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The effects of client responding on caregiver presentation of skill-building procedures

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THE EFFECTS OF CLIENT RESPONDING ON CAREGIVER PRESENTATION OF SKILL-BUILDING PROCEDURES

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Abstract

Child mediated-consequences are likely to influence how often caregivers implement a prescribed intervention with students with disabilities, but prior studies fall short of demonstrating such a functional relation. Study 1 investigated correlations between child performance and caregiver adherence using data collected from preschool students with autism using the Autism Curriculum Encyclopedia© (ACE). Study 2 experimentally evaluated the effects of different schedules of confederates' correct responses on caregiver presentation of three different tasks in a concurrent operant arrangement. Specifically, investigators compared frequency of task presentations across three confederate-mediated schedules of correct responses (0% correct, 100% correct, and lean-to-rich). Tasks associated with the lean-to-rich schedule of confederate correct responding were presented more frequently by all four participants. Study 3 extended Study 2 to naturalistic teaching conditions. Investigators compared levels of caregiver target task presentations during a 30 min teaching session under two conditions. In the first condition, learners made a high level of correct responses based on their history acquiring similar construction tasks with similar materials (i.e., large blocks). In the second condition, learners were less likely to respond correctly based on the materials (i.e., small blocks that were more challenging for participants to manipulate). Results indicated caregiver task presentations were higher given a rich schedule of correct responses relative to a lean schedule. Results are discussed in terms of future research on variables that influence caregiver adherence and, in turn, impact client outcomes.

Effects of Client Responding on Caregiver Presentation of Skill-Building Procedures

Behavior analytic researchers have conducted a number of studies examining the effects of more and less precise implementation of treatment on learning outcomes (e.g. Pipkin et al. 2010 on DRA, Wilder et al. 2006 on compliance), or what Peterson et al. (1982) describe as treatment integrity. Fewer studies have explored relations between the regularity with which treatment is applied and corresponding effects on learning. For purposes of the current investigation, procedural adherence is defined as the frequency with which caregivers implement a teaching procedure relative to how often that procedure is prescribed. Low levels of adherence may diminish outcomes of ABA therapy (Allen & Warzak, 2002; Muir & Milan 1982). By contrast, high levels of adherence may directly benefit the learner by providing increased opportunities to respond and contact reinforcement (Carnine, 1976; Koegel et al. 1980; Smith, 2001). Linstead et al. (2017), for example, demonstrated a strong relationship between high intensity of ABA therapy and increased mastery of learning objectives.

Service providers are also likely to benefit when caregivers adhere to the recommended treatment intensity. Caregivers may require frequent contact with a clinician in order to ensure that behavioral procedures are implemented consistently and accurately. For example, Schepis et al. (2001) required instruction, role-play, and feedback in both classroom training and on-the-job training to increase teacher-provided learning opportunities. Instruction, monitoring and feedback, however, require a significant amount of a consultant's time and does not ensure optimal levels of adherence. St. Peter et al. (2014) found that even with feedback and monitoring such as weekly video or written feedback, schedule development, weekly support phone calls, and a lottery system, rural parents' adherence to a prescribed schedule for submitting recorded sessions to experimenters averaged only 58%. Research elucidating the causes of low caregiver

adherence could help to inform the development of more resource-efficient and effective approaches to prevention and remediation of caregiver adherence as a barrier to student outcomes.

The study of child effects sheds a useful light on patterns of influence between caregiver and learner behavior. Carr et al. (1991) demonstrated that caregivers were more likely to present work trials to children associated with lower rates of problem behavior, and they were less likely to present work trials to children with higher rates of escape maintained challenging behavior. In practice, this may mean that a caregiver is less likely to present activities or demands that were previously associated with the onset of problem behavior. Empirical demonstrations of child effects may help clinicians to understand factors that influence adherence and to aid in developing function-based treatment of caregiver nonadherence. Stocco and Thompson (2015) reviewed the literature on child effects and its implications for caregiver behavior. Within this review, the authors highlighted empirical gaps in the literature on causes of low caregiver adherence; experimental investigations demonstrating caregiver-child interactions that strengthen desirable caregiver behavior such as adherence constitute one such gap.

A limited number of studies demonstrate the effects of child responding on caregiver behaviors such as high-quality social interaction (Bates, 1975), delivery of tangibles or praise statements (Berberich, 1971), and use of punishment procedures (Mulhern & Passman, 1979). Results from these studies support learner performance as a potential child-mediated variable that affects caregiver behavior, but researchers are yet to evaluate the effects of child response accuracy on caregiver adherence. Thus, the purpose of this series of studies is, first, to explore correlations between child performance and caregiver adherence; second, to evaluate the effects of confederate correct responses on caregiver presentation of prescribed teaching procedures;

and third, to evaluate the effects of child correct responses on caregiver adherence to prescribed procedures in more naturalistic teaching conditions.

Study 1: Exploratory Analysis of Variables

Method

Participants

Participants included 21 children (4 girls, 17 boys) who attended an educational day program for children diagnosed with Autism Spectrum Disorder (ASD). Participants ranged in age from 3 to 8 years old. Participants received behavior analytic programming 5 days a week for 6 hours each day in a year-round intensive instruction program. Board Certified Behavior Analysts (BCBA) employed at the day program developed programming for each participant. All participants had an active profile on the Autism Curriculum Encyclopedia® (ACE®); observational data on skill acquisition were scored and archived using this software system. Participant inclusion criteria was developed to minimize differences between participants that may inhibit a caregiver's ability to adhere. Inclusion criteria required participants to have minimal interruptions to their ABA instruction (i.e., academic, vocational, or community instruction), identical instruction hours, set prescriptions for all included active teaching programs on ACE®, as well as established progress objectives.

Data Collection

Participant data were extracted from ACE®. The ACE® Applied Behavior Analysis Software System is an educational software system for learners diagnosed with autism. The software is designed to help BCBAs and special educators assess, teach, and evaluate progress using evidence-based procedures. The ACE® was developed at The New England Center for Children located in Southborough, MA. Learners have individual profiles within which a BCBA

can activate and individualize teaching programs. Each teaching program is associated with a skill targeted for acquisition in the learner's Individualized Education Plan (IEP); thus, each learner has multiple active teaching programs at any given time. After a BCBA selects a teaching program to activate, they can individualize that program to meet the specific learner's need. Options include adding learner-specific instructions for teaching, prescribing how often that program should be run, as well as recommending how data should be collected. The BCBA can then use the ACE software system to monitor the learner's progress on each of the active teaching programs.

Data for this study were extracted from active teaching programs for each of the 21 participants. Data from teaching programs were included in this study if that program was activated by a BCBA, if that program was associated with an active IEP, if baseline data had been collected and teaching procedures had been implemented, and if the BCBA had entered a session per week prescription into the software system. A total of 339 active teaching programs met these inclusion criteria, with an average of 17.1 teaching programs active per participant, with a range of 2-23 programs.

Data were collected on multiple variables of interest for each included teaching program. These variables included teaching prescription, average sessions conducted per week, progress towards an objective, prorated progress towards a goal (with and without a ceiling), and adherence (with or without a ceiling). The teaching prescription consisted of the number of 5-9 trial teaching sessions to be conducted within a week, as recommended by the BCBA that activated the teaching program. Average sessions conducted per week were calculated by dividing the total number of teaching sessions conducted by the number of weeks between the client's IEP start date and the data extraction date. Progress towards an objective was calculated

as percentage of progress towards a pre-determined mastery criterion. Mastery criteria for each teaching program were established by the BCBA prior to the implementation of that program and specified the percentage correct, the number of therapists, the number of stimuli, targets, or contexts the skill must be demonstrated across to be considered mastered. An example of mastery criteria for a teaching program targeting naming objects might be: across 2 people and 1 setting, John will name an object presented individually in 89% of opportunities for 3 consecutive sessions with 15 objects. Percentage mastery was calculated by dividing the number of stimuli or contexts mastered by the total number specified in the mastery criterion for that program and multiplied by 100. Using the example above if John had mastered the skill with 10 objects out of the 15 prescribed, percentage mastery would be 66.7%. Prorated progress was then calculated by dividing the current progress toward mastery criteria for a teaching program by the proportion of the IEP year that had elapsed. This provided experimenters with the percentage mastery of the teaching program if the client continued to progress at the same rate for the remainder of the IEP year. Referencing the example with John above, if John had mastered the skill with 10 out of the prescribed 15 objects, and 80% of his IEP year had elapsed, prorated progress would be calculated by dividing 66.7 (percentage mastery) by 80 (percentage of elapsed IEP year) to get 83.4. For some teaching programs, this resulted in percent mastery exceeding 100%. Investigators calculated prorated progress with ceiling exactly as they calculated prorated progress except that any prorated progress value over 100% was recorded as 100%. Adherence was calculated by dividing the average sessions conducted per week by the session prescription and multiplied by 100. Some teaching programs were taught more frequently than they were prescribed, and adherence was reported as greater than 100% in those

cases. Adherence with a ceiling was calculated in the same way as adherence except all values over 100% were recorded as 100%.

