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Cover Page Footnote

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The Effects of a PowerPoint Activity Schedule to Teach a Night and Morning Routine to Twins with ASD

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Abstract

Behavior analysts can use activity schedules (i.e., a list of ordered steps with embedded visual supports) to teach skills, such as following schedules, completing chained tasks, varying play, and collaborating with others. The present study examines the effects of an electronic activity schedules with a series of visual, gestural, model, and physical prompts to teach two young girls on the autism spectrum to complete morning and night routines in their home. In addition, the lead clinician assessed the extent there were generalized effects by teaching the parents to implement the routine. Finally, the clinician identified if the activity schedules produced additional benefits, such as decreased latencies to sleep. For both girls, the activity schedules were successful in decreasing challenging behavior and increasing independence with night and morning routines across four clinicians and their two parents. In addition, on average, both girls had decreased latencies to sleep on nights they used the nighttime activity schedule. Limitations and implications of this project are discussed.

The Effects of a PowerPoint Activity Schedule to Teach a Night and Morning Routine to Twins with ASD

Research shows activity schedules are effective tools to teach children a variety of skills in a chained sequence, in both joint and individual formats. Activity schedules are a list of steps or activities that include embedded visual or electronic supports. In clinical application, clinicians use activity schedules to teach children diagnosed with autism spectrum disorder (ASD) to stay on task (Akers et al., 2018; MacDuff et al., 1993), vary their independent play on tablets (Brodhead et al., 2018), and reduce escape-maintained challenging behaviors (Lory et al., 2020). Clinicians also use activity schedules to teach collaborative skills, such as playing hide and seek (Brodhead et al., 2014), completing chore lists (White et al., 2011), and playing games with peers (Betz et al., 2008). Thus, researchers and clinicians can use activity schedules in multiple formats and can curate them to match their client's needs. For example, in a seminal paper on activity schedules, MacDuff et al., (1993) taught four children with autism to stay on-task and on-schedule when completing leisure and homework activities using photographic activity schedules and graduated guidance. All four participants generalized these skills across novel stimuli and maintained high levels of on-task and on-schedule behaviors when clinicians faded their prompts.

When designing activity schedules, clinicians must choose the physical characteristics of the activity schedule; when doing so, it is necessary to evaluate the learner's preferences, skill set, and learning history. For example, a clinician may decide to use paper activity schedules with picture prompts for an individual who has had a successful history with schedules of this format, whereas they may select an electronic activity schedule for an individual who has no prior experience with activity schedules and the tablet is a known reinforcer. Clinicians should also consider necessary prerequisite skills, such as if their learner can attend to a screen and follow electronic instructions (Brodhead et al., 2018) or accurately imitate video models (Gies, 2012), when choosing between formats.

Clinicians must also consider what prompting and error correction style will be the most effective for their learner and their environment. For example, hand-over-hand guidance might be inappropriate for a child with an aversion to physical touch. Multiple studies demonstrate different prompt styles can be effective when using activity schedules. For example, Brodhead et al. (2018) demonstrated clinicians did not need to use vocal prompts to teach clients to follow their activity schedule; rather, clinicians could embed video and picture models throughout the routine to model and prompt correct responding (Spriggs et al., 2015). Furthermore, Cihak (2011) found pictures or video modeling can be effective when used interchangeably within activity schedules, meaning clinicians can use either, or both, to meet their learner's strengths.

Finally, clinicians must consider how to monitor progress when using activity schedules. Several studies have promoted the use of a task analysis (TA) to measure the effectiveness of the activity schedule (Brodhead et al., 2018; Gies, 2012; Giles & Markham, 2017). A TA is a list of all responses necessary to complete a task, typically arranged in sequential order (Mayer et al., 2019). Creating a TA for all steps of a routine has several benefits. First, the TA could serve as a prompt for clinicians to ensure they address all steps of the complex task or routine during training trials. Second, the TA provides clinicians a consistent order of steps to follow and thus provides consistency for the clients too. Finally, TAs provide an opportunity to clearly define how the tasks should be completed, according to the stakeholder's preference. For example, some families approach toothbrushing differently (e.g., some wet the toothbrush before putting on the toothpaste, whereas others do not). By writing a TA for the entire routine and reviewing it with the stakeholders, the clinician can better ensure they are teaching skills that will be reinforced in the natural environment, while also involving parents' opinions in programming.

Purpose

This clinical project had three main goals. The primary goal was to teach twin elementary-aged girls on the autism spectrum to independently complete steps of their night routine without challenging behavior (CB) using an electronic activity schedule. Brodhead et al. (2018) suggests this format can decrease instructor involvement and increase attending by using a preferred item (i.e., a tablet). Furthermore, tablets were known reinforcers for the clients involved, and their parents preferred an electronic version as it would be more accessible and durable when compared to a paper version.

