition was slightly elevated from the others with an accelerating trend. However, elopement across sessions was still low overall ranging from 0% of a session to 4.3% of a session. These data are depicted in Figure 15.

Miguel. Across all 3 conditions, the only challenging behavior Miguel engaged in was elopement, as displayed in Figure 16. Elopement occurred during two Premack Pure Condition sessions for 7.4% and 12.5% of sessions. Elopement occurred during one Comparison Condition session for 1.6% of the session.

Correct Responding

Across all 5 participants, there was no differentiation in correct responding across the three experimental conditions.

Simone. There was no differentiation in Simone's correct responding across conditions. Correct responding in both typing (high probability activity) and matching words to pictures (low probability activity) ranged from 0-60% with one session in the Comparison Condition where Simone correctly typed 80% of letters. Simone's correct responding per activity is displayed in Figure 17.

Jamar. There was no differentiation in correct responding across conditions in either high probability activity (writing letters) or low probability activity (sounding out CVC words). Jamar correctly wrote between 0% and 20% of letters across conditions with the exception of one Comparison Condition session where he wrote 80% of letters correctly. Jamar acquired the skill of sounding out CVC words more rapidly and was responding correctly to 40% to 100% of targets in the final third of sessions (sessions 10-15) across conditions. Jamar's correct responding to writing letters and to sounding out CVC words is displayed in Figure 18.

Emmett. Emmett's correct responding in the low probability activity (writing letters) was undifferentiated across conditions. By the end of the study, Emmett was writing 80% of letters correctly across conditions. When spelling CVC words, Emmett correctly spelled words between 0% and 20% in the Premack Prime condition and between 20% and 60% in the Comparison condition with a zero-celerating trend in both conditions. Emmett's correct responding in the Premack Pure condition has an accelerating trend and he typed 80% of CVC words correctly in the final Premack Pure condition. These data are displayed in Figure 19.

Shantel. Shantel's correct responding was undifferentiated across conditions in both the low probability activity (matching words to pictures) and the high probability activity (receptive

identification of teachers) as displayed in Figure 20. Shantel correctly responded to matching word to picture demands 0% of opportunities across all 3 conditions. Shantel correctly responded to receptive identification of teacher demands between 0% and 40% of targets across conditions.

Miguel. Correct responding was largely undifferentiated across conditions for both the low probability activity (matching objects to pictures) and the high probability activity (motor imitation). Miguel responded correctly to between 0% and 33.3% of matching objects to pictures targets. Miguel engaged in the highest level of correct responding to motor imitation demands in the Premack Prime condition with 66.66% correct responding for 3 sessions. Correct responding in the Comparison and Premack Pure Conditions ranged from 0% to 33.3% with one exception in the first Premack Pure session with 100% correct responding. Miguel's correct responding is displayed in Figure 21.

Rate of Reinforcement

Across all 5 participants, there was no differentiation in rate of edible reinforcement between the two conditions with edible reinforcement provided (Premack Prime and Comparison).

Simone. The rate of obtained reinforcement was undifferentiated between conditions between a range of 2.9 to 4.8 edible reinforcers delivered per minute. Researchers also evaluated session duration to consider if session duration could have influenced the obtained rate of reinforcement, however there was no differentiation in session duration with a range of 456 s to 635 s. Rate of obtained reinforcement and session duration are depicted in Figures 22 and 23.

Jamar. There was no differentiation in the rate of obtained reinforcement between conditions. In both Premack Prime and Comparison the rate of reinforcement was between 2.9 and 5.2 edible items delivered per minute. These data are displayed in Figure 24. Additionally,

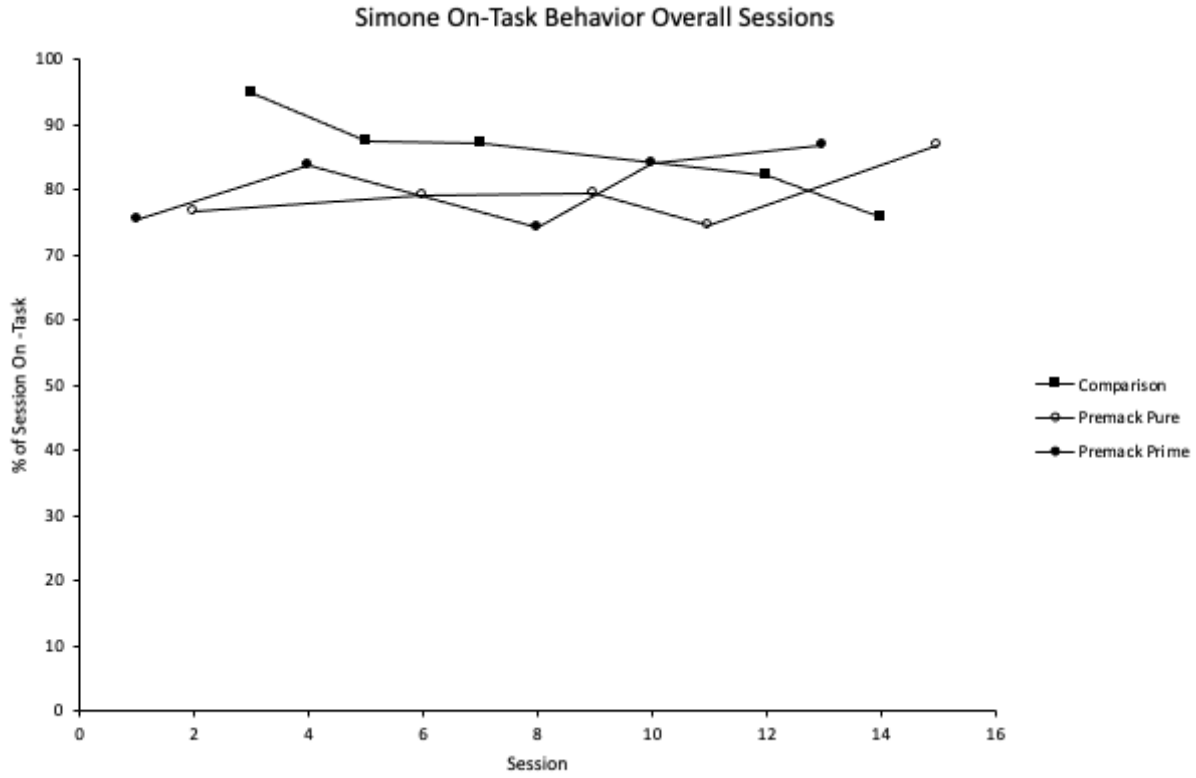
there was no differentiation between session duration that could have impacted the rate of reinforcement delivery. The range of session durations in both conditions was 429 s to 691 s as depicted in Figure 25.

Emmett. There was little differentiation between conditions with the Premack Prime rate of obtained reinforcement ranging from 2.7 to 3.9 per min and rates ranging from 2.9 to 3.6 per min the Comparison condition. These data are displayed in Figure 26. There was little differentiation in the session durations in these conditions as well, with the Premack Prime condition ranging from 618 s to 883 3 s and the Comparison condition ranging from 608 s to 752 s. These data are depicted in Figure 27.

Shantel. The rate of obtained reinforcement differentiated slightly between conditions. During the Premack Prime condition, Shantel received an edible item at a rate between 3 and 3.9 items per minute. During the Comparison condition, Shantel received an edible item at a rate between 2.1 and 3.2 items per minute. These data are displayed in Figure 28. There was no differentiation in session duration between these conditions with sessions ranging from 545 s to 925 s as depicted in Figure 29.

Miguel. Figure 30 depicts an undifferentiated rate of obtained reinforcement between rates of 3.5 and 5.4 edible items delivered per session. Similarly, Figure 31 depicts undifferentiated session duration data between conditions ranging from 231 s and 383 s.

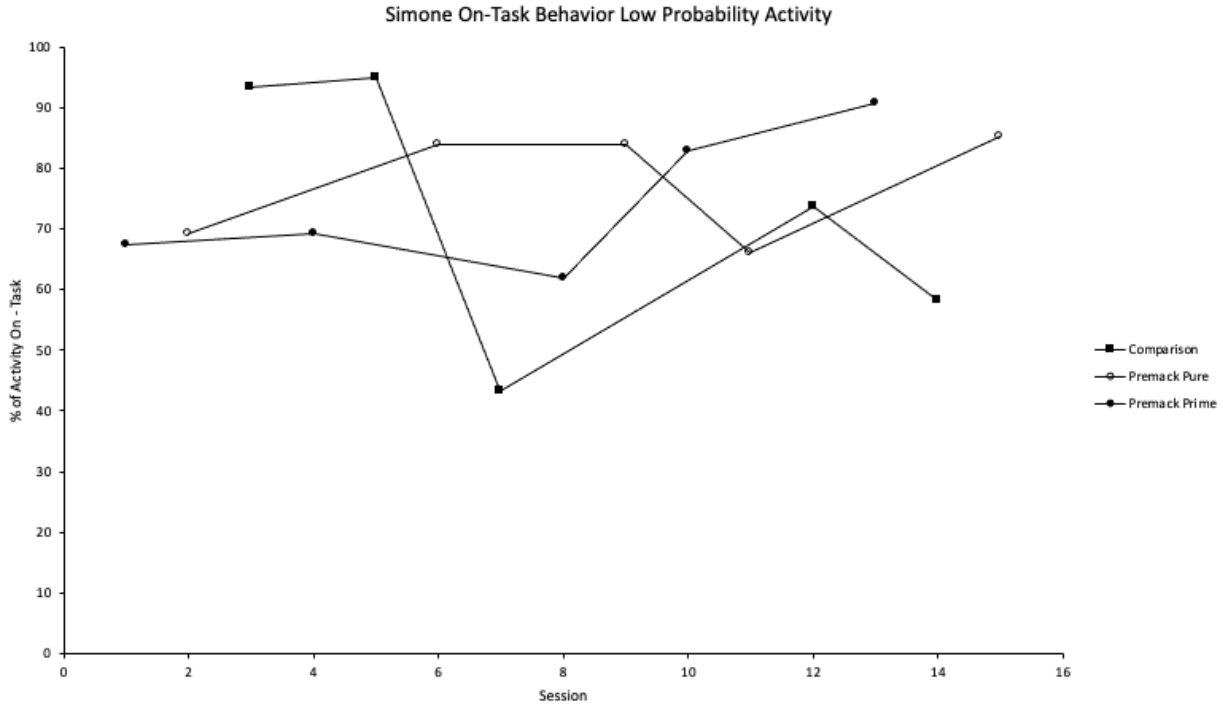
Figure 2
Simone On-Task Across Sessions



Note. Figure 2 depicts Simone's on-task behavior for whole sessions across conditions.

Figure 3

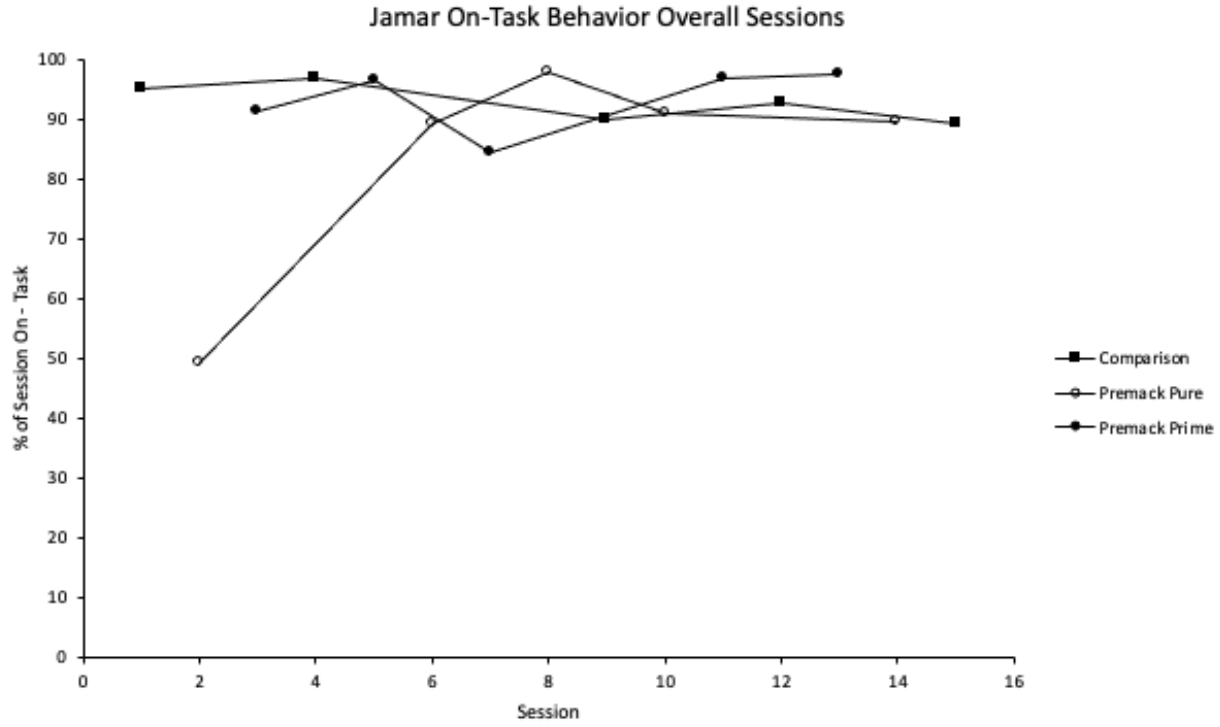
Simone On-Task Low Probability Activity Only



Note. Figure 3 depicts Simone's on-task behavior during the low probability activity of each session.