Analyses

Investigators conducted an exploratory analysis of relations between the average sessions conducted per week with prorated mastery, as well as relations between adherence to the teaching prescription and prorated mastery for each teaching program.

Pearson Correlation. A Pearson Correlation was used to examine the relation between two variables at a time. Investigators initially examined the following potential correlations: average session per week and prorated progress; average sessions per week and prorated progress with a ceiling; adherence and prorated progress; adherence and prorated progress with ceiling; adherence with ceiling and prorated progress with ceiling. Based on the results of these analyses, investigators conducted further data manipulations. Manipulations included the exclusion of data from IEPs in which less than 50% of the IEP year had lapsed, as well as removal of the occupational therapy (OT) curriculum. Occupational therapy programs were selected for exclusion because there were typically conducted in an environment specific to that program (e.g., gym), and no other curriculum could be implemented at that time.

Chi-Square Analysis. Data were characterized based on results of a receiver operating characteristics (ROC) graph. The ROC graph was used to establish a cut off and organize data into two groupings for analysis in the Chi Square model. The cut off value was selected where percent specificity (the proportion of average sessions per week that resulted in progress towards goal) of variables was the highest before percent sensitivity (the proportion of average sessions per week that did not result in progress towards a goal) began to decrease. The ROC graph was computed using average sessions and prorated progress toward goal. The chi-square analysis was

then conducted to determine the relationship between average sessions conducted per week and prorated progress toward goal.

Results

Table 1 shows the results of this exploratory analysis. Results of a Pearson correlation demonstrated only weak relations between the variables of interest. The strongest correlation occurred between adherence with a ceiling and prorated progress with a ceiling when more than 50% of IEP had elapsed, and OT programs were removed. The second weak correlation occurred between adherence with a ceiling and prorated progress with a ceiling when 50% of the IEP year had elapsed. Significance of the r value is determined by proximity to +1. The strongest of our weak correlations occurred between the variables for which data were excluded. No statistically significant relations were detected. Results of a post-ROC chi-square analysis appear in Figure 1. Results of this analysis were not significant at the $p<0.05$ level.

Study 2

Method

Participants, Settings, and Materials

Participants included four behavior therapists employed at agencies providing ABA therapy to children diagnosed with Autism Spectrum Disorder (ASD). Three of the four therapists were employed at an educational day program. These three participants were employed at the same facility, but each worked in a different program. Abigail worked in a residential program with clients between 10 and 13 years old. Lucy worked in a home-based program with clients under 3 years old. Pepper worked in an adult program with clients above 22 years old. The fourth therapist, Willa, was employed at an agency providing in-home and center-based ABA therapy; she worked with students ages 3 to 8 years old. Participants were referred to

this study by their supervisor, had received 40+ hours of instruction in behavior analytic teaching methods, and had been in the field for 2 years or less.

Sessions were 10 min in length and were conducted 1-3 times per day, 2-5 days per week. Sessions ran in a 4.3 m by 4.1 m room equipped with a one-way mirror, leisure materials, work binders, and a timer that beeped either every minute (Abigail only) or on a variable schedule averaging to 1-min intervals. The timer was a key locator activated by the experimenter when a timer indicated. The experimenter turned the sound off when the participant travelled to the button and pressed the large red circle in the center.

Two typically developing children ages 4-5 and one adult graduate student served as confederate learners during sessions. All confederates wore headphones connected to a cellular phone. The cellular phone had an ongoing call with the experimenter's cellular phone in another room, thus the experimenter could speak to the confederate without the participant hearing. The experimenter was able to see all sessions via a two-way mirror.

Measurement and Interobserver Agreement

Data were collected on the frequency of task presentations. Experimenters defined a task presentation as the caregiver's verbal presentation of an instruction for a specific task (e.g., "Clap hands"). Confederate response to an instruction is not included in the definition and not required for an instruction to be counted as a task presentation. In the current study all participants waited for a confederate response before presenting a task instruction. Experimenters scored each session from video records using Instant Data® software.

Interobserver agreement (IOA) was scored for at least 30% of sessions distributed across all phases of the study. Interobserver agreement of task presentations were calculated by dividing the total number of 10-s intervals with agreement (i.e., two independent observers both recorded

the same frequency of trials for the same tasks in that interval) by 60 intervals in each 10-min session. The resulting quotient was converted to a percentage. Interobserver agreement was assessed for 34.2% of sessions for Abigail distributed across phases of the study. Mean IOA for the frequency of Abigail's task presentation was 96.3%, with a range of 90.2-100%. For Lucy, 32% of sessions distributed across phases of the study were scored. Mean IOA calculated for frequency of Lucy's task presentation was 95.9%, with a range of 90.2-100%. Interobserver agreement was scored in 30% of sessions for Pepper distributed across phases of the study. Mean IOA calculated for Pepper's frequency of task presentation was 98.9%, with a range of 94.3-100%. For Willa, 33% of sessions were scored across phases of the study. Mean IOA calculated for Willa's frequency of task presentation was 99.3% with a range of 95.2-100%.

Design and Procedures

Study 2 evaluated the degree to which differential confederate correct responding affected caregiver adherence in a concurrent-operant arrangement. Experimental control was demonstrated with a multi-element design with embedded contingency reversal. In which the schedules of correct responding for each task were reversed between conditions. In cases where caregiver responding was undifferentiated between teaching tasks, experimenters examined effects of a series of manipulations (e.g., experimenter-prescribed number of task presentations).

Confederate training. Confederates completed brief pre-experimental training sessions in which they practiced following the experimenter's verbal prompts to respond to teacher instructions correctly (agreement trials; 100% correct responding) or incorrectly (disagreement trials; 0% or no correct responding). The training sessions consisted of randomly interspersed agreement and disagreement trials until the confederate reached mastery criterion. The mastery criterion for pre-experimental training was five consecutive correct agreement trials (100%

correct responding) and five consecutive correct disagreement trials (0% or no correct responding) without prompts from the experimenter. The child confederate received small toys or candy for participation at the end of each pre-experimental training session, while the adult confederate received verbal praise and gratitude statements from the experimenter.

During each pre-experimental training session, the experimenter first delivered instructions to the confederate (e.g., "This time when you sit at the table, you should touch your nose no matter what the teacher says. Let's practice. Show me what you'll do if the teacher says 'Clap your hands.' Great! Now show me what you'll do if the teacher says 'Touch your nose.' That's right!"). The experimenter then told the confederate that he or she would wear headphones and listen to the experimenter while following the instructions. Next, the experimenter left the room and a novel teacher was introduced to the confederate. The experimenter then prompted the confederate from outside of the room to respond accurately or inaccurately to the novel teacher's instructions. When the confederate responded accurately on agreement (100% correct responding) and disagreement trials (0% correct responding), the experimenter delivered verbal praise via the headphones. When the confederate either did not respond or responded inaccurately during training (e.g., the confederate clapped his hands when the experimenter prompted him to touch his nose regardless of the teacher's instruction), the experimenter immediately restated the instruction (e.g., "Remember, we're going to touch our nose no matter what the teacher asks!").

While this original method of confederate training was efficacious, the confederate training protocol was revised to adjust for the addition of a third condition. During the third condition (Lean to Rich), the confederate was required to respond correctly and incorrectly to the same task during some sessions. An overarching rule could not be applied (e.g., touch your nose

no matter what the teacher says), thus, the revised training prepared confederates to only follow the instructions of the experimenter and to ignore the instructions of the teacher.

Following criterion-level performance in pre-experimental training, confederates participated in subsequent experimental sessions identical to the final training session. Confederates continued to receive small toys or candy for their participation in experimental sessions.