Second, we (the clinicians in collaboration with the parents) aimed to program for stimulus and response generalization (Baer et al., 1968; Stokes & Baer, 1977). This included teaching parents to implement the night routine and introducing a morning routine solely implemented by the parents. By using the same format as the night routine for the morning routine, the clinician hoped to see generalization of skills for (a) the girls to navigate a routine using a PowerPoint format (b) low levels of CB when transitioning to and between tasks and (c) their parents effectively implementing the routine.

Finally, we aimed to evaluate the extent to which these activity schedules had auxiliary effects in the families' lives. Parents reported they would lay in their daughters' room for 30-60 min waiting for the girls to fall asleep, which ultimately disrupted the parents' sleep schedule. Aligning in calls to address social validity (i.e., the extent to which the intervention provides change that is socially significant and thus important to the family and other stakeholders) by using observable behavioral outcomes (Hanley, 2010), the lead clinician asked the parents to collect information on how fast (latency) their children fell asleep with and without the activity schedule for the nighttime routine.

If successful, this routine would increase the clients' independence with a variety of functional living skills, thus decreasing the parents' response efforts in helping the clients complete these tasks. Furthermore, a consistent night routine can be beneficial for children and has been shown to promote more restful sleep (Delemer & Dounavi, 2018).

Method

Participants

Prior to developing and implementing the intervention, the lead clinician and supervisor met with the family to discuss the project and obtain approval and consent from the family. After receiving informed consent, two five-year-old female siblings (Cora and Suni, pseudonyms) participated in this project. They both had received two years of home and telehealth behavior-analytic services. Cora and Suni demonstrated strong communication, imitation, and listener responding skills. They often needed support when transitioning to unpreferred tasks and completing fine motor and daily living tasks. A doctoral-level board certified behavior analyst supervised this internship project as fulfillment of the lead clinician's master's degree in applied behavior analysis.

Setting and Materials

Both the morning and night routine interventions took place at Cora and Suni's home. Clinicians and/or parents prepared these rooms prior to each trial to ensure necessary items were accounted for (e.g., correct PowerPoint visual schedule) and distracting or hazardous materials (e.g., toys on the bathroom floor) were removed.

When the intervention first began, the clinician embedded the night routine PowerPoint with picture and video models; videos included models of Cora and Suni dancing, handwashing, and bringing clothes to and from the bathroom; picture models included pictures of pajama options, putting the toilet seat up and down, wiping, flushing, dressing and undressing, handwashing, cleaning, toothbrushing, and reading. The morning routine PowerPoint did not contain visual prompts to assess for generalization of skills (i.e., correctly following a written instruction without need for additional visual aids). Per parental request, clinicians provided candy or ice cream for toileting successes during the routine; clinicians provided these treats during the play step of the night routine.

Prerequisite Skill Assessment

The lead clinician conducted several assessments and observations with both Cora and Suni to ensure they had the necessary prerequisite skills to be successful with the proposed intervention. The lead clinician first observed how the Cora and Suni's dad assisted them through their nighttime tasks. This observation revealed the girls needed additional supports during the night routine (e.g., toothbrushing); however, appropriately transitioning to instructions was a greater barrier. When not engaging in CB, both Cora and Suni demonstrated they had the skill sets to complete most tasks of the routine, such as dressing, toileting, and handwashing, and more so required prompts to stay on task.

In the second assessment, the clinician presented typed instructions on a tablet to see if Cora and Suni could attend to a screen and follow instructions correctly. On thirteen trials, when the lead clinician presented one, two, or three typed instructions, both girls had 100% correct responding. The clinician then provided an additional assessment to identify if Cora and Suni could interact with a screen when presented an instruction (i.e., presenting vocal instructions, such as "tap the arrow," but provided no additional support). This assessment revealed both girls could orient to and interact with the screen; however, Cora and Suni required clear, concise instructions (e.g., "touch the black square at the bottom of the screen" versus "touch the square").

Throughout these observations, the clinician hypothesized the screens themselves served as establishing operations (i.e., a stimulus that momentarily increases the value of a reinforcer or the frequency of performing an action that provides access to a reinforcer) for task completion, given transitions to each electronic assessments consistently occurred within 5 s and in the absence of CB (Michael, 1993). This level of appropriate transitions was atypical for either Cora, or Suni, and thus provided support for tablets servings as abolishing operations for CB when presenting task demands.

The clinician conducted three virtual observations of the morning routine to collect baseline data and determine if intervention was warranted. Cora and Suni both had CB during most steps of the routine and often the family had to skip morning tasks due to lack of time (e.g., toothbrushing, brushing hair). These observations warranted a morning routine intervention and the generalization phase with a morning routine PowerPoint.

Clinical Research Design

To determine if activity schedules and prompting strategies had functional control over Cora and Suni's correct responding and level of CB, the lead clinician embedded several withdrawals (Mayer et al., 2019) throughout the project. Withdrawals also occurred for generalization phases.