Figure 4

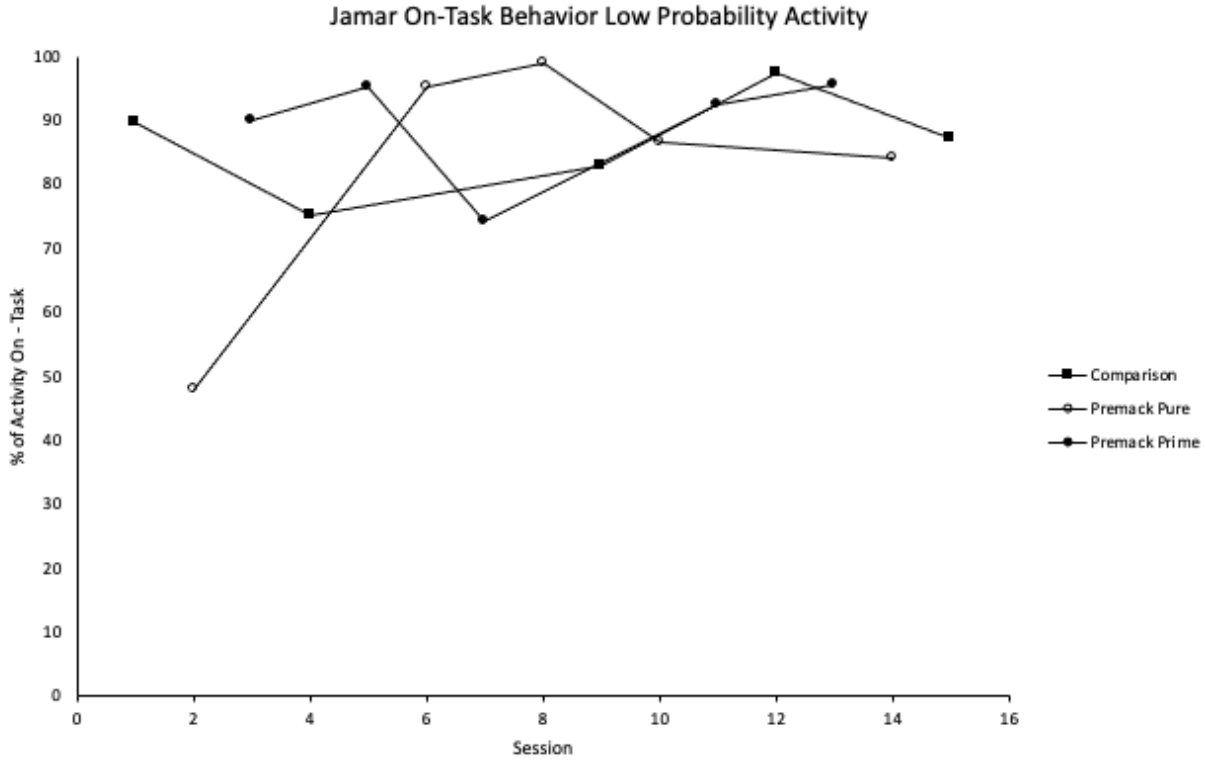
Jamar On-Task Across Sessions



Note. Figure 4 depicts Jamar's on-task behavior for whole sessions across conditions.

Figure 5

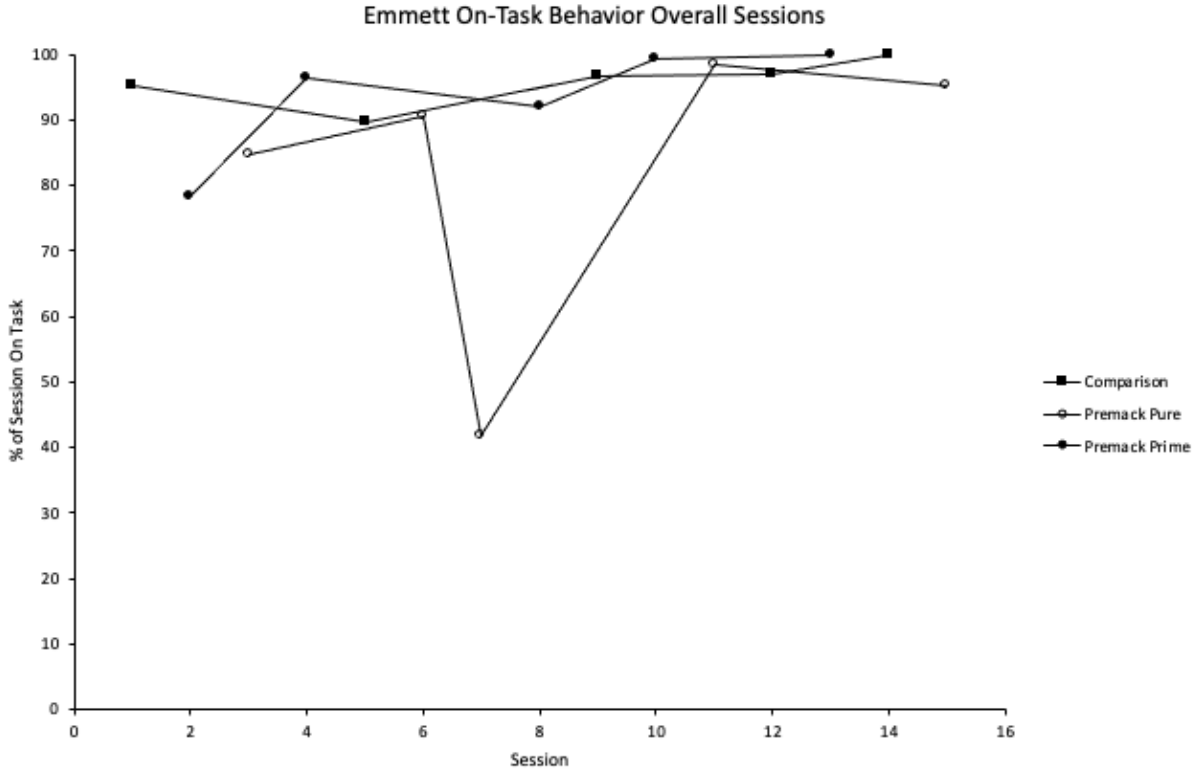
Jamar On-Task Low Probability Activity Only



Note. Figure 5 depicts Jamar's on-task behavior during the low probability activity of each session.

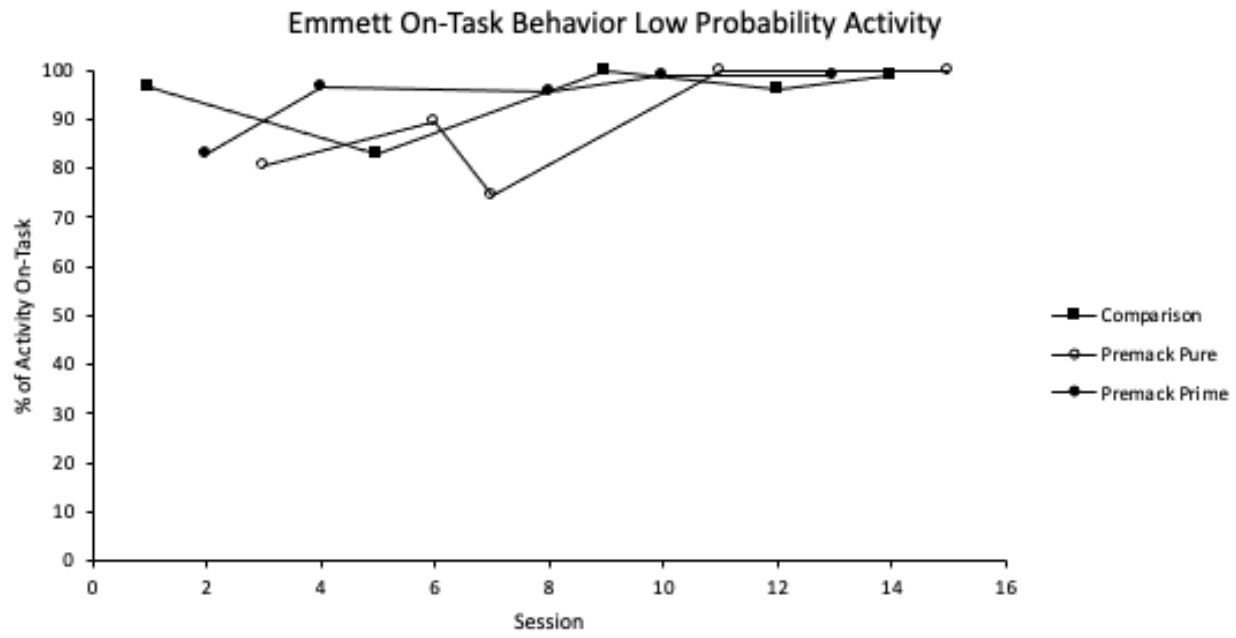
Figure 6

Emmett On-Task Across Sessions



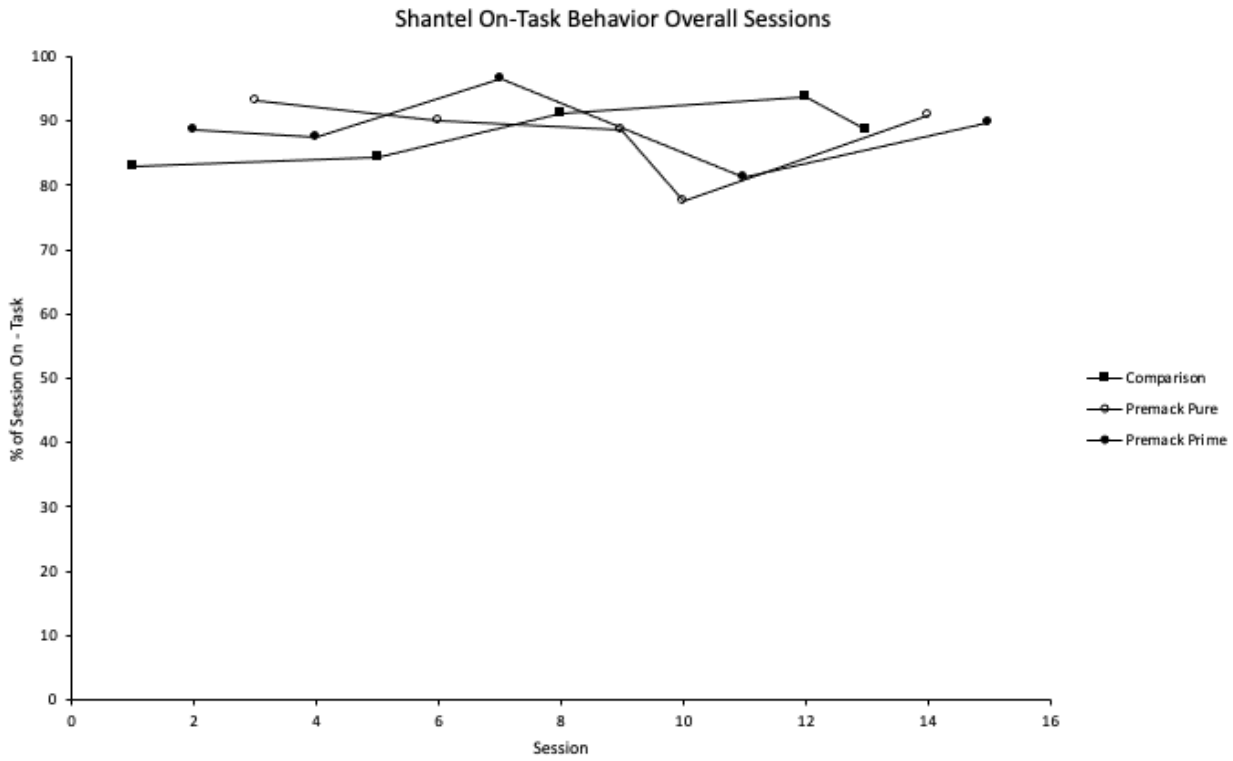
Note. Figure 6 depicts Emmett's on-task behavior for whole sessions across conditions.