Two-schedule analysis of task presentation (100% correct, 0% correct). Experimenters placed two work binders (for example: one binder contained the task "Clap hands," the other binder contained the task "Arms up"), a bin of leisure materials, and a timer on a table across the room from the work table. The experimenter told the teacher to sit at the work table. Prior to each teaching session, the experimenter read the following script to the teacher:

> *This study is investigating interactions between students and caregivers. Following your completion of this study, I will answer any questions you have about its purpose or findings. Your participation in this study has no effect on your relationship with me, (agency), or Western New England University. During the next session you will be teaching two direction following tasks to (student). Each task is located in a separate binder on this shelf; please take only one binder at a time to the table to teach. After teaching a task, please return the binder to the shelf before moving on to another task or activity. Try to present each of the direction following tasks about 15 times. You can choose the direction following tasks you would like to teach and you can change between teaching tasks or a leisure break any time. When teaching, no physical guidance is required on your part; just state the instructions, without a model, for the task you want to teach. For example: "touch head". When the student responds, please only restate the*

instruction with the word "that's…" at the beginning and demonstrate the action. Let your intonation depict whether it was a correct or incorrect response. For example: "That's touching your nose!" while touching your nose for a correct response or "That's touching your nose" while touching your nose for an incorrect response. During the leisure break, please bring the tray of materials from the shelf to the table and allow the student to play independently. You may provide help if the student asks but try to limit your interactions with the student during leisure breaks. Whenever the timer beeps, please press the "enter" button to reset it. For the next session, whenever you present the instruction "clap your hands" the participant will always respond correctly. Whenever you present the instruction "arms up" the participant will never respond correctly. Again, you can choose the direction following tasks you would like to teach and you can change between teaching tasks or a leisure break at any time. You have the right to end the session at any point. Can you please summarize these instructions for me?

The experimenter answered teacher questions only if it was possible to do so without revealing the purpose of the study. During initial experimental sessions investigators introduced procedural modifications to mitigate the effects of potential mediating behavior on participant responding. A timer beeped every minute for Abigail and beeped at variable intervals averaging to 1 minute for the remaining participants. Participants turned off the timer by traveling across the room and pressing a button to cease the sound, potentially interrupting any mediating behavior. To prevent participants from quickly alternating between tasks, the response effort to switch tasks was also increased. Investigators placed tasks in binders on a shelf in the teaching environment and instructed participants to return each binder before switching tasks. Finally, the experimenter stated contingencies associated with each task prior to each experimental session. The

experimenter provided rule statements to more efficiently bring behavior under control of the programmed schedules of correct responding. Some of the aforementioned procedures (such as the addition of the binders, stated contingencies, and timer) were not in place during early phases for Abigail. Introduction of these procedures are noted on Figure 2.

Three-schedule analysis of task presentation (100% correct, 0% correct, lean-to-rich [50-66-100%] correct). This comparison was identical to the two-schedule comparison except a third task was available for the caregiver. The third task ("Tap table") was followed by 50% correct child responding for the first session, 66% correct responding for the second session, and 100% correct responding for the third session of each comparison. If a three-schedule comparison revealed differential adherence and effects were replicated in a contingency reversal, experimenters introduced a second manipulation in which the task assigned to the lean-to-rich schedule produced stable correct child responding (66%) across multiple sessions. The purpose of this manipulation was to interpret whether intermittent correct responses within a teaching session or an increasing probability of correct responses across teaching sessions best account for caregivers' differentially high adherence under the lean-to-rich schedule. Due to constraints on participant and confederate time, investigators did not conduct sufficient experimental sessions to evaluate and replicate the effects of this manipulation.

Because the three-schedule phase did not reveal differential levels of adherence with Pepper, experimenters introduced additional manipulations. First, experimenters slightly altered part of the script before sessions. Originally, the script read:

> *"Whenever you present the instruction "tap table," the participant will emit some correct and some incorrect responses."*

Experimenters changed the script to:

"Whenever you present the instruction "tap table," the participant will make progress across sessions."

The purpose of this manipulation was to more clearly describe the contingency to Pepper. Second, experimenters changed the task associated with lean-to-rich (50-66-100%) correct client responding to a schedule of 20-25-33-50-66-100% correct client responding. The purpose of this manipulation was to evaluate whether more gradual fading from lean-to-rich across more sessions would affect frequency of task presentation. Due to constraints on participant time, Pepper was only exposed to a single abbreviated phase of the lean-to-rich schedule of 20-25-33% correct confederate responding.

Prescription of trial frequency (P100, P15, or P0). Some schedule analyses included instructions that each task should be presented at least 100 times (i.e., 100 trials of each task) or at least 15 times (i.e., 15 trials of each task). Introduction of these prescriptions are indicated as P100 and P15 in Figures 2-5. P0 indicates no prescribed minimum number of task presentations. Additionally, the experimenter said the following script prior to each P0 session:

"During the next session you will be teaching two direction following tasks to (student). Each task is located in a separate binder on this shelf; please take only one binder at a time to the table to teach. After teaching a task, please return the binder to the shelf before moving on to another task or activity. For this session, you can allocate your teaching time however you choose."

Single Choice Assessment. A single choice assessment (SCA) was conducted after every third session throughout the three-schedule analysis for most participants. Each SCA was 2 min in duration. Experimenters provided the participant with the instruction to teach only one of the

three tasks for the duration of the session (no leisure was available). The experimenter also stated how the child would respond to each task prior to each SCA:

> *"For the next session, whenever you present the instruction "clap your hands" the participant will always respond correctly. Whenever you present the instruction "arms up" the participant will never respond correctly, and when you present the instruction "tap table" the participant will emit some correct and some incorrect responses."*

If the participant chose the task associated with the "lean-to-rich" schedule (i.e., some correct, some incorrect), the confederate responded 66% correct throughout the single 2 min SCA session.

Contingency reversal. Experimenters rotated the schedule of confederate correct responses across tasks, while all other procedures remained the same. For example: the instruction "arms up" which was previously followed by a lean-to-rich schedule of correct responding was now followed by 100% correct confederate responding; "tap table" which was previously followed by 100% correct confederate responding was now followed by 0% correct responding; and "clap hands" which was previously followed by 0% correct confederate responses now produced the lean-to-rich schedule of correct responding (50%-66%-100%).

Results

Figures 2-5 displays results for each of the participants. Under the described procedural arrangement, the results of this study demonstrate a functional relation between the lean-to-rich schedule of correct child responses and higher frequencies of participant task presentations. Patterns of relative task presentations on the 0% and 100% schedules varied between participants, although these patterns were replicated within each participant.

For Abigail (Figure 2), the initial two-schedule analysis showed little difference between task presentation frequencies for the first 20 sessions despite several manipulations (i.e., increasing the prescription, placing tasks in binders, verbally stating contingencies per task prior to a teaching sessions, and adding a timer). Following the placement of tasks in binders and requiring the caregiver to return each binder before switching to another task, overall levels of responding increased. With the introduction of a timer that beeped every 1 min, overall levels of responding decreased to initial presentation frequencies. Levels of responding remained similar when the prescription was increased from 15 to 100 presentations per task. When the prescription was to teach tasks with no prescribed minimum, experimenters observed slightly higher levels of responding allocated to the task associated with 0% correct confederate responding (an average of 9.5 and 7 task presentations per session, respectively). This pattern maintained when a 15 task presentation prescription was reintroduced (an average of 13.8 and 10.3 task presentations per session respectively).

A two-schedule analysis for Lucy (Figure 3) revealed only small differences between the frequency of presentations of the task associated with 100% and 0% correct confederate responding. The level of responding increased when a 15 task presentation prescription was introduced and remained at this level when the prescription was removed. Similar to Abigail, data for Lucy indicate that correct client responding did not affect levels of task presentation within the two-schedule analysis. A two-schedule analysis was not completed for Pepper and Willa.

During a three-schedule analysis Abigail presented tasks associated with some level of incorrect responding (0% and lean-to-rich schedules of confederate correct responding) compared to the task followed by 100% correct responding (an average of 13, 17.3, and 8.6

presentations per session, respectively). This pattern of responding persisted when investigators reversed schedules of confederate responding across tasks and when the lean-to-rich schedule was held constant at 100% for three additional sessions (sessions 36, 37, and 38).