Dependent Variables and Response Measurement

The steps of the nighttime routine were: 1) practicing their dance routine, 2) picking out pajamas, 3) using the bathroom, 4) washing hands, 5) getting dressed into pajamas, 6) cleaning up their old clothes, 7) playing, 8) cleaning up play items, 9) brushing teeth, and 10) picking a book to read. Depending on the phase of the project and behavior-change agent implementing (clinicians or parents), the type of response measurement varied.

Night Routine: Clinician-Led

Clinicians and parents took data according to correct completion of each step of a TA, which varied across intervention, given the lead clinician added or removed steps based on observations. For example, the original TA did not include a step for closing the toothpaste, which was later considered a crucial step to document due to consistent errors from both Cora and Suni and thus added to the TA for subsequent trials.

Clinicians scored each step as independent correct (i.e., no physical or visual prompts were used), prompted correct (one prompt used), multiple prompts (MP; more than one prompt used), CB, or non-applicable (NA). Independent and prompted correct were depicted similarly on the graphs as both were considered correct responses on prompted trials. Clinicians scored MP when they provided prompts on independent trials or if additional prompts were needed on prompted trials. Clinicians scored CB if any of the following behaviors occurred: elopement (i.e., moving more than an arm's length away from an adult without permission), flopping (i.e., falling to the ground outside of the context of play), negative vocalizations (i.e., vocalizations above a conversational volume outside of the context of play or protest statements), property destruction (i.e., manipulating an item in the environment in a way that can or does damage the item), or aggression (i.e., using any part of the body to make contact with another person that can or does harm). Clinicians scored NA if a step could not be completed or was not relevant for that session (e.g., putting on pants would be scored as NA if they chose a pajama dress). Trials scored as NA would not be counted toward the total number of responses in the TA.

For visual analysis purposes, the clinician graphed the percent of correct steps and the percent of steps with CB for the nighttime routine. These data indicated if revisions needed to be made (i.e., less than 75% correct responding across two consecutive trials) or if Cora and Suni were ready for the next phase of intervention according to mastery criteria (i.e., 85% correct responding across two consecutive trials).

Night and Morning Routines: Parent-Led

When parents collected data for both the morning and night routines, the clinician simplified the TA; the parent would score either the presence or absence of CB for each step or NA. For the morning routine, the clinician documented whether steps scored as NA were truly nonapplicable (e.g., putting on socks may not occur if the girls wore sandals) or if it was due to a lack of time (e.g., toothbrushing could not be completed due to CB and delayed task completion). The clinician graphed the night routine data as percent of steps in CB and percent of steps without CB. The clinician graphed the morning routine the same way and had an additional data path to document steps scored as NA due to a lack of time. The clinician used this data path to identify if the morning routine would reduce the number of steps skipped due to time constraints.

General Procedure

All trials began by vocally instructing Cora and Suni to start their routine and ended when the final step of the routine was complete. Cora and Suni would complete their routine on a staggered bases; that is, one of the girls would start the routine first with one clinician or parent, and approximately 10 min later, the next girl would start the routine. While there may have been benefits to the girls simultaneously completing their routines and thus allowing for social learning opportunities; clinical observations prove that Cora and Suni often engaged in challenging or distracting behaviors towards each other during simultaneous tasks; thus posing a risk to the quality of trials and skill acquisition. Throughout the intervention, both clinicians and parents implemented the routine and the lead clinician observed either in person or via Zoom.

Night Routine Baseline

During baseline, clinicians presented each girl with the activity schedule and instructed them to begin their night routine. Clinicians allowed 5 s before providing parental-like-prompts (e.g., positional prompts, back-to-back vocal prompts, full physical guidance) for each step of the TA and scored Cora and Suni's performance. Clinicians used general praise (e.g., "nice" or "you're so sweet!") throughout the routine but did not provide behavior-specific praise or other reinforcers. If CB or incorrect responses occurred, clinicians responded as parents typically did (e.g., commenting on the behavior, providing extra incentives, physically completing the task for the client). The lead clinician based the above baseline procedure on prior direct observations of the parents.

Night Routine Intervention

Clinicians used an errorless learning style (Mayer et al., 2019), blended set of stimulus and response prompts, and a consistent error correction procedure informed by Gardner et al. (2015). As mastery was met, the lead clinician faded prompts by first removing visual prompts, followed by removing gestural/model prompts. The prompting sequence was as followed: Activity Schedule + Visual Prompt + Gestural Prompt (AS+VP+GP), Activity Schedule + Gestural Prompt (AS+GP), Activity Schedule (AS), and Activity Schedule + 5-s Delay to Gestural Prompt (AS+5GP).