Figure 7
Emmett On-Task Low Probability Activity Only



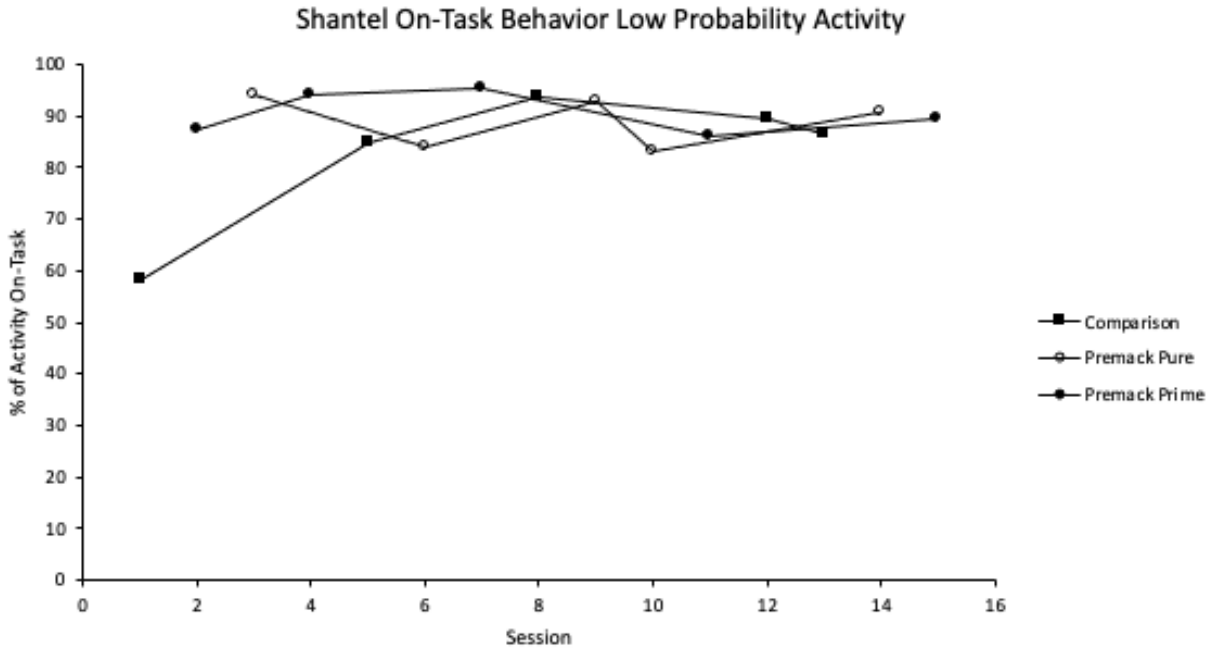
Note. Figure 7 depicts Emmett's on-task behavior during the low probability activity of each session.

Figure 8
Shantel On-Task Across Sessions



Note. Figure 8 depicts Shantel's on-task behavior for whole sessions across conditions.

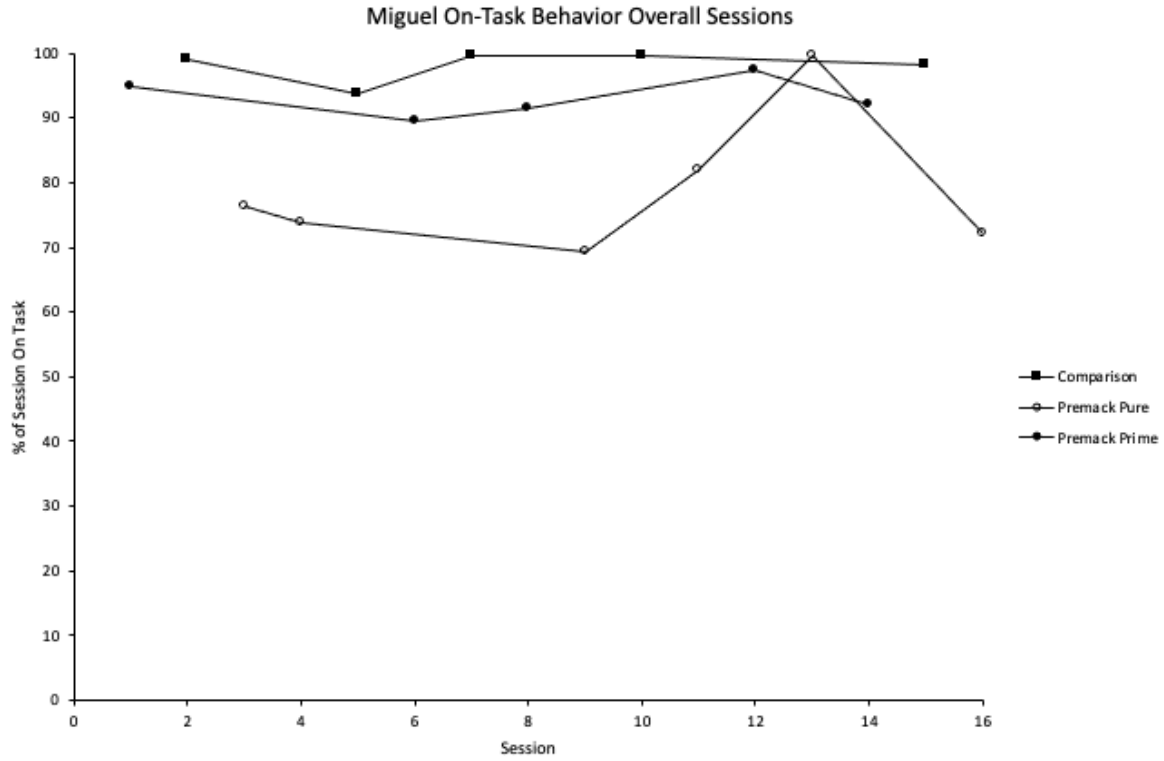
Figure 9
Shantel On-Task Low Probability Activity Only



Note. Figure 9 depicts Shantel's on-task behavior during the low probability activity of each session.

Figure 10

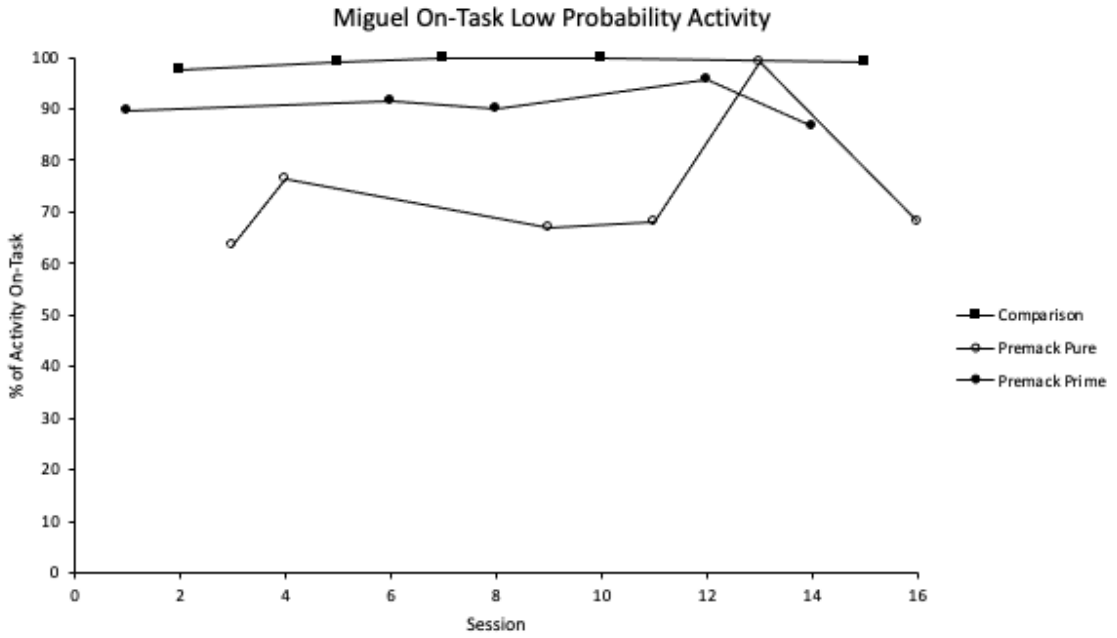
Miguel On-Task Across Sessions



Note. Figure 10 depicts Miguel's on-task behavior for whole sessions across conditions.