Results of a three-schedule analysis for Lucy demonstrate that correct confederate responding on a lean-to-rich schedule influenced task presentations. Lucy presented the task associated with a lean-to-rich (50-66-100%) schedule of correct confederate responses more than the tasks associated with 0% and 100% correct confederate responding (an average 14.7, 0, and 2 presentations per session, respectively). These results were replicated across two task reversals in which investigators manipulated the schedule of confederate responding per task. Average presentations for each task reversal were as follows: lean-to-rich, 16.3 and 17.3 presentations per session; 0% correct, 0 and 0; 100% correct, 0 and 2.3 presentations per session. Although Lucy presented more trials of the task followed by a lean-to-rich schedule (50-66-100%), presentation frequency varied based on the richness of the schedule of correct responses in each session. Specifically, Lucy's presentation frequency peaked in 3 of 4 comparisons when the confederate learner's correct responding increased to 66%. When confederate learner's correct responding was at its richest point, 100% correct, Lucy's presentation frequency decreased. Lucy continued with this pattern of responding across task reversals. In order to determine whether intermittent correct responses or the increasing probability of confederate correct responses accounted for Lucy's response allocation patterns, experimenters conducted an additional 3 sessions in which one task was followed by 66% correct confederate responding for all sessions. During this phase, Lucy allocated all of her responding to the task followed by the 66% correct schedule of confederate responses.

Pepper's task presentation frequencies (Figure 4) were undifferentiated for the first four comparisons of three teaching sessions, despite several manipulations (e.g., increasing prescription and updating the stated contingency). After the lean-to-rich schedule was altered to 20-25-33%, Pepper presented the task associated with that schedule and 100% correct confederate responding more often than she presented the task followed by 0% correct confederate responding. These results were replicated in one task reversal phase.

A majority of Willa's responding (Figure 5) was allocated toward the task followed by a lean-to-rich schedule of confederate correct responding across teaching sessions as compared to tasks associated with 100% and 0% correct responding. During the first two comparisons of three teaching sessions, experimenters noted that Willa was responding away from the task "arms up." Following session 6, Willa stated that she was self-conscious about lifting her arms; therefore, experimenters replaced the task "arms up" with "touch nose" for the remaining experimental sessions.

Results of the Single Choice Assessments are documented in Figures 2-5. Lucy reliably chose the schedule corresponding to her highest presentation frequency during the previous sessions. Abigail only participated in one SCA. Although not replicated, her selection also matched the schedule associated with her highest presentation frequency in the previous sessions. Pepper reliably selected the same schedule during each SCA; however, her responding during the concurrent schedule arrangement was variable and therefore experimenters could not assess whether or not responding during the SCA correlated with the highest task in the previous teaching sessions. Willa's task selection varied during each of her three SCAs. Task selection during the SCA corresponded with the most frequently presented task from prior teaching sessions only once. Of the three participants that completed repeated SCAs, Lucy and Pepper

demonstrated a reliable preference while Willa showed indifference. Three of the four participants responded away from the 0% correct schedule of confederate responding during the SCA.

Figure 6 displays the cumulative presentations of tasks by confederate schedule of correct responding for each participant during all three schedule comparisons. Data from SCAs and two schedule comparisons were not included. Each participant experienced a different number of three schedule comparisons. Data were reported from 9 sessions for Abigail (sessions 29-31, 33-38), 14 sessions for Lucy (sessions 11-13, 15-17, 19-22), 30 sessions for Pepper (sessions 1-3, 5-7, 9-11, 13-15, 17-19, 21-23, 25-27, 29-31, 33-35, 37-39), and 18 sessions for Willa (sessions 1-3, 5-10, 12-14, 16-21). Three out of the four participants presented tasks associated with the lean-to-rich schedule of correct responding more often than tasks associated with 100% correct and 0% correct.

Study 3

Method

Participants and Setting

Two caregivers, Jane and Mary, participated in Study 3. They were 22-30 years old and employed in an educational day program for children diagnosed with an Autism Spectrum Disorder. Each participant worked with the same client during all sessions, and experimenters ensured that participants did not have extensive experience working with their assigned client prior to enrollment in this study. Participants received at least 2 hr of training in teaching response chains and the use of a least-to-most prompting procedures as part of their employee onboarding.

Two male clients, Leo and John, also participated in the study. Clients ranged from 7-14 years old. Both clients were diagnosed with an Autism Spectrum Disorder and received educational and clinical services in a private school for children with disabilities. Both clients demonstrated color matching and a history of acquiring response chains with least-to-most physical prompting and reinforcement.

Sessions were conducted in the client's typical learning environment within a special education classroom. Classrooms contained desks, chairs, cabinets, shelves, and materials for academic programming. Teaching tasks in Study 2 included building a variety of constructions using Lego® blocks. Leisure items included access to drawing materials, various sensory toys, and an iPad. Materials for maintenance programs included small pictures, and worksheets. Prior to each session, the experimenter gave participants written directions for teaching block constructions as well as a blank data sheet. A video camera was also present in the classroom to record each session. An experimenter was present during sessions; however, she sat at least 1 m away from the participant-client dyad.

Response Measurement and Interobserver Agreement

Task presentation frequency was calculated for participant presentation of the target construction task during each teaching session. Observers recorded the frequency of task presentations defined as the participant placing the task materials on the client's desk and delivering the verbal instruction "build the Legos."

Interobserver agreement (IOA) was scored for at least 33% of sessions for each participant across all conditions and phases of the study. Interobserver agreement of trials per task was calculated by dividing the total number of 10-s intervals with agreement (i.e., two independent observers both recorded the same frequency of trials for the same tasks in that

interval) by 180 intervals in each 30-min session. The resulting quotient was converted to a percentage. For Jane, 36% of sessions were scored across conditions of this study. Mean IOA for the frequency of Jane's task presentation was 97% with a range of 89.2-100%. For Mary, 35% of sessions were scored across conditions of this study. Mean IOA for the frequency of Mary's task presentation was 98% with a range of 96-100%.

Experimental Design and Procedures

Effects of client correct responding were examined by measuring participant frequency of task presentation in two conditions: low probability of correct performance (Lean) and high probability of correct performance (Rich). Mean percentage correct for each student participant are depicted in Table 2.

General procedure. At the start of each 30-min session, the experimenter gave caregiver participants the teaching materials, data sheets, and a menu of tasks to present to the client. The menu contained a description of one target construction task, at least one leisure task, and two tasks that the client had previously mastered. The maintenance and leisure tasks remained consistent across all sessions for each client, whereas the target task varied between conditions. Caregivers were given instructions to teach the target task using a total task chaining procedure and a least-to-most prompting hierarchy. The experimenter read the following instructions to each participant:

> *Here is a list of work tasks to be taught during this session. You can teach tasks in any order. Try to teach the construction task at least 15 times, and try to work on all tasks and activities during the session. You may also provide breaks for the student or access to leisure items whenever you deem appropriate. You can change between tasks and activities at any time.*

Following delivery of these instructions, the experimenter started the session timer which was out of view for participants. Sessions were conducted once per day, 3-5 days per week.

Rich Schedule of Correct Responses (Rich). During sessions of the rich condition, a 5-step construction task consisting of large, easy to manipulate blocks served as the target task. In an attempt to maintain similar participant response effort between conditions (i.e., prompting, implementation of correction procedures), experimenters introduced a new construction when the client responded with at least 50% independence or an increasing number of independently completed steps on three consecutive task presentations within the previous teaching session. For example: if a client performed 3 of 5, 4 of 5, and 5 of 5 steps independently on consecutive task presentations within a session of the rich condition, the experimenter introduced a new construction task with similar, large blocks in the next session. Table 2 denotes the mean percentage client correct responding in for each participant.

Lean Schedule of Correct Responses (Lean). All experimenter instructions and materials were identical to the rich condition except that the lean construction task involved smaller blocks that were difficult for clients to manipulate. Experimenters introduced a new construction task if the client exceeded 50% independence on any trial within the previous teaching session. For example: if a client performed 3 of 5 steps on a construction task within a session of the lean condition, the next session included a new construction task with similar materials.

Results

Client responding affected participant adherence. Mean percentage correct client responding is denoted in table 2. Both clients engaged in a higher percentage of correct responses during the rich condition, as compared to correct responding in the lean condition.

When client correct responding occurred on a lean schedule, participants were less likely to present the prescribed target task. When client correct responding occurred on a rich schedule, participants presented the prescribed target task at a higher frequency relative to responding on a lean schedule of correct responses. These results extend the findings of study 2 to naturalistic teaching conditions. Task presentation frequency for Jane and Mary are depicted in Figure 7.

Under the initial rich schedule, Jane presented the target task an average of 11.25 times per session. Presentation frequency of the target task decreased to an average of 6.33 presentations with the introduction of the lean schedule of correct responses. During a return to the rich schedule, the frequency of task presentations exceeded initial levels; Jane presented tasks an average of 13.67 times during sessions. In the final return to the lean schedule, Jane replicated previous frequencies with an average of 6.67 presentations per session. The teaching prescription was 15 presentations per session during all of Jane's teaching sessions. Despite the increase in the frequency of task presentations during the rich schedule, Jane only met the prescribed frequency per session during session 8.