During intervention, clinicians instructed each girl to start their routine and immediately presented them with the electronic activity schedule. Clinicians (based on the prescribed prompting style) immediately provided prompts. Contingent on correct responses, clinicians provided behavior-specific praise. If Cora or Suni completed the steps quickly (e.g., completed their toileting and dressing steps in less than 10 minutes), clinicians provided extra play time during and after the routine. Clinicians provided reminders of this contingency; for example, before prompting Cora or Suni to begin cleaning up after their first play break, clinicians would state there were 30 min left in the session, so if they cleaned up now and finished their toothbrushing task, they would have about 25 minutes left to read, snuggle, or play with other toys.

Across all phases, if Suni or Cora engaged in CB, clinicians blocked CB and redirected Cora and Suni to the current step in the TA (using the prompting sequence below) or prompted them to use functional communication (i.e., if you need more time, please say "One more minute"). If an incorrect response occurred (5-10 s of no response from Cora and Suni when a task was presented or if CB occurred), clinicians would deliver up to three gestural or model prompts before using a full-physical prompt. In video model phases, the video could be played up to three times to serve as the model prompt in the above hierarchy. Clinicians did not use any vocal prompts; however, they provided behavior-specific praise and feedback after the girls completed all steps. For example, after clinicians prompted Cora and Suni to orient their pants the right way, a clinician would provide praise and feedback (e.g., "That's how you flip your pants around, so the tag is in the back!").

Generalization

To address generalization, the lead clinician trained the parents to implement the 1) nighttime routine and b) morning routine. For these phases, the clinician simplified data collection (i.e., scoring if there was CB or not for each step). This data collection method addressed the primary goal of the intervention (i.e., reducing CB), while being user-friendly for the parents.

Parent Training: Night Routine

The clinician trained the parents to implement the nighttime routine using a modified behavioral skills training (Mayer et al., 2019). After Session 41, the clinician sent a parent-friendly procedure for the parents to review and had the parents observe a clinician implement the entire routine at the following session. Afterward, the clinician reviewed the protocol and how to use the PowerPoint with parents, debriefed on their observations during the modeling phase, and answered questions. At the following session, the clinician briefly reviewed the instructions and then one of the parents implemented the routine themselves, while the other parent watched, asked questions, and observed the clinician collect data. The clinician provided positive and corrective feedback on the parents' implementation, while also collecting data on a treatment integrity checklist.

After this training session, the parents began independently implementing the routine. Occasionally, the parents implemented the routine during sessions when clinicians were present. In those sessions, clinicians provided feedback and collected treatment integrity.

Parent Training: Morning Routine

The second phase of generalization consisted of creating a PowerPoint activity schedule for Cora and Suni's morning routine. The clinician collaborated with parents to determine the order of the schedule and adjusted as needed throughout the project. Two baseline sessions occurred in which no tablet was used, and the clinician instructed parents to guide the girls through these tasks as they normally would. Then, identical to the procedures used for the night routine, the clinician trained the parents to implement the morning routine with a curated PowerPoint activity schedule.

The clinician collected treatment integrity data and modeled providing behavior-specific praise throughout the parent's implementation. Following rehearsal, the clinician debriefed with the parents and delivered positive and corrective feedback. The parents helped the girls through this routine on their own and typically met with the clinician once a week via Zoom to continue the rehearsal and feedback process.

Treatment Integrity and Interobserver Agreement

During treatment integrity and interobserver agreement (IOA) trials, the clinician collected data on one of the eleven steps of the routine (i.e., the clinician used a random number generator to determine which step of the routine to watch and collect data on). The lead clinician collected treatment integrity (i.e., extent to which clinicians implemented the intervention as designed) on 37.5% clinician-led trials. To score treatment integrity, one clinician observed another clinician implementing the designated step and scored if the clinician completed the following steps correctly: set the environment, used the prescribed prompt, provided error correction, avoided using vocal prompts, provided praise, and redirected CB without directly commenting on the CB. Clinicians scored each of these elements as either correct, incorrect, or non-applicable (NA). The number of steps completed correct was divided by the total number of applicable steps and then multiplied by 100. Any steps scored as NA did not count towards the denominator of the equation. Criterion was set at 80% correct and if clinicians' integrity dropped below 80% for two consecutive sessions, booster trainings would occur. Integrity was 67-100% correct with 17 of the 18 sessions meeting or exceeding the mastery criterion.

The clinician also collected treatment integrity data on nights the parents implemented the routine. On the sessions the clinician observed the parents, the clinician scored the number of correct demonstrations, divided by the total number of correct and incorrect demonstrations. Correct responding ranged from 77-92%.

IOA occurred for 31% trials across all clinicians. Two clinicians took data on the same step of the night routine and the data were compared by totaling the number of agreements, dividing by the total number of steps, and multiplying by 100. Clinicians scored agreement as recording a check in the same descriptive box (i.e., independent correct, prompted correct, multiple prompts, CB, NA). IOA ranged from 75-100% accuracy, with an average of 95%.