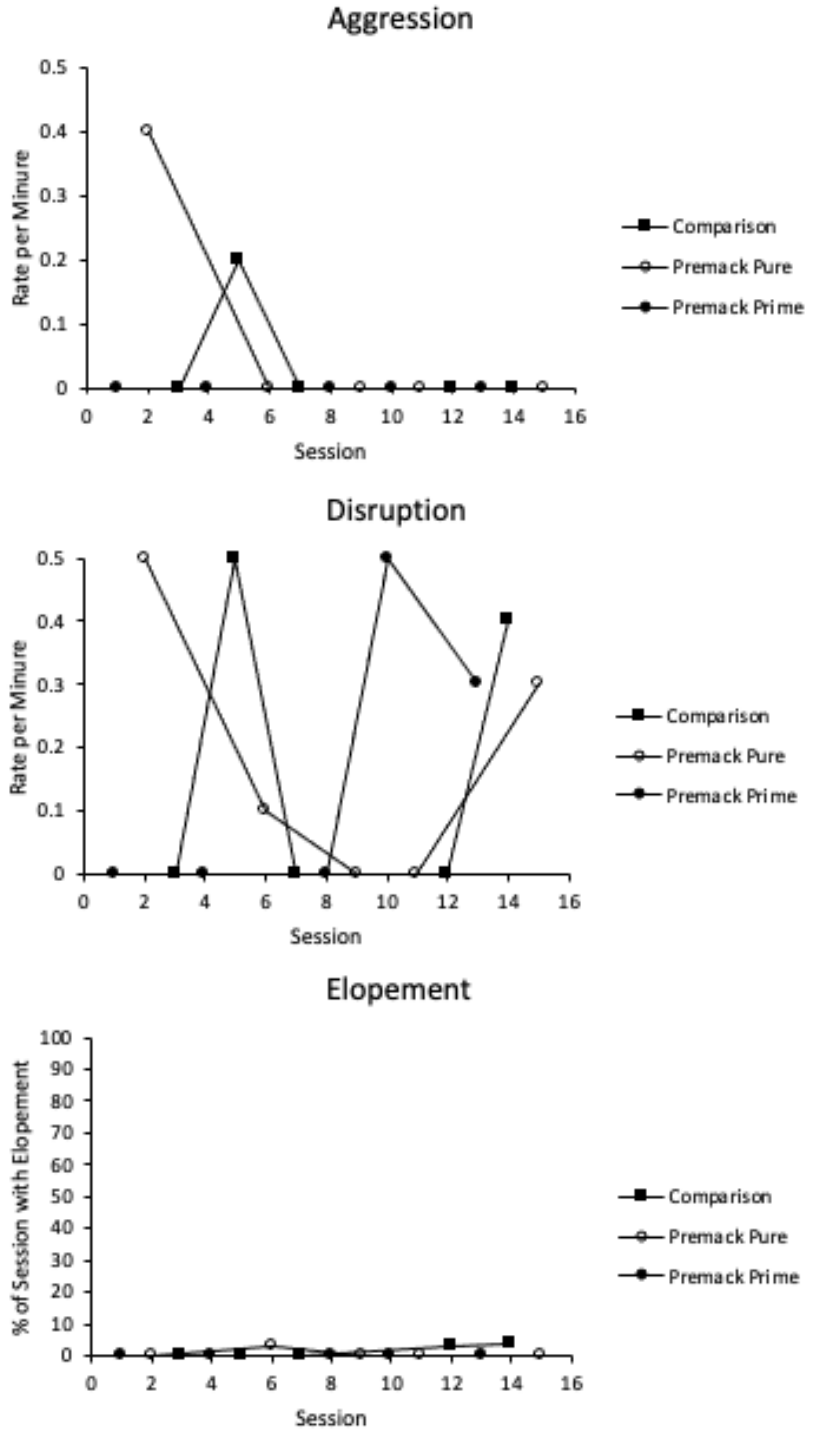
Figure 11

Miguel On-Task Low Probability Activity Only



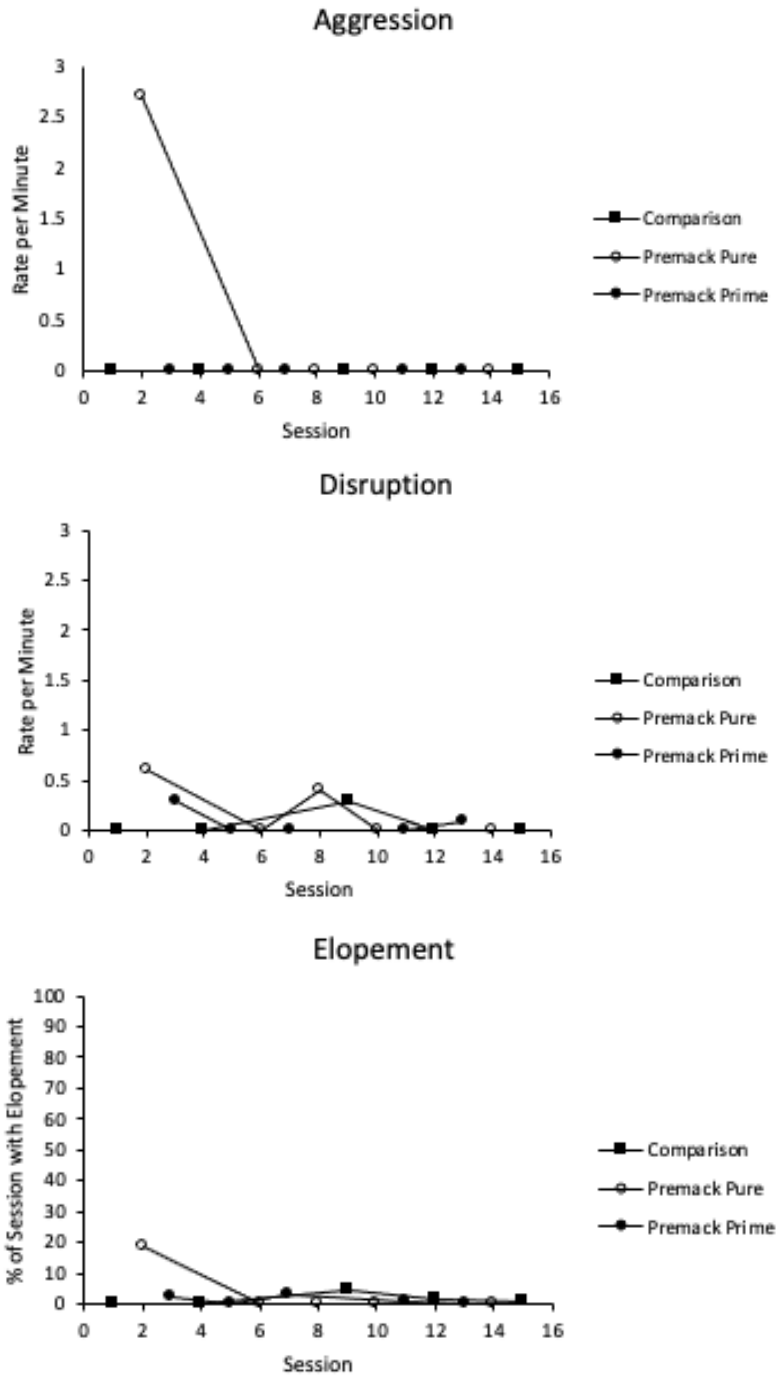
Note. Figure 11 depicts Miguel's on-task behavior during the low probability activity of each session.

Figure 12
Simone Challenging Behavior



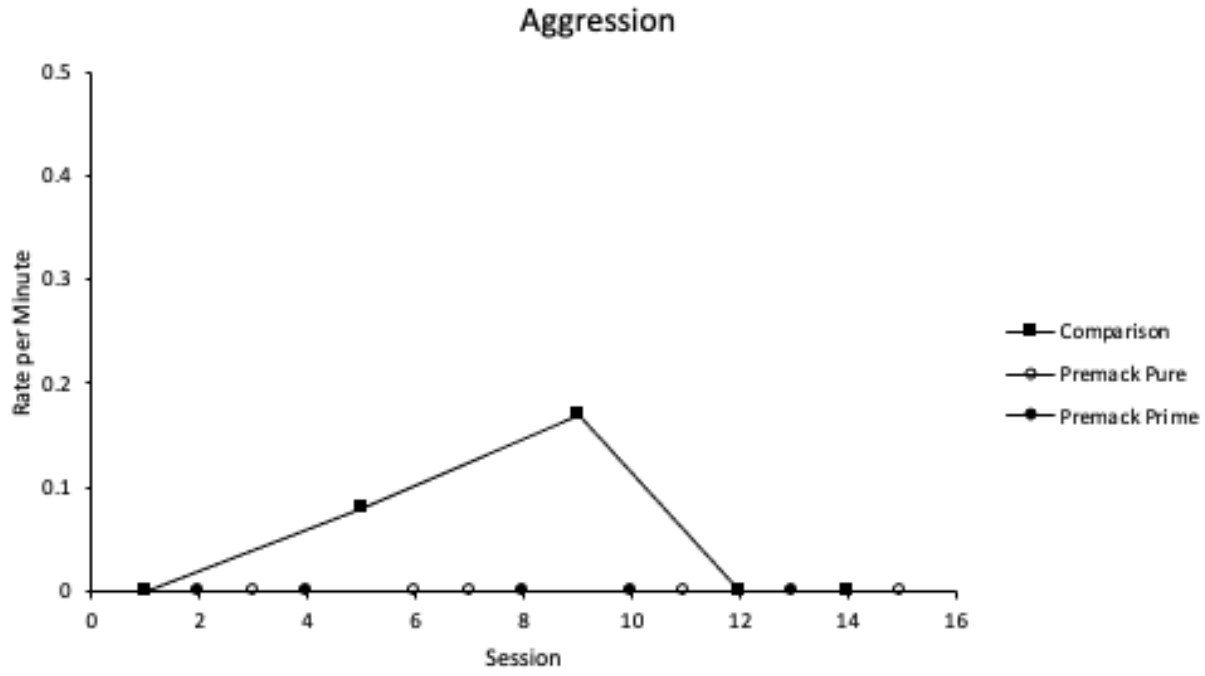
Note. Figure 12 displays Simone's challenging behavior across conditions.

Figure 13
Jamar Challenging Behavior



Note. Figure 13 displays Jamar's challenging behavior across conditions.

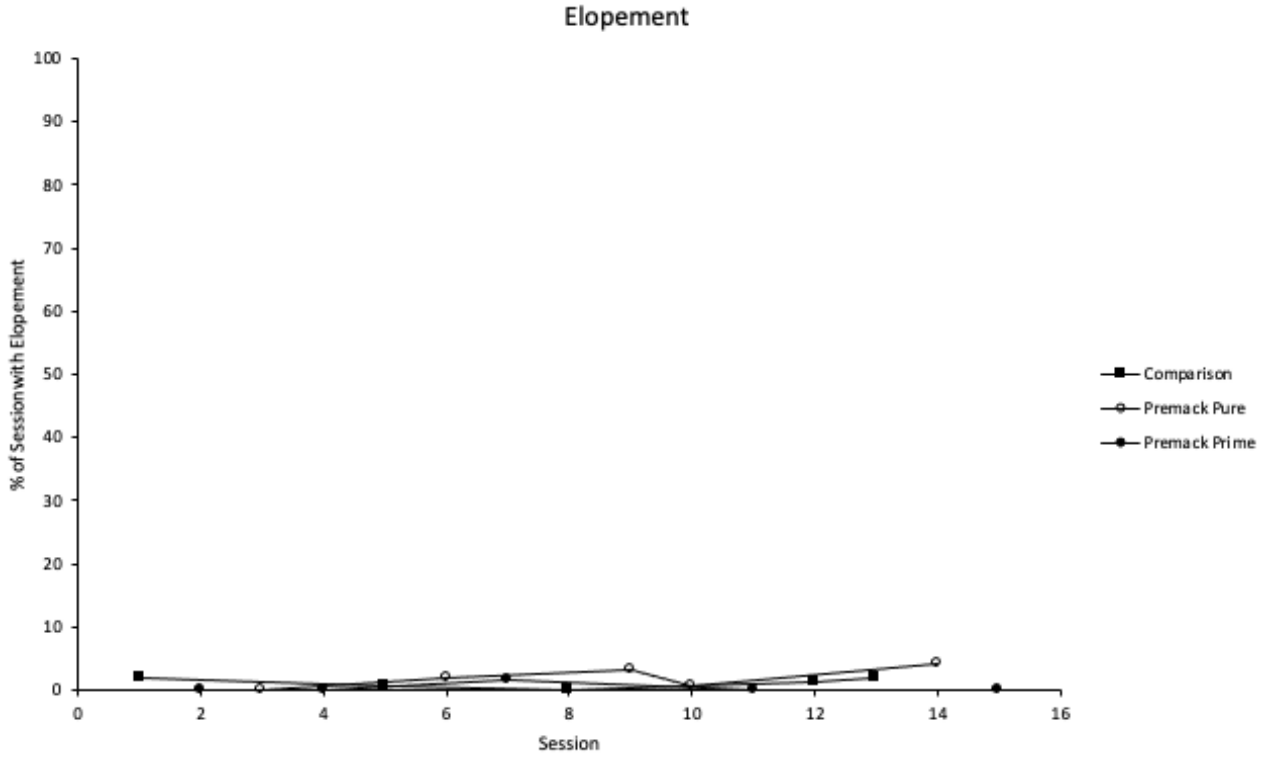
Figure 14
Emmett Challenging Behavior



Note. Figure 14 displays Emmett's aggressive behavior across conditions.

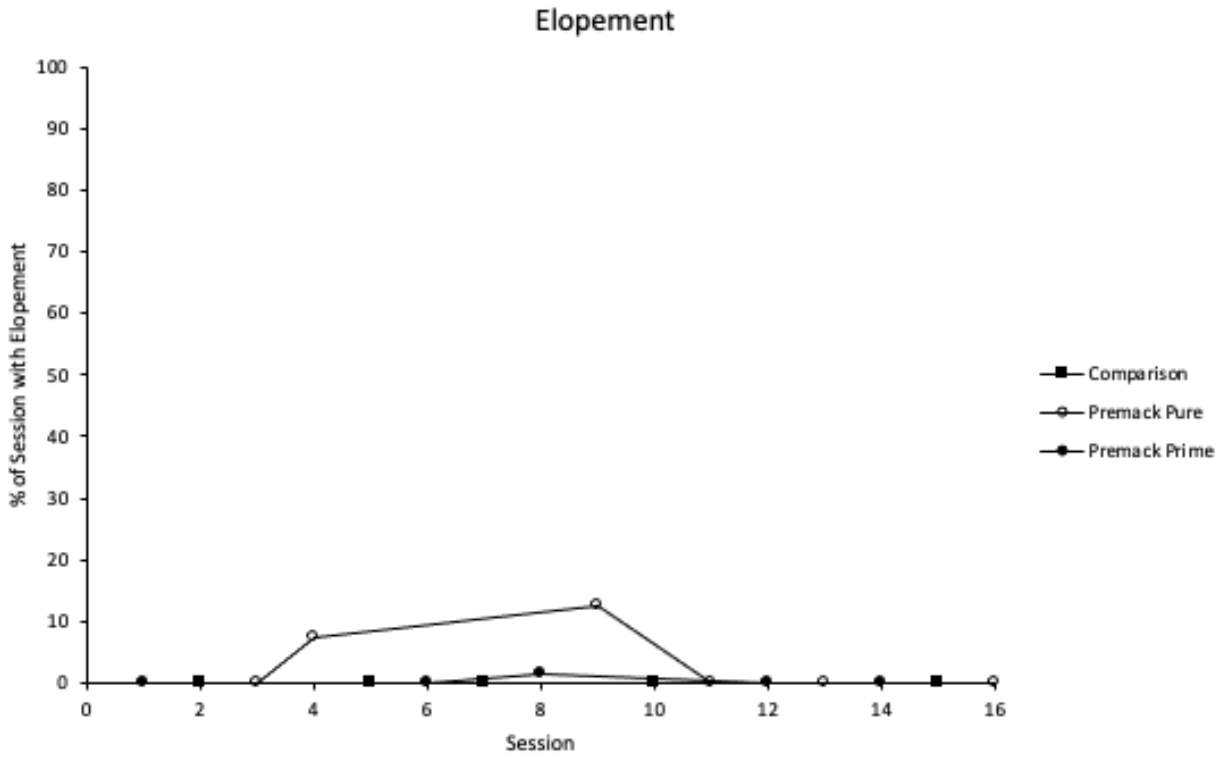
Figure 15

Shantel Challenging Behavior



Note. Figure 15 displays Shantel's elopement across conditions.