Initially, Mary's average presentation frequency was similar under both lean and rich schedules of correct responding. She performed above the prescribed frequency in the first 10 sessions; thus, at session 11, experimenters removed the minimum prescription of 15 trials of the target task. Immediately following the prescription removal, Mary presented an average of 28 trials per session in sessions 11, 12, and 13. When the lean schedule of responding was reintroduced, performance returned to levels observed prior to prescription removal (average of 20 trials per session). During a reversal back to the rich schedule of correct responding, Mary presented an increased average of 27.67 trials per session. Mary's performance in subsequent

reversal phases replicated differentially higher trials under the rich schedule of correct responding.

Discussion

Caregiver adherence is worthy of further experimental evaluation because it has direct implications for client outcomes. This series of studies sought to investigate the relation between child performance and caregiver adherence, specifically, to evaluate the effects of child correct and incorrect responses as consequences for caregiver implementation of skill building procedures. Taken together, results of these studies suggest that child responding is a variable that affects caregiver behavior. Further research is necessary to inform clinical programming and to demonstrate a scientific analysis of caregiver adherence based, at least in part, on child performance.

Study 1 evaluated correlations between caregiver adherence and child skill mastery as well as average teaching sessions and child skill mastery. Statistical analyses revealed weak relations between average teaching sessions per week and prorated mastery of teaching objectives and between prorated mastery of teaching objectives and adherence to weekly session prescriptions. The results of this study suggest that adherence, as measured in this study, was not the only determinant of child progress.

Results of Study 1, though limited to weak relations, suggest that a child's progress may be determined by multiple variables that are intimately linked. Caregiver adherence to session schedules may be one such variable; however, relations between adherence and specific child learning variables were difficult to isolate due to features of the sample. Experimenters identified four features of this sample that may have contributed to the limited findings of this study. First,

data for this study were collected from caseloads of 5 different BCBAs with varied experience levels. BCBAs were responsible for prescribing the session frequency for each active teaching program. Prescriptions may have varied based on each BCBA's knowledge about each child as well as each BCBA's field experience level or experience level as an employee of the specific service organization. Second, problem behavior was not specifically measured and may have varied across participant. If a child was engaging in high rates of challenging behavior when the data were sampled, this may have interfered with a caregiver's ability to implement skill acquisition programs. Third, the teaching methods implemented differed between each of the active teaching programs. The database from which data were collected employs three basic teaching methods: discrete trial training (DTT), incidental teaching (IT), and chaining (TA). Data were sampled across all teaching methods. Certain methods may take longer to implement (e.g., chaining), or opportunities for teaching may rely solely on the environment (e.g., availability of a desired piece of playground equipment during incidental teaching). Differences in the conditions required for implementing each method and mastery criteria for target skills per method likely precluded finding strong correlations. Fourth, client schedule may have impacted caregiver adherence. Based on inclusion criteria, each client had an individualized schedule of ABA services. The amount of competing activities and number of hours engaged in behavior analytic teaching varied between clients; therefore, the relation between progress and teaching opportunities or adherence might have been weaker than under highly standardized therapy conditions.

The exploratory nature of this study required multiple statistical analyses to find relations between the variables of interest, such as: using a prorated progress calculation and creating ceilings of 100% for both adherence and prorated progress. Clinical standards for adherence vary

across program and even by clinician, which required authors to conduct multiple analyses and impose logical assumptions to find even a weak relation. These post hoc manipulations may or may not be required to find similar effects in other more uniform, small samples or in much larger samples.

Exploratory research, such as the methods employed in study 1, did not allow us to separate and analyze the specific variable of interest (adherence) from other variables that may contribute to child learning. Future studies should look to analyze specific sample variables and their relation with caregiver adherence, such as the effect of differing levels of the uncontrolled variables in this study (e.g., BCBA experience, problem behavior, teaching method, client schedule). Controlled experimental research is necessary to isolate the effects of each variable on child progress, thus informing efficacious practices for clinical programming.

Study 2 demonstrated that participants were more likely to present tasks followed by a lean-to-rich schedule of confederate correct and incorrect responding. In other words, caregivers may be more likely to present tasks that are followed by learning or progress as opposed to maintenance tasks or tasks that are followed by no correct responding. This study is a first step in experimentally demonstrating a functional relation between learner response accuracy and caregiver adherence.

Although response differentiation was observed for most participants, certain methodological aspects of the study itself may have influenced these results. Participants were not informed of the entire purpose of the study; however, they were asked to perform in an unnatural teaching environment. Due to the experimental nature of these sessions, participants may have engaged in mediating behavior (e.g., generating rules about the purpose of the study or how they were “supposed to respond”; counting or repetitive presentation patterns). During

initial experimental sessions with Abigail, investigators introduced procedural modifications to mitigate the effects of mediating behavior on participant responding; modifications included a loud beeping timer that required a response from the caregiver, tasks placed in binders on shelves across the room from the teaching table, and pre-session statement of contingencies. Experimenters noted some changes in the frequency of Abigail's task presentations following the introduction of these modifications. These changes in participant behavior are shown in Figure 2. During the initial introduction of a 1 min timer, the overall level of responding decreased and remained at similar levels throughout the study. The timer interval was adjusted to a variable schedule during session 29. This change corresponded with the introduction of a third task, and therefore the effect of the variable timer could not be determined. Similar methods used in Hefferline & Perrera 1963 and Barnes & Keenan 1991, suggest that the use of timer may be effective in interrupting participant mediating behavior. Following introduction of task binders, Abigail demonstrated a brief period of differentiated responding. Inspection of within-session data revealed that the increase in response effort to change tasks (return binder to shelf) corresponded to a reduction of within-session alternation between tasks. Shahan & Lattal (1998) demonstrated that the use of a changeover delay disrupted a pigeon's matched responding on concurrent variable schedules. The requirement to switch binders to access different reinforcement contingencies may have functioned as a changeover delay, however a reversal evaluation is necessary to demonstrate control over participant behavior. Task binders remained in place for all subsequent sessions. Investigators introduced a statement of contingencies per task at session 25 for Abigail. Contingency statements were added to more efficiently bring behavior under control of the performance contingency. Abigail's overall task presentation increased following this change; however, higher performance did not maintain across

subsequent teaching sessions. The direct effect of stated contingencies was not evaluated and it remains unclear whether other intermittent schedules or schedules without rules would have a similar effect on performance. Mediating behavior was not measured, and therefore the effects of these specific modifications on participant mediating behavior were not directly assessed. Modifications from the current study may not be required to demonstrate a functional relation between task presentation and child correct responses in future studies. Researchers may wish to investigate the effects of caregiver mediating behavior on adherence because certain mediating behavior, such as development of strategic rules around task presentation (e.g., Bicard & Neef, 2002), may be advantageous.

The use of two different types of confederate learners may have altered the frequency of participant task presentation. All participants worked with a child confederate, with the exception of Willa, for whom an adult served as the confederate. This did not seem to effect overall patterns of responding, however, Willa demonstrated the highest task presentation frequencies of all participants. Differences between child and adult confederates such as shorter response latencies and less off-task behavior may account for the higher levels of responding with Willa; incorporating adult confederates in future research may result in more control of these extraneous variables. Future investigators should consider refining these methods with adult confederates as learners and, if clear data result, attempting to replicate the evaluation with more ecologically valid learners.

Investigators varied prescriptions to support participant contact with the schedule of reinforcement for each specific task; The overall level of responding for Lucy and Pepper appeared to increase following the introduction of a prescription and remained high even when the prescription was removed. This finding suggests that the prescription may have served as a

rule for caregiver presentation of learning opportunities. Willa had no numerical prescriptions in place for any experimental sessions; her responding remained at a constant level, throughout. Although the effects of a prescription were not directly evaluated in this study, patterns of responding suggest that use of prescriptions may be beneficial to increase the overall levels of adherence, at least in combination with the presence of the party who assigned that prescription. Future research may better assess the likelihood of this claim by measuring caregiver task presentations over time under varying prescriptions.

An SCA was conducted before each contingency reversal to test the generality of our results under a different procedural arrangement. Procedural differences within the SCA included the absence of a prescription, shorter duration of session, absence of leisure materials, and no opportunity to shift response allocation at any time during session (free operant). Based on assessing similar behaviors (frequency of task presentation) and similar consequences (confederate correct responding), one may predict correspondence between responding during the free operant arrangement and the SCA. Participant choice of task during the SCA did not consistently match presentation levels in previous teaching sessions. The inability to shift response allocation during the SCA may have accounted for this non-correspondence. Although responding under the SCA conditions did not always replicate schedule selection from the free operant arrangement, two participants did demonstrate a replicated choice pattern in the SCA condition. Forced-choice arrangements seem less likely to occur in caregivers' natural teaching environment; thus, the free operant concurrent schedule arrangement may be most appropriate to utilize in future studies of adherence.