Social Validity Measures

Social validity refers to how clinicians and researchers involve stakeholders in their assessments of the utility of their interventions (Wolf, 1978). While clinicians can use subjective measurement (e.g., survey), there are be alternative methods to collect behavioral data to create a stronger argument for an intervention being socially significant. In this study, to assess social validity, Cora and Suni's parents collected data on each girl's latency to sleep. Past research has shown consistent night routines decrease the sleep onset latency (i.e., time to fall asleep; Delemer & Dounavi, 2018), which can increase the quality and duration of the child's sleep, as well as allowing the parents to reallocate the time spent helping their children fall asleep to alternative tasks.

Results

Nighttime Routine

Figure 1 shows Cora and Suni's, respectively, percent of correct responding (black circles) and CB (open circles) on night routine TA steps across days. These data reflect performance across baseline and intervention phases across days since baseline began. Each phase indicates clinician prompts provided during the routine.

As shown in the top of Figure 1, Cora engaged in more CB and less correct responding in the absence of the PowerPoint night routine during baseline sessions than when in intervention sessions. After 61 days from baseline and 17 total intervention sessions, Cora had met mastery to progress to the AS phase. Due to decreased levels of correct responding at this phase, the lead clinician moved Cora back to the AS+GP phase. This process continued two more times, after which the clinician concluded the AS+5GP phase was consistently successful at maintaining high levels of correct responding and low levels of CB and thus AS+5GP was chosen as a maintenance phase. This level of correct responding maintained across four clinician and parents; the grey triangle on day 105 represents a parent-led session. When Cora met mastery at Day 132 after the final withdrawal to the AS+5GP phase, clinicians thinned their social praise by providing more neutral praise than elevated praise, and sometimes providing no praise at all for correct responses. Initially, levels of correct responding slightly dropped and levels of CB slightly increased; however, those levels increased and decreased, respectively, during the last two sessions.

As shown in the bottom of Figure 1, Suni completed more TA steps correct in the presence of the PowerPoint activity schedule; however, she had variable levels of CB (i.e., 0-49%) across intervention and baseline sessions. After Day 44, the lead clinician held a team training to teach the other clinicians how to use behavioral strategies to decrease CB. The data support these strategies were generally effective, as there was an increase in correct responding and relatively lower levels of CB; however, the levels were not optimal as Suni typically showed CB during at least 5-10% of the routine. Based on clinical observations, the lead clinician decided to progress Suni to the AS phase to provide her an opportunity to respond independently and thus avoid intrusive prompting may have been aversive (see discussion for more details). As shown in the data, CB dropped to near 0% levels and thus the clinician considered this approach effective.

Like Cora, Suni did not meet mastery at the AS phase either time it was presented; given high levels of correct responding and low levels of CB at the AS+5GP phase, this was selected as her maintenance phase. Like Cora, the grey triangles on Day 116 and 143 represent parent-led sessions; these data suggest appropriate responding maintains when both clinicians and parents implement the routine. When Suni met mastery at Day 132 after the final reversal to the AS+5GP phase, clinicians thinned their social praise. Initially, levels of CB slightly increased; however, those levels decreased, and high levels of correct responding maintained across the last two sessions. These data suggest Suni can maintain appropriate responding during the night routine when less praise is provided.

Generalization

Figure 2 demonstrates the percent of night routine steps that were completed with and without CB across both Cora and Suni and both of their parents. Data reflect sessions across days since the parents were trained to implement the routine. On Day 17, the parents implemented a baseline session where they instructed the girls to complete their tasks without using the PowerPoint schedule. There were more steps completed with CB for both girls in this session, than when they used the PowerPoint at the AS+5GP phase. As shown in Figure 2, when Cora and Suni's parents implemented the routine, both girls continued to demonstrate low levels of CB when the PowerPoint routine was implemented versus when it was not.

Figure 3 represents Cora and Suni's percent of morning routine steps completed with and without CB, as well as steps that were non applicable due to time constraints, when the parents implemented their morning routine. Data reflect sessions across days since the parents began implementing the routine and occur across baseline and AS+5GP sessions. As shown in the top of Figure 3, the PowerPoint activity schedule was successful in increasing the percent of morning routine steps without CB and decreasing the percent of steps in CB and percent of steps unable to be completed due to time constraints for Cora. As shown in bottom of Figure 3, the PowerPoint activity schedule helped Suni maintain high levels of steps completed without CB, while low levels of steps completed in CB and non-applicable remained low.

Social Validity

The data in Figure 4 suggests the intervention did have additional benefits for the girls and their family, as both Cora and Suni had reduced latencies to sleep on nights the girls followed the routine. The parents also provided narrative benefits of the intervention, such as noticing the girls often being quieter in bed before falling asleep on nights the routine was used and their fine motor skills when dressing and brushing teeth have improved.