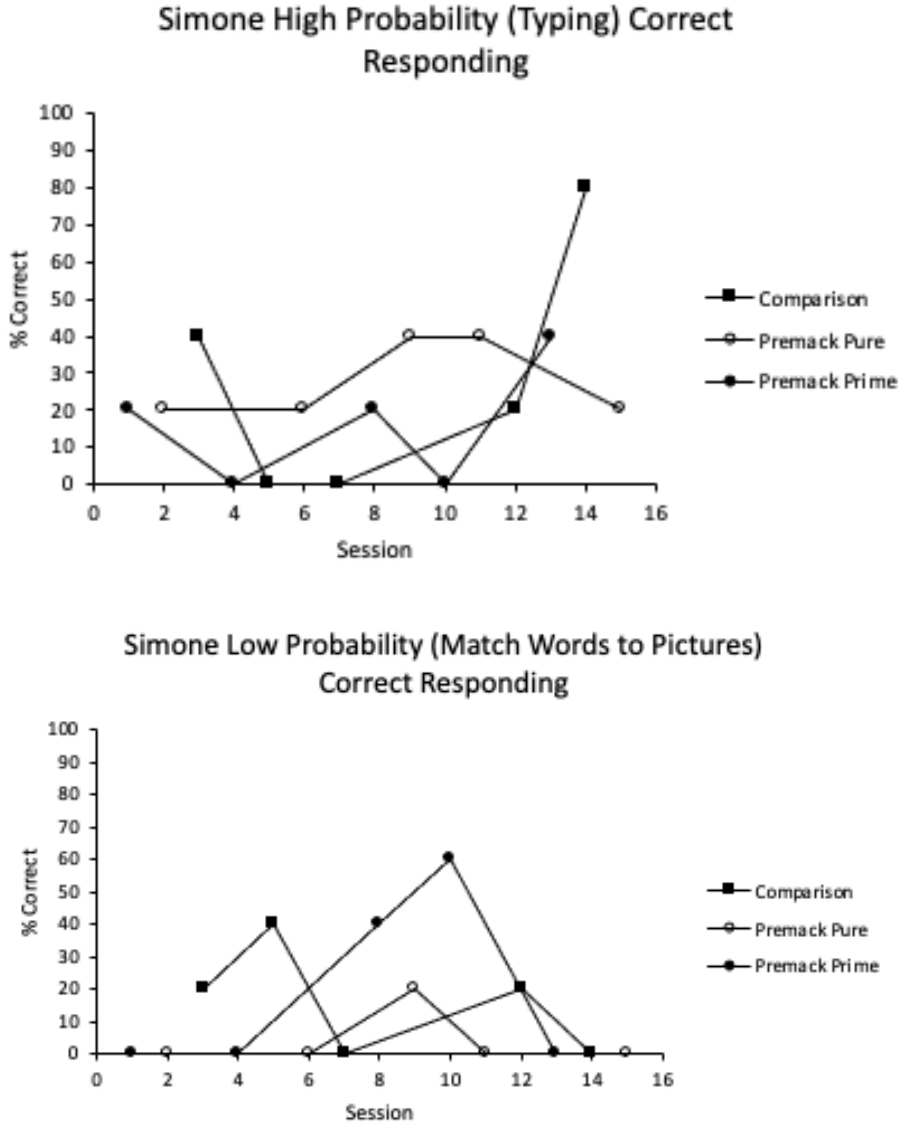
Figure 16
Miguel Challenging Behavior



Note. Figure 16 displays Miguel's elopement across conditions.

Figure 17

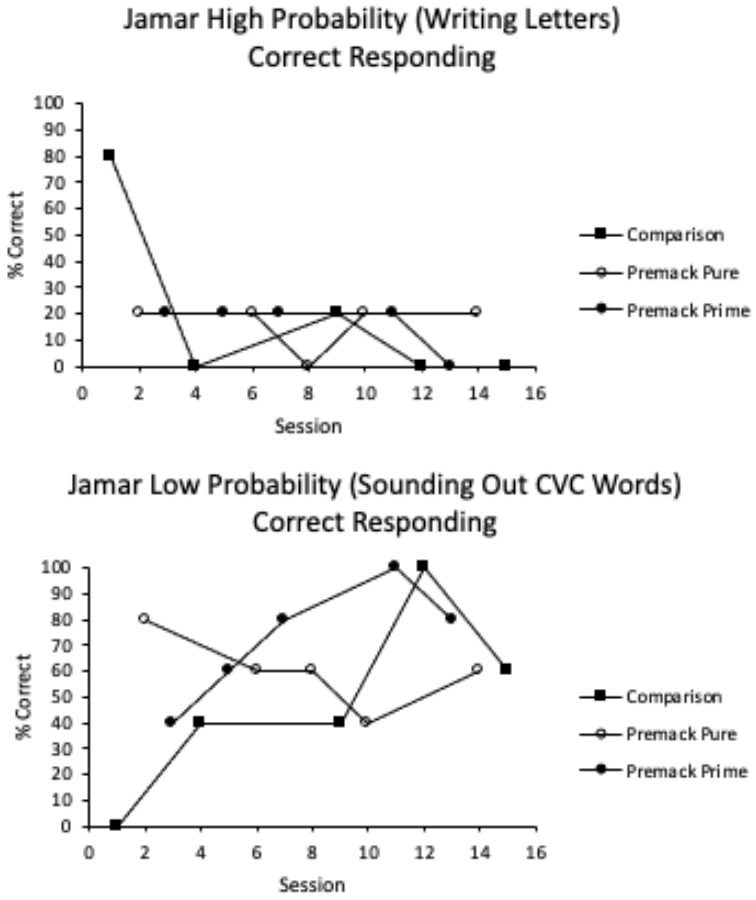
Simone Correct Responding



Note. Simone's correct responding across sessions for both high and low probability activities is displayed in Figure 17.

Figure 18

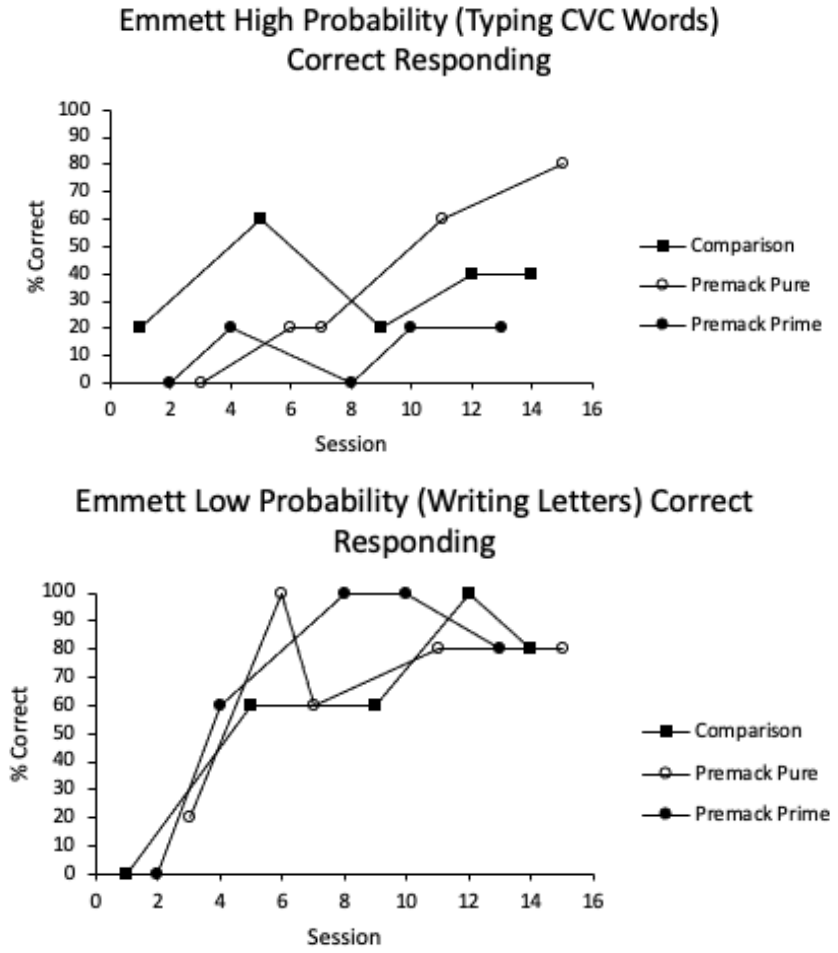
Jamar Correct Responding



Note. Jamar's correct responding across sessions for both high and low probability activities is displayed in Figure 18.

Figure 19

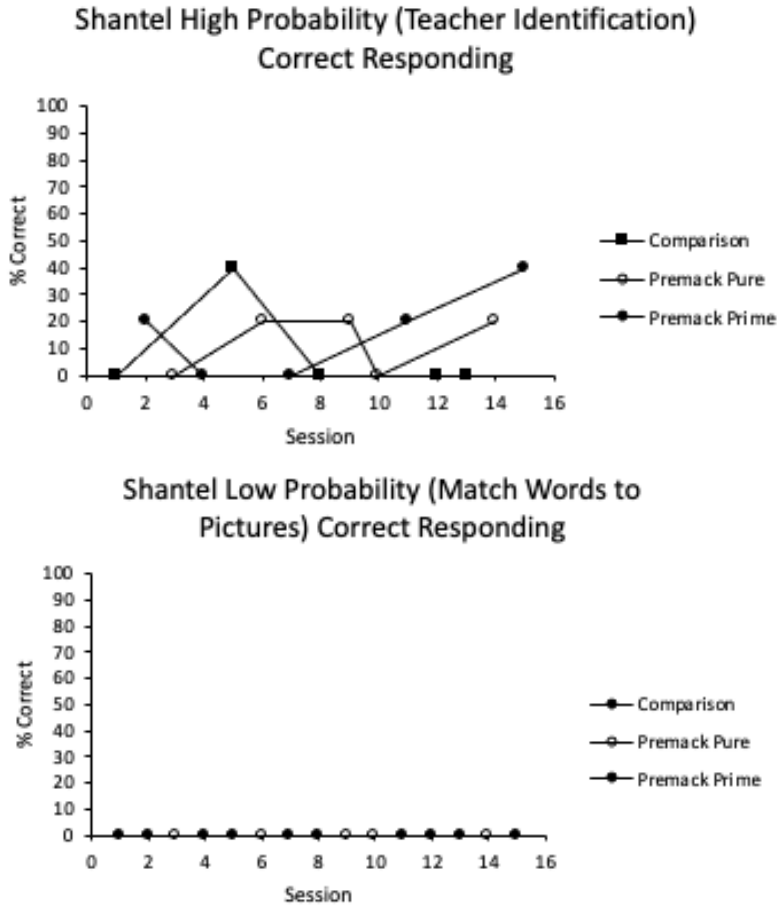
Emmett Correct Responding



Note. Emmett's correct responding across sessions for both high and low probability activities is displayed in Figure 19.

Figure 20

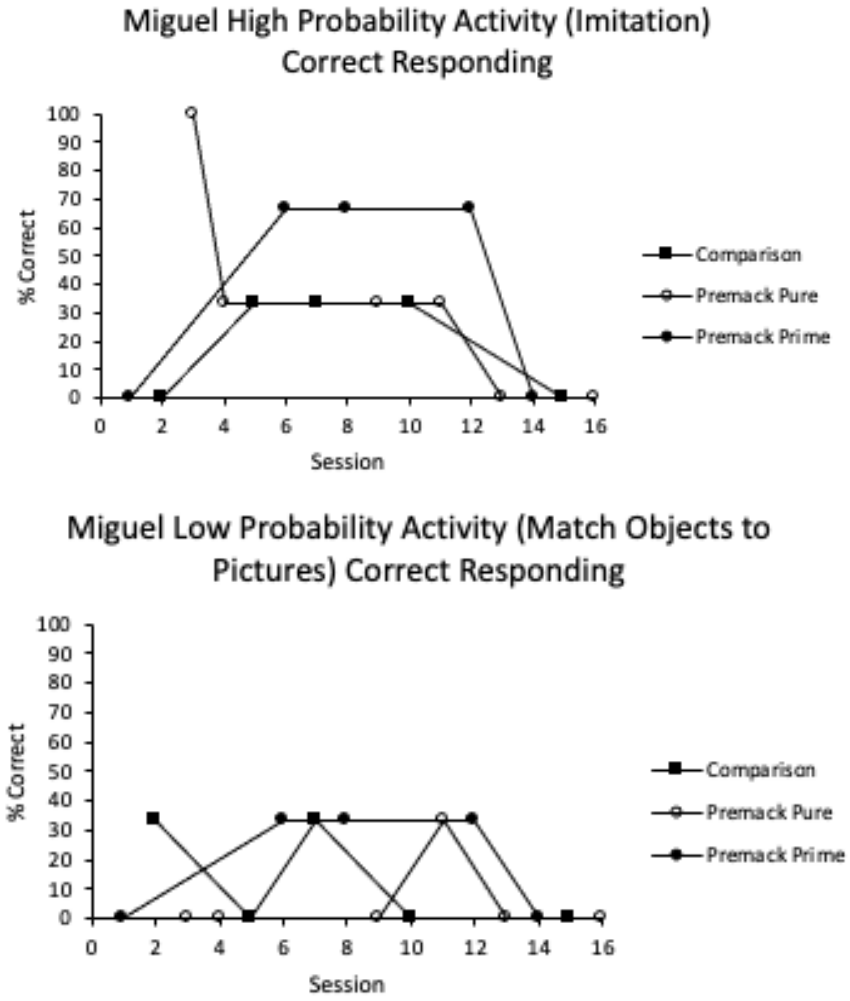
Shantel Correct Responding



Note. Shantel's correct responding across sessions for both high and low probability activities is displayed in Figure 20.