Patterns of participant responding suggest that response allocation is a result of the history of increasing probability of child correct responding across consecutive teaching sessions

as opposed to the prevailing contingencies in place within an individual teaching session. For instance, in session 13 with Lucy, if the participant chose to present the task “tap table,” the confederate responded correctly after 100% of presentations. If they chose to present the task “clap hands,” the confederate also responded correctly after 100% of presentations. Despite identical schedules of correct responding, Lucy presented the task “tap table” more than the task “clap hands.” The only difference between these two tasks was confederate responding to each task during the previous teaching sessions. For example, “tap table” was followed by 50% correct confederate responding in session 11 and 66% correct responding in session 12, while confederates responded correctly 100% of the time to “clap hands” in both session 11 and 12. This is important methodological information for researchers looking to continue experimentation in the area of caregiver adherence. In a review of research into performance under schedules of reinforcement, Lattal et al. (1996) suggests that behavior may not be solely determined by prevailing contingencies of reinforcement. An arranged history of reinforcement may influence overall responding or the persistence of a pattern of responding.

Experimenters attempted to further understand these patterns of participant task presentations under the lean-to-rich schedule of confederate correct responding by holding confederate responding constant at 66% across consecutive sessions for Lucy (session 23-25) and Willa (session 16-21). If participant responding was maintained by a pattern of increasing correct responses across sessions, we may expect to see extinction when responding stabilized. However, Willa’s task presentations persisted at high levels. One explanation for maintenance of task presentation levels despite holding confederate responding constant could be that participant responding was a result of unintended stimulus control. In a review of research investigating responding under schedules of reinforcement, Lattal et al. (1996) concluded “that if behavior has

been established under stimulus control in the past, then that past schedule performance affects current responding in the presence of the stimuli" (p. 215). The stated contingency associated with responding on the lean-to-rich schedule did not change when responding was held static. Thus, the stated contingency may have acquired some control over participant responding. Experimenters adjusted the schedule of lean-to-rich confederate responses from 50%-66%-100% to 20%-25%-33% for Pepper. This manipulation was an attempt to extend the schedule across a larger number of sessions. Following this procedural modification, Pepper presented tasks differentially. Constraints on the participant's time did not allow for evaluation of the effects of the entire extended schedule. Future researchers should assess the conditions under which establishing a history of client correct responding or stimuli associated with particular patterns of client responding may influence caregiver behavior. More specifically, future studies should establish how histories of client responding, stimulus control, and rules can be applied to optimize levels of caregiver adherence. Investigators may use a procedure similar to Bicard & Neef (2002) with a learning and a test component where rules or stimuli would be specified during learning sessions and removed during test sessions to evaluate the utility of these procedures and their effect on response sensitivity to environmental changes.

Study 3 sought to extend the results of the previous studies to a more natural teaching environment. Results of this study offer additional support that client correct responding is a variable that may affect caregiver adherence to prescribed teaching schedules. Limitations of Study 3 highlight variables in the natural teaching environment that may compete with adherence and that are worthy of further investigation.

Study 3 was conducted in a typical learning environment with unprogrammed and uncontrolled distractions for both the client and participant. These distractions included others

engaging in conversational-level verbal behavior and challenging behavior, competing work responsibilities (e.g., data collection, paperwork, unkept work area), and the presence of preferred items and leisure materials typically found in an enriched learning environment for children with ASD. Distractions in a natural teaching environment may have directly impacted task presentation, however distractions were not planned and therefore did not systematically impact one condition over another. Behavior analysts may interpret participant adherence to prescribed teaching schedules under distracting conditions in terms of response strength or resistance to change. Nevin (2000) asserted that a behavior may be strengthened by more frequently or generously reinforcing the behavior-consequence relation. By discovering client-mediated reinforcers for caregiver teaching behavior, methods to strengthen caregiver adherence in the presence of common disruptors can be developed. Results of this study suggest that child correct responding may serve as a reinforcer for caregiver adherence. Researchers should identify and evaluate the effects of disruptors and competing contingencies in the teaching environment (e.g., background conversations, challenging behavior, competing work demands, access to phone, etc.) and whether repeated exposure to client-mediated reinforcers will strengthen caregiver teaching behavior (e.g., repeatedly prescribing teaching tasks associated with quick progress).

Differential response effort and time to implement teaching tasks in Study 3 may have affected results. For example, prompting tasks with the smaller Legos™ in the Lean condition required more response effort and may have rendered participants less likely to present that task. The small Lego™ constructions also took the client longer to complete, resulting in less time for subsequent task presentations. The use of 30 min sessions with a low prescription (15 trials per session) was in attempt to provide the participant with ample time for adherence in the Lean

condition. Future studies should more closely replicate procedures used in study 2 in the natural environment by using tasks with similar response effort and time to implement.

Clients in study 3 were diagnosed with a disability, yet this study involved presenting challenging activities for them to complete. In addition to approval from an IRB, experimenters considered other ethical factors before working with this vulnerable population. The methods used in this study exposed clients to teaching methods resulting in low rates of acquisition under closely monitored and time-limited conditions. If researchers do not study caregiver adherence, clients that receive their ABA services via behavioral consultation or other low supervisor-to-staff service models may have fewer learning opportunities with more socially important skills. It may be most prudent, however, to focus on analog studies with less vulnerable learner populations and to progress to studies with clinically relevant populations only after functional relations are apparent

Clinicians should consider the results of this series of studies when faced with low rates of caregiver adherence. Child effects, specifically schedules of client correct responses, should be considered when attempting to improve caregiver adherence to recommended teaching schedules. For example, when attempting to increase or establish high rates of task presentation by direct care staff, prescribing teaching tasks associated with quick progress may be more effective in promoting adherence than prescribing tasks that a learner previously mastered. These results remind us that teacher performance is based largely on history, and that arbitrary reinforcers (e.g., social praise, pizza parties, gift cards) may or may not be sufficient to control behavior relative to those unique histories. We, as a field, need focus on more function-based solutions to addressing the behavior of low adherence. It is also important to consider the implications of findings for tasks associated with repeated high levels of correct responding, such

as implementation of task maintenance. Given the number of variables that impact maintenance and generalization of skills acquired via ABA therapy (e.g., Richling et al. 2019; Swan et al., 2016), clinicians may do well to frequently monitor staff adherence with maintenance checks relative to adherence with teaching schedules.

When clients do not make progress on their learning targets, adherence may be a contributing variable; thus, clinicians should assess caregiver adherence prior to significantly altering clinical programming and supervision. Monitoring and addressing adherence deficits prior to modifying learner programming may reduce the need to alter an otherwise successful teaching procedure. When difficulties with caregiver adherence are identified, assessing potential child effects may be a good first step prior to implementing more effortful or ongoing interventions such as feedback, self-monitoring systems, and arbitrary rewards. In order to increase adherence to teaching schedules, BCBAs may consider modifying teaching procedures (e.g., adjusting teaching targets, changing prompt hierarchies) to expedite learner progress. When designed training for caregivers, clinicians should consider a caregiver's specific experience in regards to learner history. To increase adherence to maintenance programming, clinicians may continue to add contexts for generalization, or embed maintenance checks between new skill acquisition targets. These arrangements may help to ensure that caregivers continue to contact increasing schedules of correct responses.

Allen and Warzak (2000) highlight gaps in the literature when it comes to caregiver adherence. They suggest that an empirical analysis would provide a framework for assessment and treatment options carefully tailored to the individual implementing behavior change procedures, thus leading to more efficient, effective and function-based techniques for increasing caregiver adherence. This series of studies sought to address some of these gaps by investigating

the effects of child responding on caregiver behavior. The results of this series of studies suggest that child mediated variables, specifically correct responding, influences the frequency with which a caregiver presents a teaching task. Future researchers should evaluate the effectiveness of clinical procedures such as modified teaching methods that promote progress, as well as the use of rules and prescriptions to bridge instances where client progress is minimal. Investigators should also use methods from this study to further evaluate the impact of procedural response effort, problem behavior, and environmental distractions on caregiver adherence. By uncovering these variables, researchers and clinicians are better-positioned to develop behavior analytic solutions for low caregiver adherence and, thereby, to optimize client outcomes.