Discussion

Past research has shown behavior-analytic researchers have used activity schedules to teach individuals with disabilities many skills in a variety of modalities (Akers et al., 2018; Betz et al., 2008; Brodhead et al., 2014; Lory et al., 2020; MacDuff et al., 1993; White et al., 2011). The present study expands this research and the empirical base of activity schedules by demonstrating an electronic activity schedule was successful in reducing CB and increasing correct responding for morning and night routine tasks for two girls on the autism spectrum. Additionally, the intervention was successful across four clinicians and two parents over the course of six months and with thinned levels of reinforcement, suggesting maintenance and generalization effects occurred. This expands upon prior research that did not thin praise or include generalization phases and thus could not accurately predict the long-term benefits of the procedure (Gardner & Wolf, 2015; White et al.,2011). Furthermore, the present study demonstrated high treatment integrity scores across the intervention when clinicians implemented the routine and thus provides further evidence for the effectiveness of activity schedules; this expands upon prior research that did not have fidelity measures (Betz et al., 2008; Brodhead et al., 2014).

The intervention was successful in addressing its main goals of decreasing CB with morning and night routines, specifically when parents implement them, and increasing the girls' independence with routine tasks. Both Cora and Suni demonstrated increased independent correct responses across daily living skills, specifically dressing and toothbrushing for Cora and handwashing and dressing for Suni. During observations, the clinician noticed both Cora and Suni began to behave in respect to the discriminative stimuli in chained responses, rather than waiting for an adult to direct them to the next step. For example, during pajama dressing, the clinician noticed Cora pause before putting a leg into her pull up to see if tag was in the back; similarly, during handwashing Suni would pause after turning off the water, look at her wet hands, and then look around for a towel. These observations suggest the prompting style was effective at teaching chained responses and behavior was under the control of the relevant stimuli, potentially avoided prompt dependency. These results expand the work of Cihak (2010) by providing evidence that clinicians do not have to choose between pictorial prompts or video modeling; rather they can use a combination of the two based on the learner's skill set and what prompt style is most appropriate for the target. The present study's success also expands upon Cihak (2010) by using activity schedules in a distracting environment (i.e., the girls' home). Thus, this study demonstrates activity schedules can be effective across environments and when distractions are present.

As briefly discussed, both Cora and Suni had reduced latencies to sleep on the nights they followed their routine versus the nights they did not, suggesting there could be additional health values to using this intervention. Prior to the intervention, Cora and Suni's parents informed the clinician that they stayed in the girls' bedroom until they both fell asleep. Therefore, by reducing the time it takes to fall asleep, it could improve the parents' night routine, given they would spend less time waiting for the girls to fall asleep and could allocate time to other tasks, or their own sleep. Regarding the girls, shorter latencies to sleep could increase quality and duration of sleep. Therefore, while improved sleep was not a goal of this intervention, it may have been an additional benefit and could be considered in future research. This approach to collecting social validity data provides an example of how clinicians can measure socially significant change outside of the target skills without relying on subjective questionnaire answers (Gardner & Wolf, 2015) or no measure at all (Akers et al., 2018; Brodhead et al., 2014; Brodhead et al., 2018; MacDuff et al., 1993).

Perhaps most importantly, by the end of the intervention both parents could implement both the morning and night routines with their children. This transfer of skills is especially important given the family had a pause in services and so they will be able to provide consistency in practice when clinicians are unavailable. Furthermore, night and morning times can be considered private times for families; therefore, the parents being able to implement the routine without need for clinician oversight also means they can regain their privacy.

As mentioned in the results section, Suni demonstrated levels of CB that warranted programmatic changes and clinician trainings. Based on the clinician's observations and consultation with the girls' direct clinicians, Suni's CB surrounded the initial transition to the night routine; thus, the clinician selected strategies that were most likely to decrease the aversiveness of the transition. These strategies included using behavioral momentum, honoring mands, rebuilding and maintaining rapport, contracting for preferred items, and prompting functional communication for breaks (Mayer et al., 2019). Clinicians also implemented another strategy of separating Cora and Suni for at least 15 min before they started their night routine and having Cora go first. The clinician assumed the transition to the night routine was particularly aversive when Suni went first and saw her sister was allowed to continue playing while she had to transition to a series of tasks. This behavior was not observed in Cora and thus, by separating the girls and having Suni go second, it would create an abolishing operation for CB during the transition. As shown in Figure 1, this approach was effective.

After consulting with clinician and reviewing the raw data, it appeared CB primarily occurred when Suni was putting on her pajamas; clinician also noticed protest statements when they were prompting Suni to put the clothes on in a specific order. Based on this information, at Day 90 the clinician progressed Suni to the AS phase, despite not meeting mastery criteria, as the clinician hypothesized giving her time to respond independently would allow her the autonomy to choose the order of dressing and thus would decrease CB during that step. As shown in the bottom of Figure 1, this approach was effective at reducing CB. Given the trend of these data prior to these changes, it is likely CBs would have continued and potentially increased, which would decrease learning opportunities and place undue strain on Suni.