Figure 21

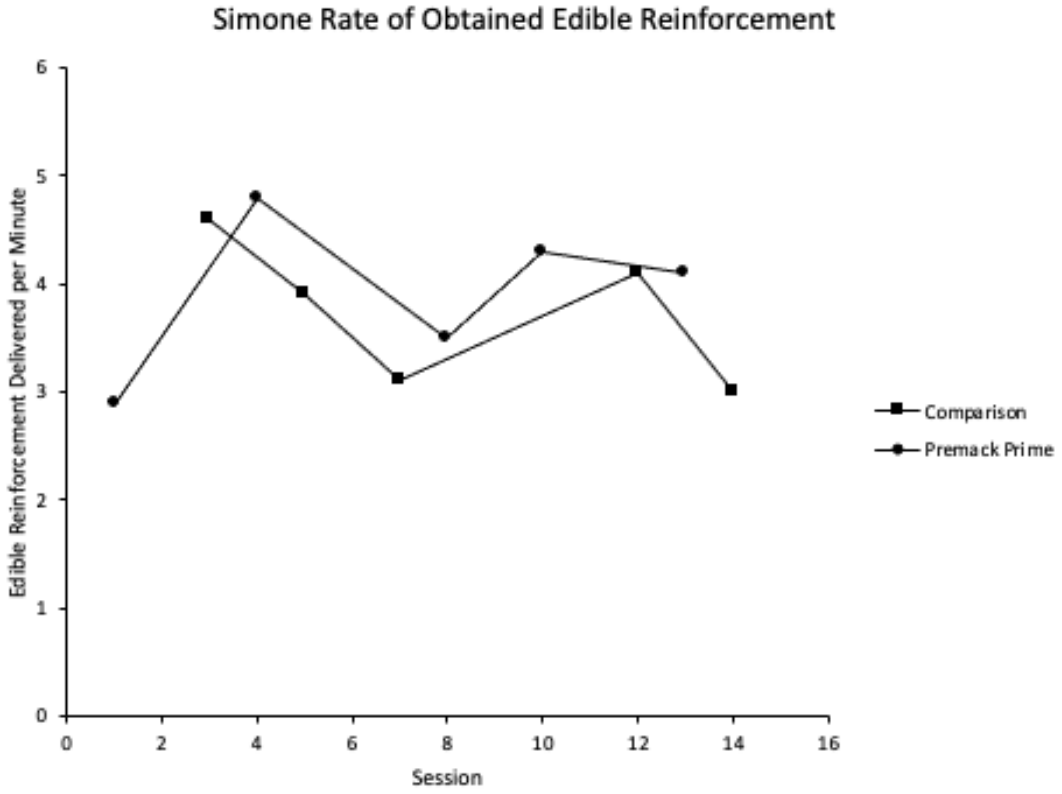
Miguel Correct Responding



Note. Miguel's correct responding across sessions for both high and low probability activities is displayed in Figure 21.

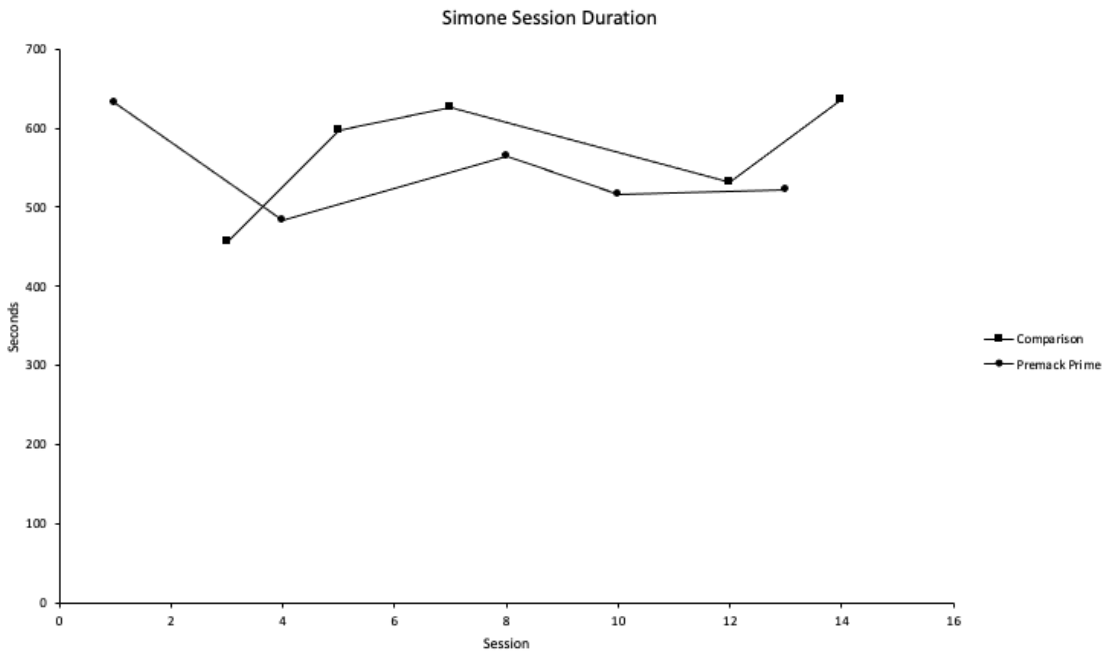
Figure 22

Simone Rate of Obtained Reinforcement



Note. Figure 22 depicts the rate of edible reinforcement obtained by Simone during the Premack Prime and Comparison Conditions.

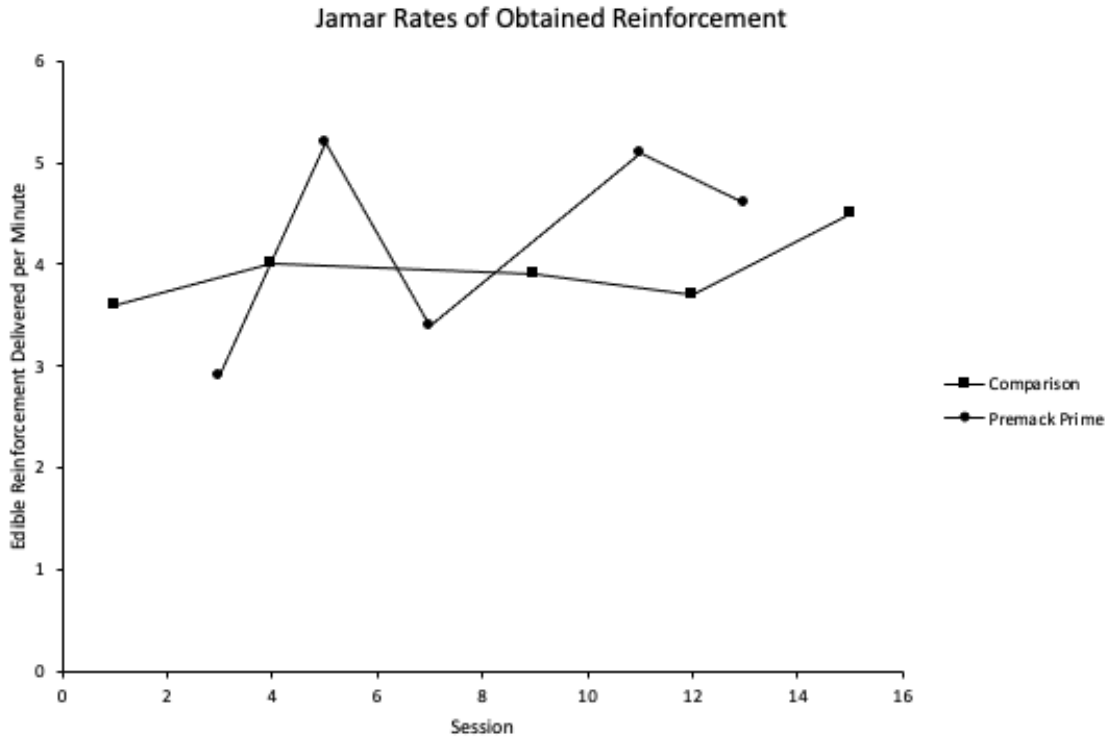
Figure 23
Simone Session Duration



Note. Figure 23 depicts the session durations during the Premack Prime and Comparison Conditions.

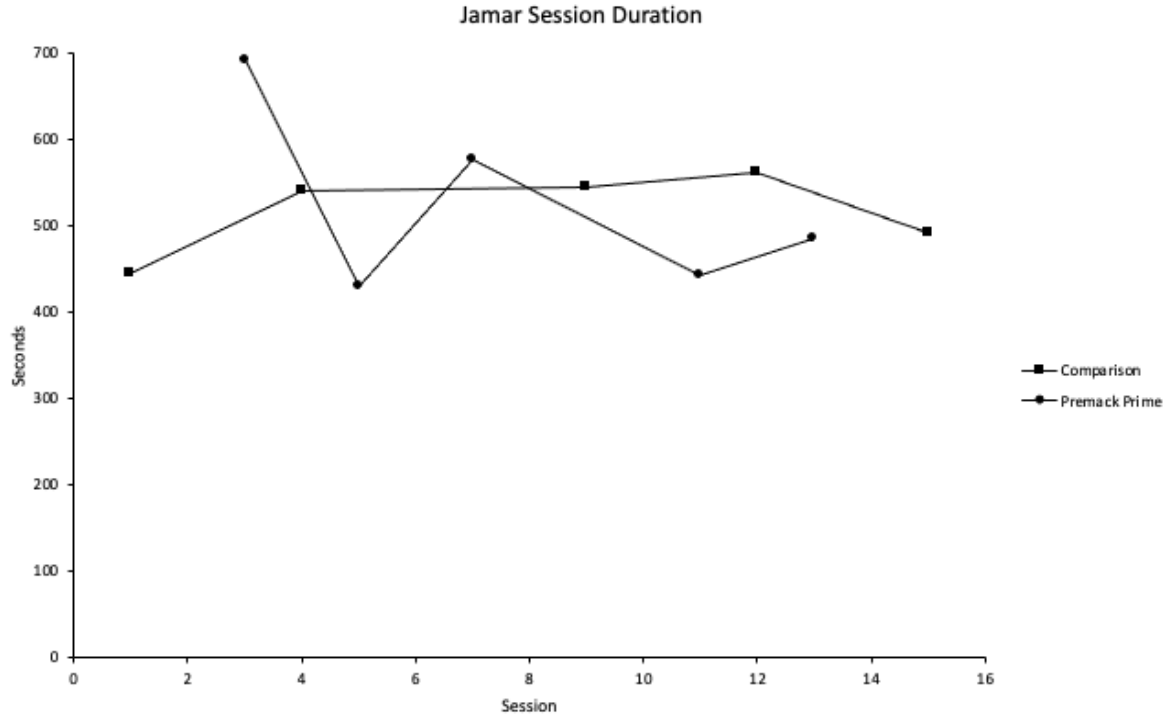
Figure 24

Jamar Rate of Obtained Reinforcement



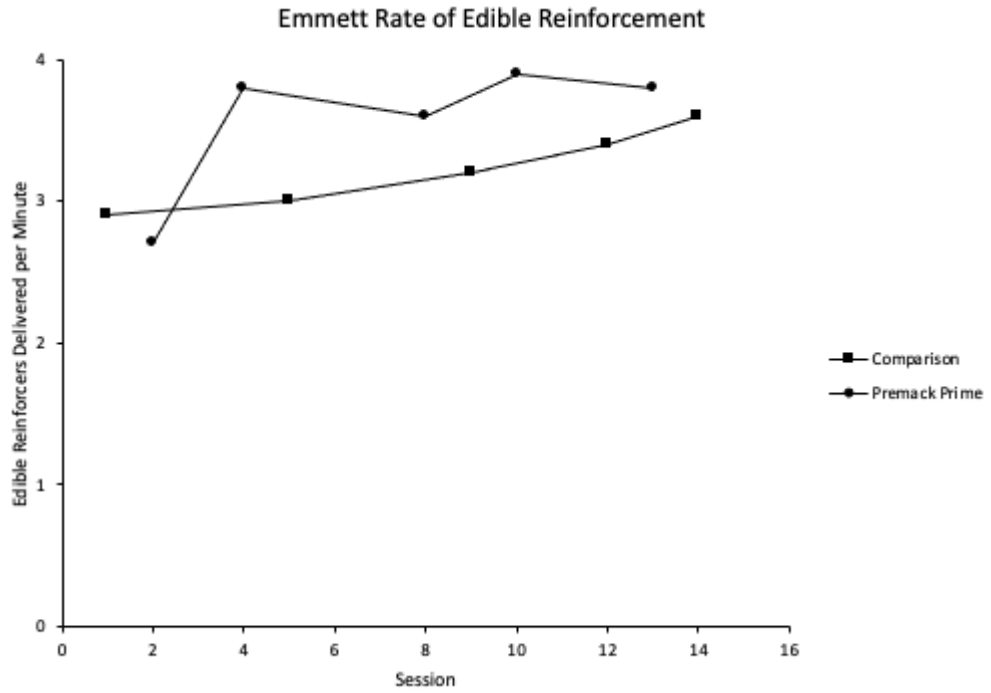
Note. Figure 24 depicts the rate of edible reinforcement obtained by Jamar during the Premack Prime and Comparison Conditions.