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Table 1

r value calculated using Pearson Correlation

Variable	Avg Sessions	Adherence	Adherence w/ceiling
Prorated Progress	0.010599	-0.035207	0.1911468
Prorated Progress w/ceiling	0.029996	0.123939	0.234914
Prorated Progress >50% of IEP year w/OT programs removed	0.062709	0.093552	0.191147
Prorated Progress w/ceiling and >50% IEP year	0.061314	0. 1822635	0.254149
Prorated Progress w/ceiling, >50% IEP year, OT programs removed	0.032792	0.186091	0.28004

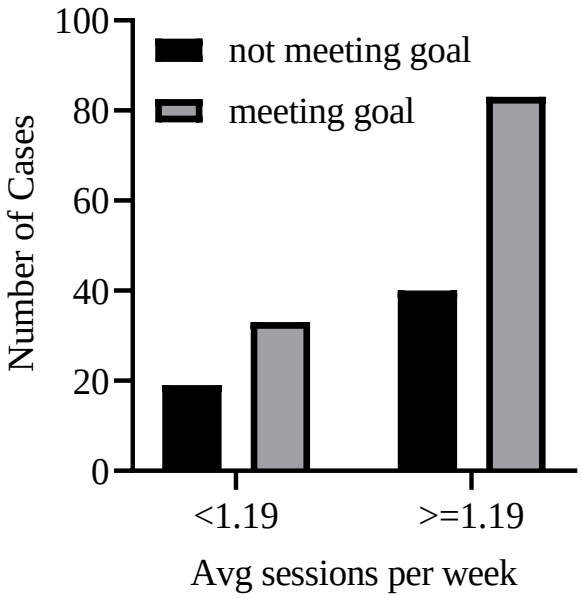
Table 2

Mean Percentage Correct Client Responding

Condition	Leo (Jane's Student)	John (Mary's Student)
Rich	64%	89%
Lean	16%	69%

Figure 1

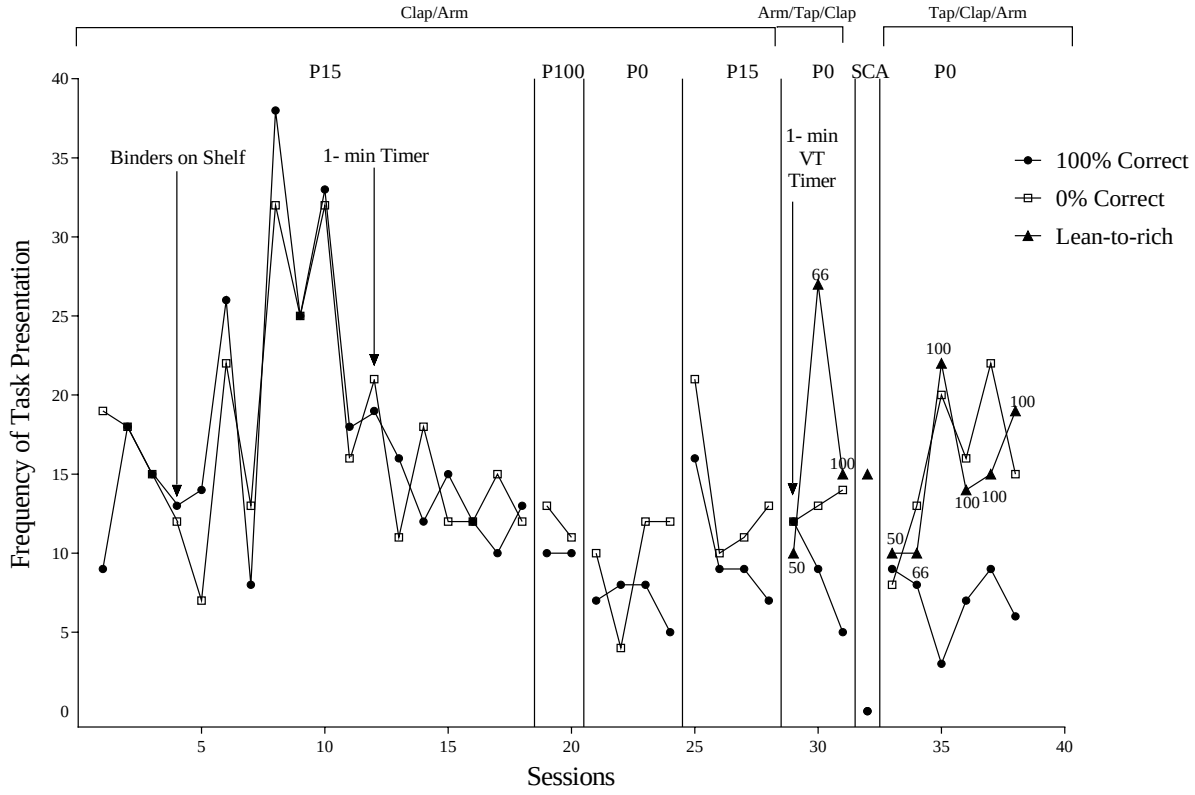
Post ROC Chi-Square Analysis of the Number of Cases Completing More or Less than 1.19 Sessions per Week as a Function of Meeting Mastery Goals



Note. Session per week groupings were determined by ROC analysis.

Figure 2

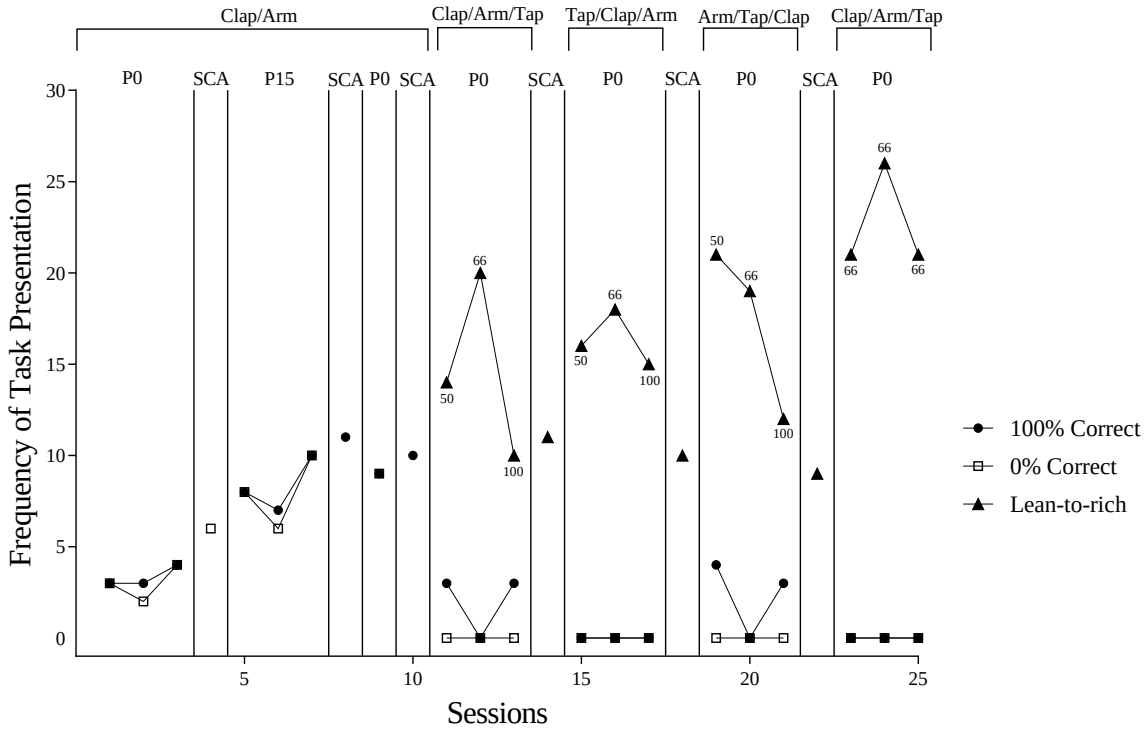
Frequency of Task Presentation for Abigail



Note. The labels above the bracket denote the tasks available to the caregiver. Presentation of the task listed first was followed by 100% correct responding, the task listed second was followed by 0% correct responding, and the task listed third was followed by a lean-to-rich schedule of correct responding further denoted by the subscript numbers above data points within the figure. Phase labels describe the trial prescription provided to the participant. SCA denotes responding in a forced choice assessment.