While there are limitations, this clinical project demonstrates an electronic activity schedule can be effective in teaching clients to follow a morning and nighttime routine. These routines can be effective across clinician and parents and can lead to additional benefits, as previously discussed. Given the length of the routines and number of steps involved, it was critical the clinician made revisions throughout the program to ensure the girls were succeeding and idiosyncratic changes were made to address their individual needs.

Limitations and Barriers

The duration of the routine made it difficult to collect accurate and meaningful treatment integrity and IOA data. The clinician decided to take detailed data on one or two steps of the routine at any given session to ensure data was accurate; however, this ultimately created opportunities for clinicians and parents to error on other steps of the routine and those moments went undocumented. Therefore, the treatment integrity and IOA data represents select moments of the routine and may not accurately reflect true performance.

Another barrier of the intervention was the high response effort for the implementor associated with preparing the tablet. This intervention did not include teaching the girls to independently navigate the tablet, such that they would be able to find the app the activity schedule was in and begin their night routine completely independently. This step required an adult, and often there were technical difficulties surrounding passwords, battery life, Wi-Fi connection, and download processes that interfered with smooth transitions. It may have been easier to use a different application, device, or visual two-dimensional stimuli, such as a printed copy of the PowerPoint, to avoid these issues.

The data collection method for the clinician-led night routine was lengthy and often difficult to use when either Cora or Suni was engaging in CB or requiring consistent prompts throughout the routine. While the TA did serve as a reminder to the clinician of what steps needed to be completed and in what order, it did take several weeks before clinicians reported they felt fluent in data collection methods. Perhaps an alternative data collection strategy could have been used to make these methods simpler. Alternatively, more rehearsals during clinician training could have helped develop fluency prior to implementation with Cora and Suni. While the results of the IOA data do not suggest there were significant data collection errors, it is important to recognize the response effort this type of data collection method places on clinicians.

The duration of this intervention could also be reconsidered. The clinician used a total task chaining approach (i.e., providing prompts on all steps of the routine) to provide consistency of expectations from the start. However, it may have been beneficial to start with the most important tasks, perhaps toileting, dressing, and toothbrushing, and then adding in other tasks as they demonstrated mastery. This approach could have made the transition easier for clients and clinician by reducing response effort. Then, as mastery is met and as clinicians achieve fluency with prompting, error correction, and data collection, other tasks could be added in to create the entire night routine. Regardless of the approach, it is apparent either more training should be done on the front end to ensure clinician are prepared to implement a lengthy intervention with confidence and accuracy, or the intervention should be modified.

Despite the limitations and barriers of this clinical project, there were many positive results. If the above issues are resolved, it is possible parents and clinicians would be able to implement the routines with higher fidelity, which would therefore increase the quality of learning opportunities for Cora and Suni. These refinements are what improve our practice and set new standards for programming; it is the clinician's hope this study sets a template for future clinicians to expand and improve upon.