Figure 25
Jamar Session Duration



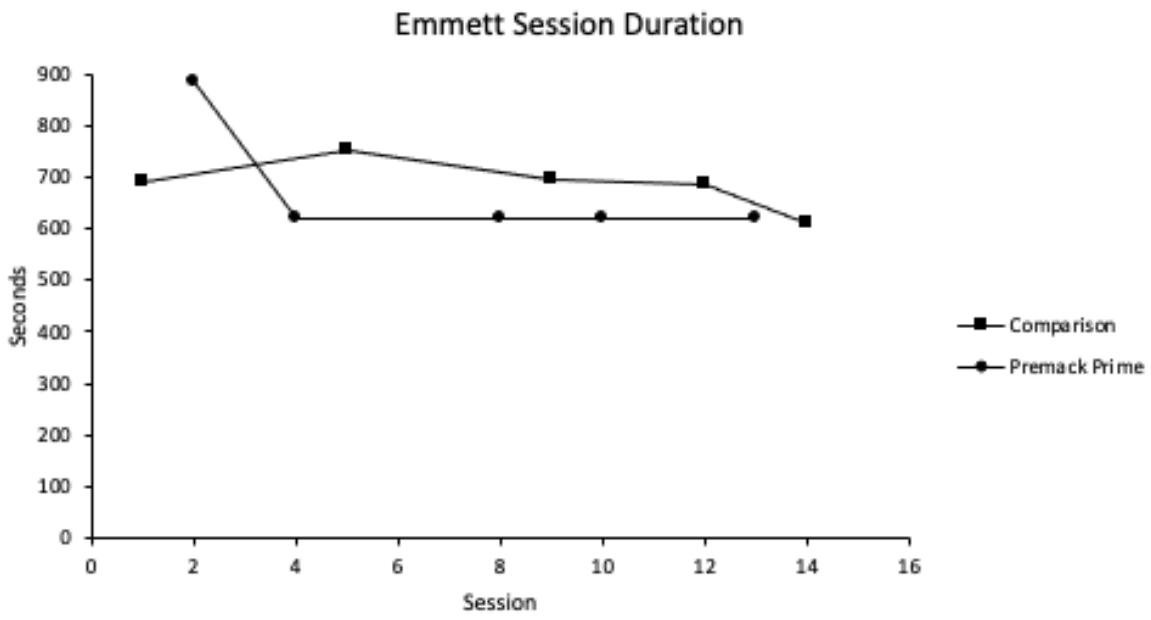
Note. Figure 25 depicts the session durations during the Premack Prime and Comparison Conditions.

Figure 26
Emmett Rate of Obtained Reinforcement



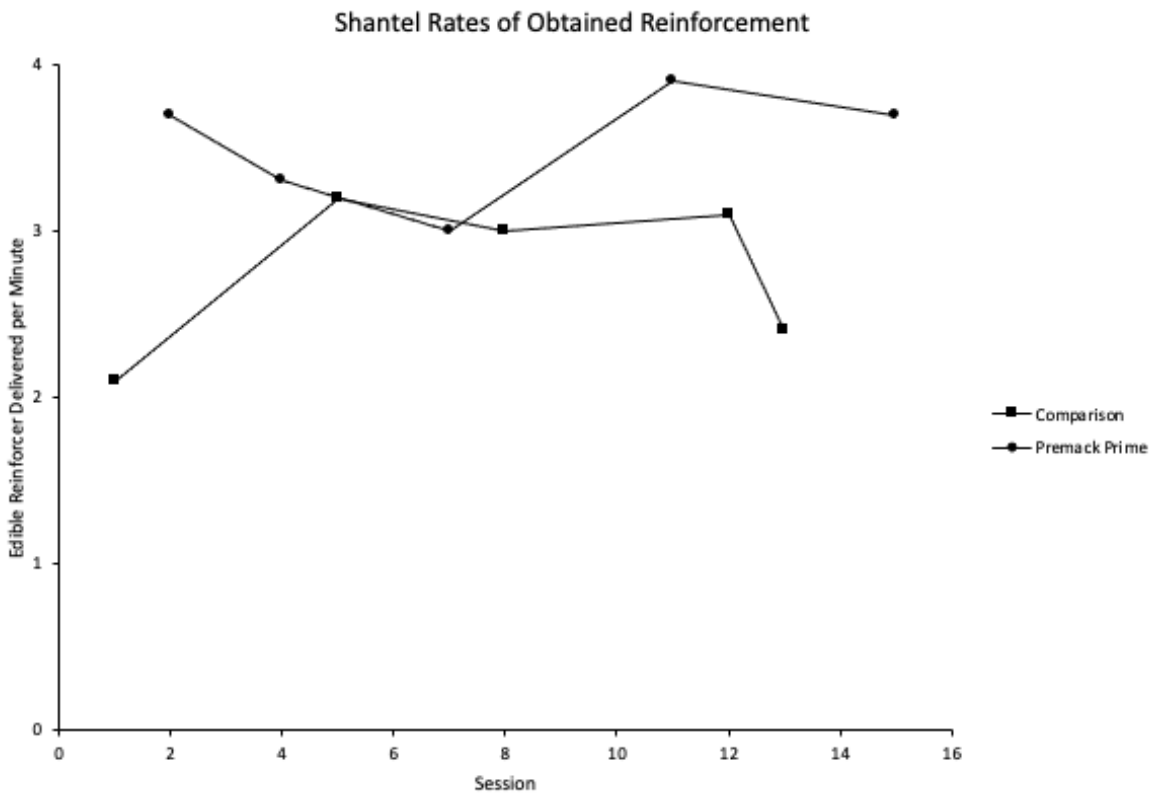
Note. Figure 26 depicts the rate of edible reinforcement obtained by Emmett during the Premack Prime and Comparison Conditions.

Figure 27
Emmett Session Duration



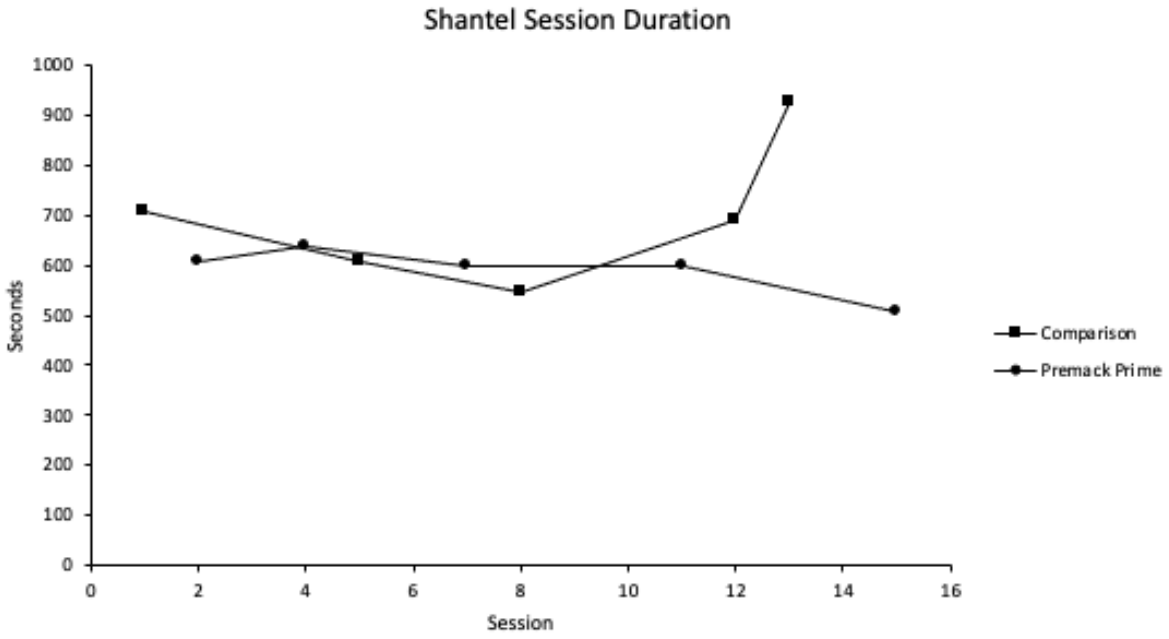
Note. Figure 27 depicts the session durations during the Premack Prime and Comparison Conditions.

Figure 28
Shantel Rate of Obtained Reinforcement



Note. Figure 28 depicts the rate of edible reinforcement obtained by Shantel during the Premack Prime and Comparison Conditions.

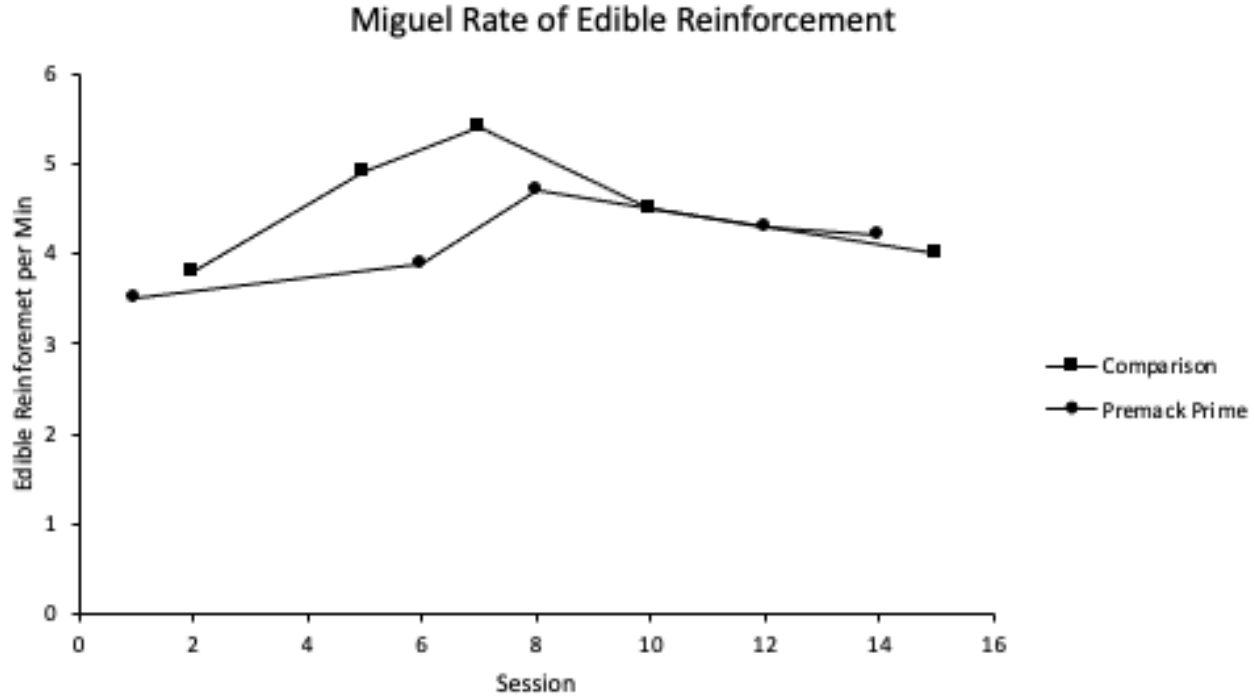
Figure 29
Shantel Session Duration



Note. Figure 29 depicts the session durations during the Premack Prime and Comparison Conditions.