Figure 3

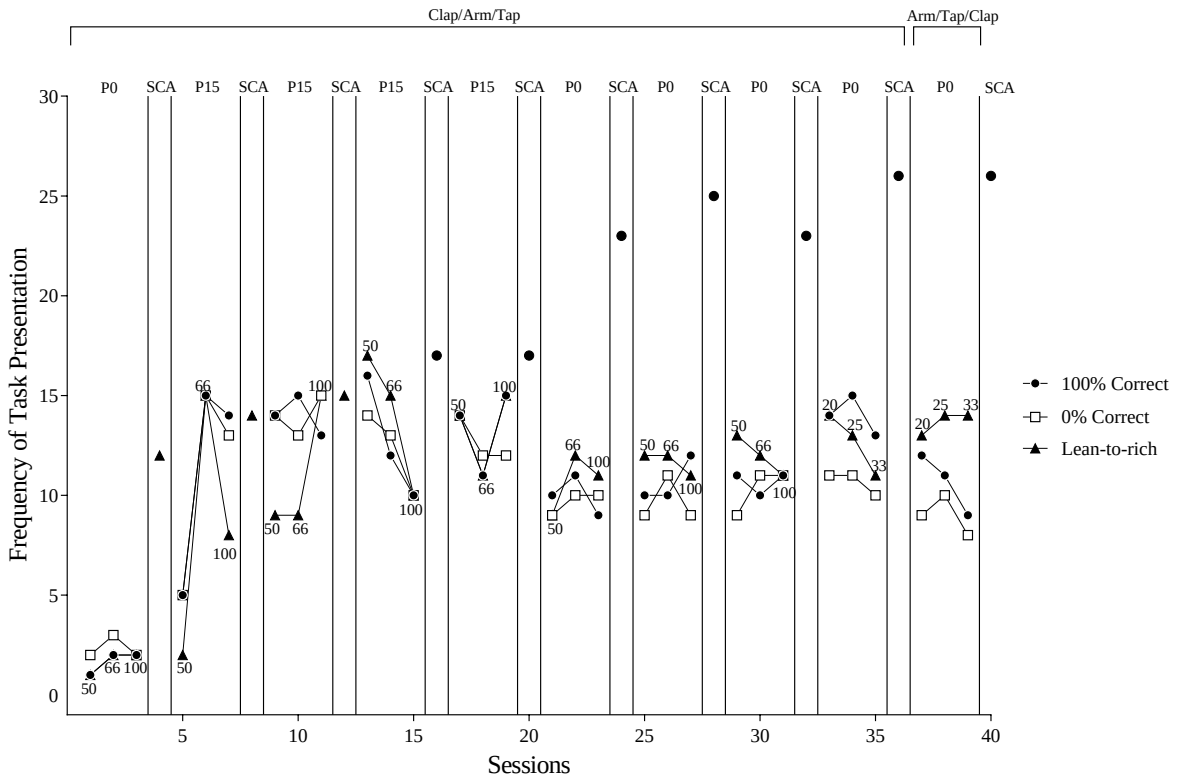
Frequency of Task Presentation for Lucy



Note. The labels above the bracket denote the tasks available to the caregiver. Presentation of the task listed first was followed by 100% correct responding, the task listed second was followed by 0% correct responding, and the task listed third was followed by a lean-to-rich schedule of correct responding further denoted by the subscript numbers above data points within the figure. Phase labels describe the trial prescription provided to the participant. SCA denotes responding in a forced choice assessment.

Figure 4

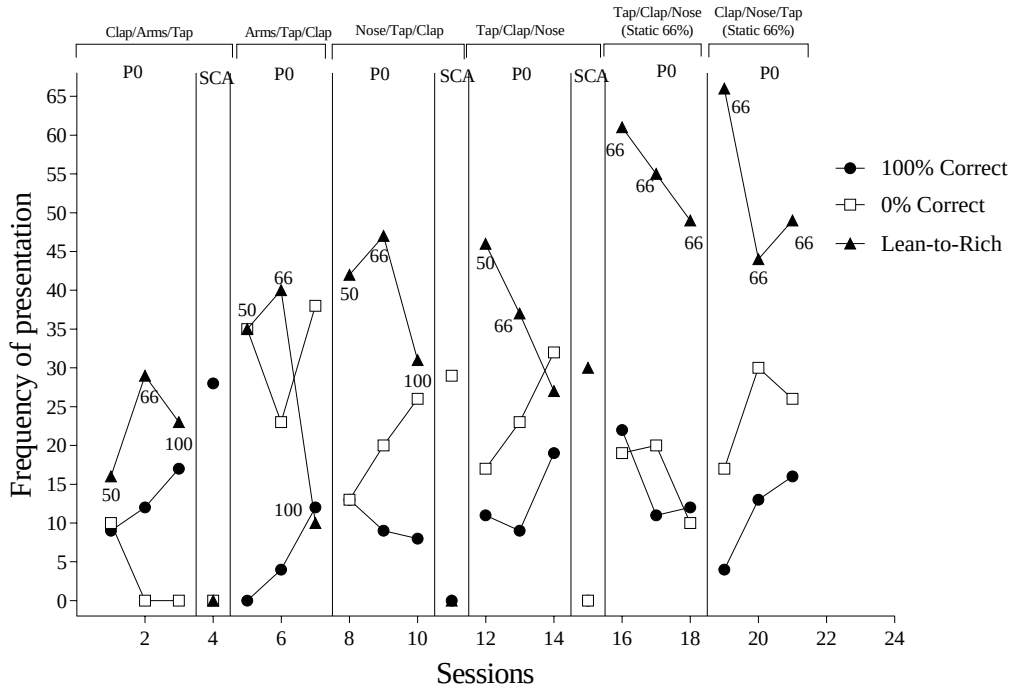
Frequency of Task Presentation for Pepper



Note. The labels above the bracket denote the tasks available to the caregiver. Presentation of the task listed first was followed by 100% correct responding, the task listed second was followed by 0% correct responding, and the task listed third was followed by a lean-to-rich schedule of correct responding further denoted by the subscript numbers above data points within the figure. Phase labels describe the trial prescription provided to the participant. SCA denotes responding in a forced choice assessment.

Figure 5

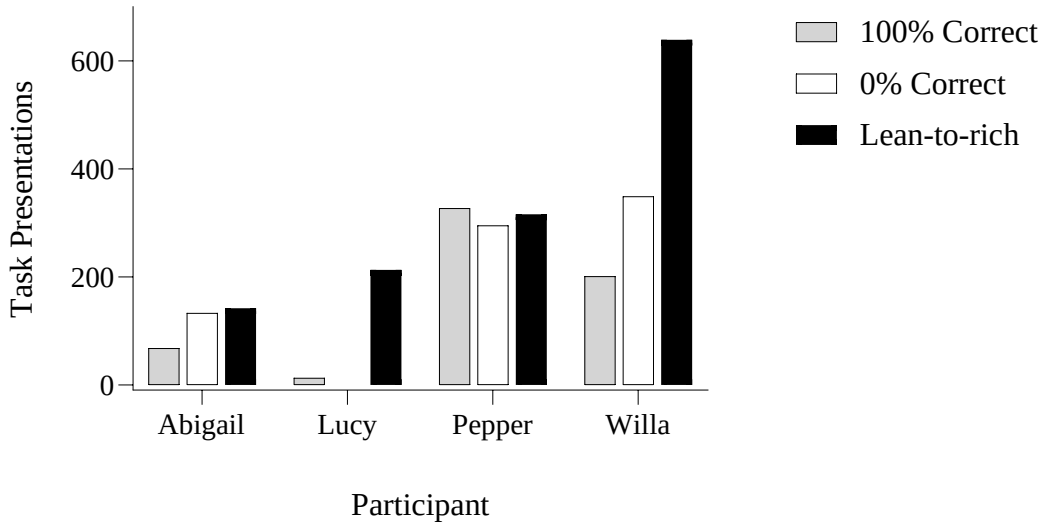
Frequency of Task Presentation for Willa



Note. The labels above the bracket denote the tasks available to the caregiver. Presentation of the task listed first was followed by 100% correct responding, the task listed second was followed by 0% correct responding, and the task listed third was followed by a lean-to-rich schedule of correct responding further denoted by the subscript numbers above data points within the figure. Phase labels describe the trial prescription provided to the participant. SCA denotes responding in a forced choice assessment.

Figure 6

Cumulative Task Presentations for All Participants During Three Schedule Comparisons



Note: Data presented in this figure is from three schedule comparisons only and does not include task presentations from SCAs or two schedule comparisons.

Figure 7

Frequency of Task Presentation for Jane and Mary