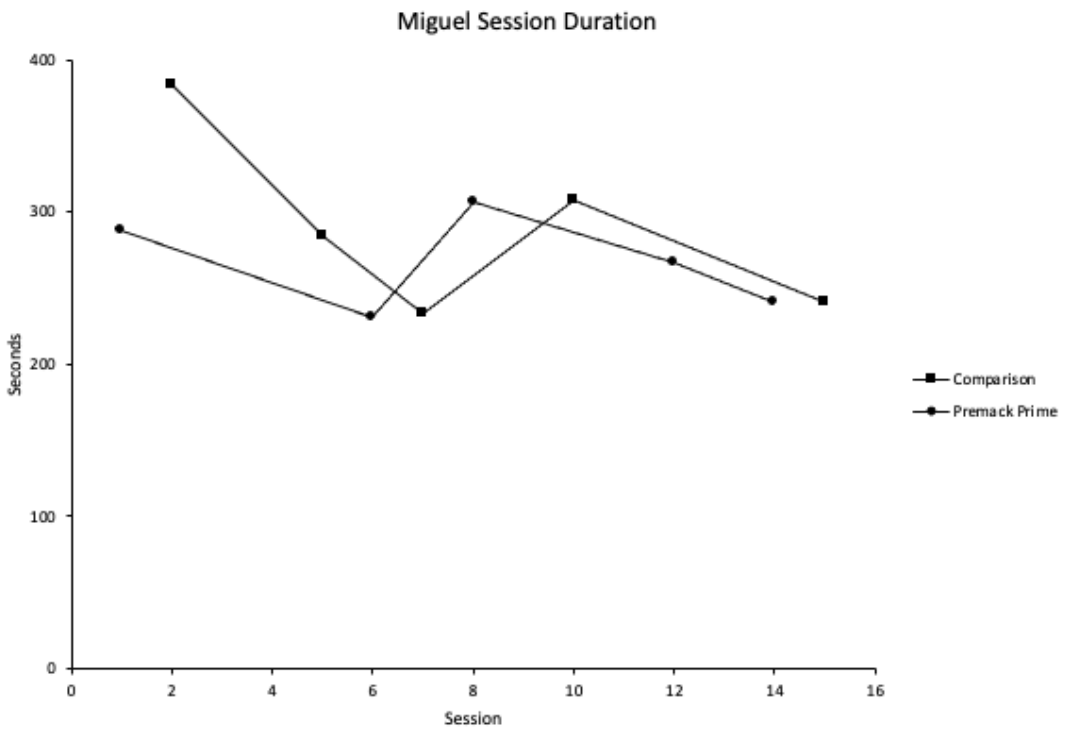
Figure 30

Miguel Rate of Obtained Reinforcement



Note. Figure 30 depicts the rate of edible reinforcement obtained by Miguel during the Premack Prime and Comparison Conditions.

Figure 31
Miguel Session Duration



Note. Figure 31 depicts the session durations during the Premack Prime and Comparison Conditions.

CHAPTER 5

DISCUSSION

The Premack principle suggests that any Response A can be used as a reinforcer for any Response B as long as Response A occurs at a higher probability than Response B. Premack's initial evaluation first monitored participants' rates of responding between two concurrently available activities in a 15 min session. After establishing high and low probability responses between the activities, Premack demonstrated that the rate of low probability response increased when access to a high probability response was contingent upon engaging in a low probability response. Though the literature regarding the Premack principle has demonstrated that restricting access to a high probability response can increase the likelihood of engagement in a low probability response, there is a need for further research to determine how these contingency arrangements may impact behavior in applied settings.

The current evaluation differs from Premack's 1959 description of the Premack principle in a few ways. In this experiment, the researcher controlled access to both high and low probability activities based on a specific number of trials per activity, so evaluation of increasing the future likelihood of the low probability activity would not have been a meaningful evaluation. Therefore, the present study aimed to evaluate how participants respond in other meaningful ways (on-task behavior, challenging behavior, correct responding) when activities were arranged according to the Premack principle (low probability to high probability) versus the opposite (high probability to low

probability).

The present study evaluated participant behavior under three conditions. The Premack Pure Condition was designed to evaluate participant responding with Premack principle alone being the only schedule of reinforcement programmed (i.e., completion of low probability activity grants access to high probability activity). The Premack Prime Condition was designed to evaluate both arranging the schedule according to the Premack principle as well as programming for a schedule of reinforcement using edible reinforcers throughout activities. The Comparison Condition was designed as a comparison to the schedules arranged using Premack by starting the sequence with the high probability activity and then the low probability activity. The same edible schedule of reinforcement was programmed in the Comparison Condition as well to design it as a direct comparison to the Premack Prime Condition. This decision was made primarily in consideration of the natural environment, as the participants' classroom had programmed schedules of edible reinforcement embedded across activities throughout the school day.

Results of the present evaluation show little to no differentiation between any of the conditions on any of the dependent variables. There was no difference in participants' on-task behavior, challenging behavior, correct responding, or rate of obtained edible reinforcement regardless of condition. Though the data were not differentiated, the participants responded favorably by engaging in on-task behavior for the majority of sessions and engaging in very few instances of challenging behavior.

One possible explanation for the lack of differentiation could be the session length. In the typical classroom environment, participants engage in work sessions of approximately the same

length with similar schedules of reinforcement. With this familiarity, there may be a stronger establishing operation (EO), or motivation, for participants to finish the work session and return to their classroom schedule than any EO to escape either activity by engaging in off-task behavior or challenging behavior. In sum, the negative reinforcement of ending a work session may be a more potent reinforcer than the temporary negative reinforcement available for escaping work in a session by engaging in off-task or challenging behavior.

Limitations

The present evaluation has some limitations that may have impacted results interpretation. One consideration is that the researcher did not control for what activity participants returned to following a session of the study. All study sessions were embedded within the participant's typical school schedule when individual instruction typically occurs. However, the classroom schedule had a variety of activities that followed individual instruction. For example, after some instructional periods participants have a whole group instruction period, after others participants go to specials (i.e., art, music, physical education). This limitation may add some validity to the previously mentioned consideration that there was a stronger EO to escape the work session entirely and resume typical school day schedule, potentially to attend a more preferred activity, than an EO to escape work in the short term within a work session.

Another limitation of the present evaluation is that the researcher did not differentially reinforce correct responding during the probes. This decision was made to ensure schedules of programmed reinforcement for responding were consistent across conditions. Given participants learned that as long as they made an academically appropriate response (point, tact) they recieved an edible reinforcer without having to make a condition discrimination, thus they engaged in high rates of incorrect responding.

Future Directions

Though the present evaluation produced undifferentiated results, these results may inform future research in this area. One area for future expansion of this work could be to conduct a similar evaluation with an additional assessment to evaluate if participants engaged in escape maintained challenging behavior prior to conducting the experiment. Additionally, researchers could conduct an assessment to determine general work tolerance per participant to more appropriately program for session lengths that may evoke off-task or challenging behavior to better evaluate any differences that may exist between schedules.

Future work in this area may also include evaluating low and high probability activities that differ in response topography or environmental stimuli more than just the instructional materials as in the present study. For example, researchers may evaluate the same dependent variables when the high and low probability activities are more different, such as whole group versus individual instruction or independent work. Researchers may observe response differentiation if the high and low probabilities differ more substantially.

Additionally, there is room for further evaluation of the Comparison Condition. Ordering activities from high probability to low probability is a similar arrangement to high-probability response sequences. High-probability response sequences apply behavioral momentum theory (BMT) to build "momentum" during the high probability responses that persists when a low probability demand is placed (Mace et al., 1988). The BMT literature would suggest sequencing activities in the opposite order from the Premack principle. This contrast in theory may warrant further evaluation.

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APPENDIX

Appendix A

Simone

_____HIGH PROB TO LOW PROB
Therapist:
Date:

Typing Letters			Matching Words to Pictures		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
T			toothbrush		
H			sink		
J			chair		
O			book		
E			shirt		

_____LOW PROB TO HIGH PROB - **EDIBLE**
Therapist:
Date:

Matching Words to Pictures			Typing Letters		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
bowl			M		
pencil			B		
trash can			G		
microwave			F		
toilet			L		

_____ LOW PROB TO HIGH PROB - **NO EDIBLE**
Therapist:
Date:

Matching Words to Pictures			Typing Letters		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
door			U		
pants			C		
table			P		
shoes			D		
water bottle			R		

Jamar

_____HIGH PROB TO LOW PROB
Therapist:
Date:

Writing Letters			Reading CVC words		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
P			cat		
M			pen		
D			big		
C			hot		
H			mud		

_____LOW PROB TO HIGH PROB - **EDIBLE**
Therapist:
Date:

Reading CVC Words			Writing Letters		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
ran			K		
wet			G		
fit			S		
cod			A		
tub			O		

_____ LOW PROB TO HIGH PROB - **NO EDIBLE**
Therapist:
Date:

Reading CVC Words			Writing Letters		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
sad			N		
get			E		
win			V		
dog			L		
run			B		

Emmett

_____HIGH PROB TO LOW PROB
Therapist:
Date:

Typing CVC Words			Writing Letters		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
sad			A		
wet			J		
pig			B		
hot			K		
fun			N		

_____LOW PROB TO HIGH PROB - **EDIBLE**
Therapist:
Date:

Writing Letters			Typing CVC Words		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
F			bat		
L			pen		
E			win		
M			dog		
G			hum		

_____ LOW PROB TO HIGH PROB - **NO EDIBLE**
Therapist:
Date:

Writing Letters			Typing CVC Words		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
O			man		
H			led		
P			sit		
C			got		
I			tub		

Shantel

_____HIGH PROB TO LOW PROB
Therapist:
Date:

Teacher Identification			Matching Words to Pictures		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
Maddie			toilet		
Leah			bowl		
Annie Grace			cup		
Jazmynn			shoes		
Chloe			trash can		

_____LOW PROB TO HIGH PROB - **EDIBLE**
Therapist:
Date:

Matching Words to Pictures			Teacher Identification		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
shirt			SK		
water bottle			Lydia		
table			Amber		
book			Jessica		
microwave			Natalie		

_____ LOW PROB TO HIGH PROB - **NO EDIBLE**
Therapist:
Date:

Matching Words to Pictures			Teacher Identification		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
door			Prentiss		
pants			Nadya		
chair			Emma		
pencil			Ale		
sink			Hannah		

Miguel

_____HIGH PROB TO LOW PROB
Therapist:
Date:

Imitation			Matching Objects to Pictures		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
Tap head			Ball		
Touch belly			Dog		
Knock table			Table		

_____LOW PROB TO HIGH PROB - **EDIBLE**
Therapist:
Date:

Matching Objects to Pictures			Imitation		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
Chair			Raise your hand		
Box			Clasp hands		
Girl			Touch feet		

_____ LOW PROB TO HIGH PROB - **NO EDIBLE**
Therapist:
Date:

Matching Objects to Pictures			Imitation		
Target	**Probe**	**Tally (3)**	**Target**	**Probe**	**Tally (3)**
Car			Quiet mouth		
Spoon			Arms in T		
Cup			Tap lap		

Procedural Fidelity - red & blue

Target:	1	2	3	4	5
1. Teacher presents visual schedule in order corresponding with condition.					
2. Tells student order of activities.					
3. Probes all targets in the first activity.					
4. Provides an edible item following each response.					
5. Conducts 3 teaching trials using controlling prompt for first activity.					
6. Provides an edible item following each response.					
7. Removes first activity from visual schedule.					
8. Probes targets in second activity.					
9. Provides an edible item following each response.					
10. Conducts 3 teaching trials using controlling prompt.					
11. Provides an edible item following each response.					
12. Removes second activity from visual schedule.					
13. Tells student they are all done with work.					

Procedural Fidelity - yellow

Target:	1	2	3	4	5
1. Teacher presents visual schedule in order corresponding with condition.					
2. Tells student order of activities.					
3. Probes all targets in the first activity.					
4. Does not provide an edible item following each response.					
5. Conducts 3 teaching trials using controlling prompt for first activity.					
6. Does not provide an edible item following each response.					
7. Removes first activity from visual schedule.					
8. Probes targets in second activity.					
9. Does not provide an edible item following each response.					
10. Conducts 3 teaching trials using the controlling prompt.					
11. Does not provide an edible item following each response.					
12. Removes second activity from visual schedule.					
13. Tells student they are all done with work.					