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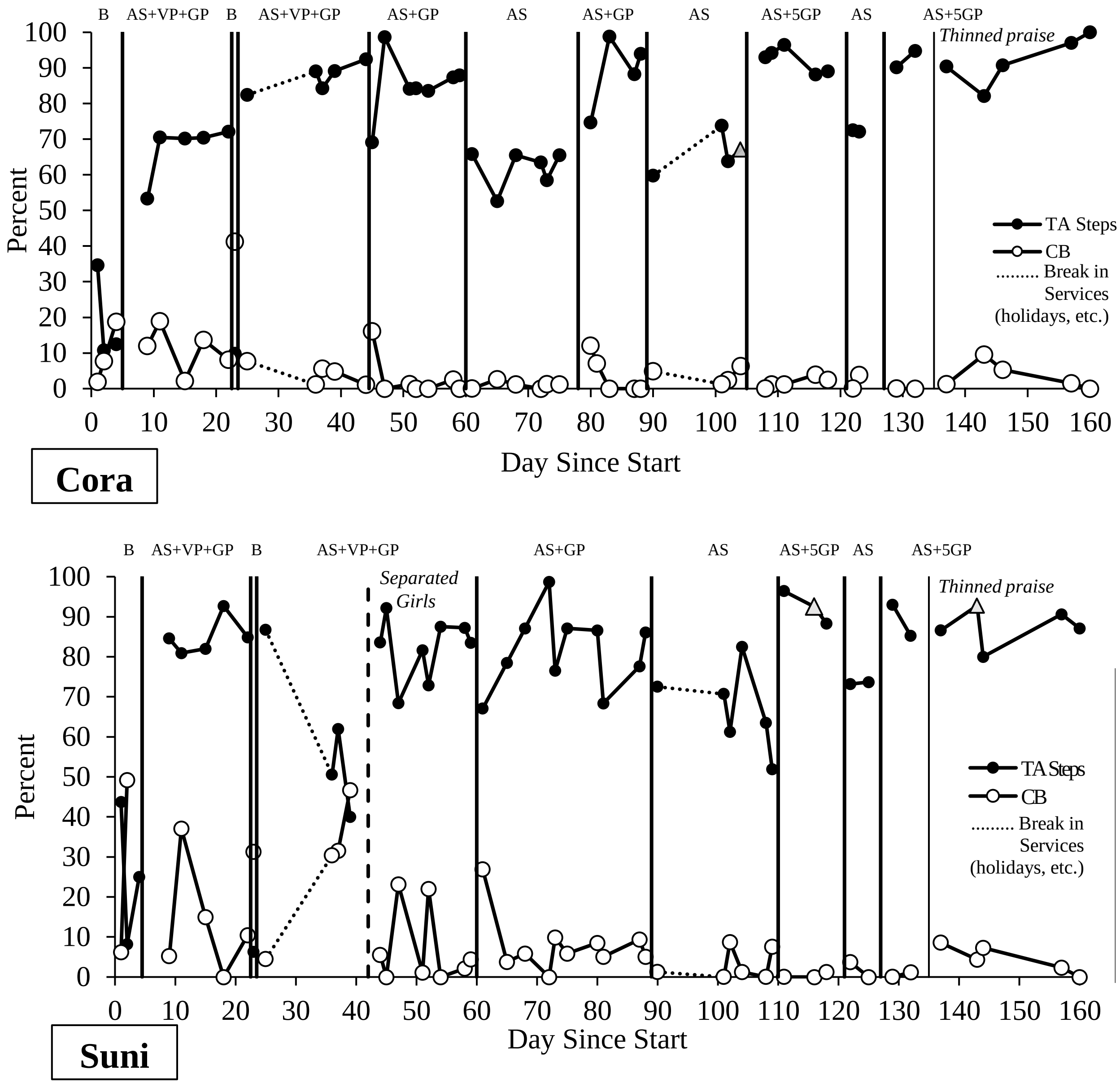
Figure 1

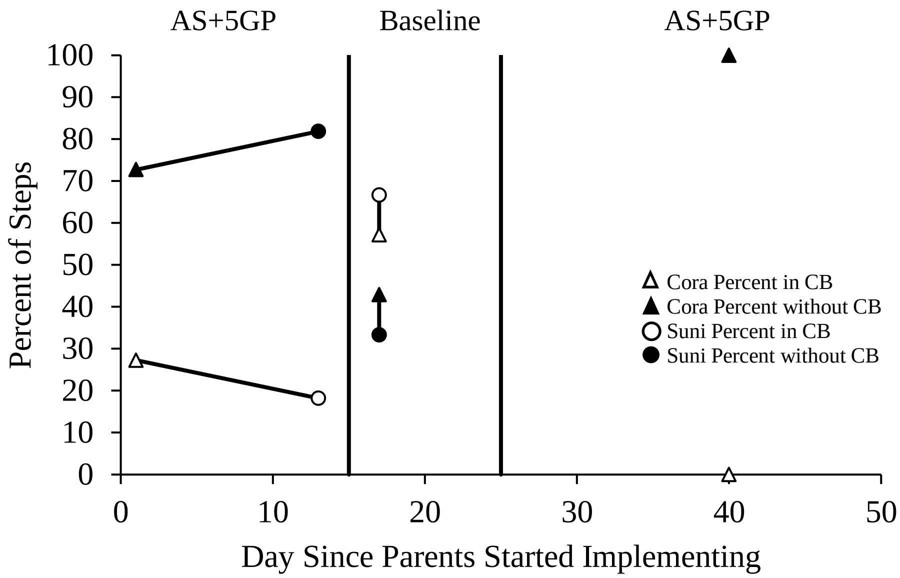
Cora and Suni's Percent of Steps Completed Correct or in CB for their Night Routine.



Note. Data reflect scores across Baseline (B), Activity Schedule + Visual Prompt + Gestural Prompt (AS+VP+GP), Activity Schedule + Gestural Prompt (AS+GP), Activity Schedule Only (AS), and Activity Schedule + 5-Second Delay to Gestural Prompt (AS+5GP) phases. CB reflects Challenging Behaviors.

Figure 2

Cora and Suni's Percent of Night Routine TA Steps Correct and in CB Since the Day Parents Began Implementing the Night Routine



Note. Singular data points represent either Cora or Suni's performance that day, meaning some days there were only data for one girl's performance. Data reflect scores across Baseline (B) and Activity Schedule + 5-Second Delay to Gestural Prompt (AS+5GP) phases. CB reflects Challenging Behaviors.

Figure 3

Cora and Suni's Percent of Morning Routine TA Steps Correct, in CB, and Non-Applicable Due to Lack of Time Since the Day Parents Began Implementing the Morning Routine

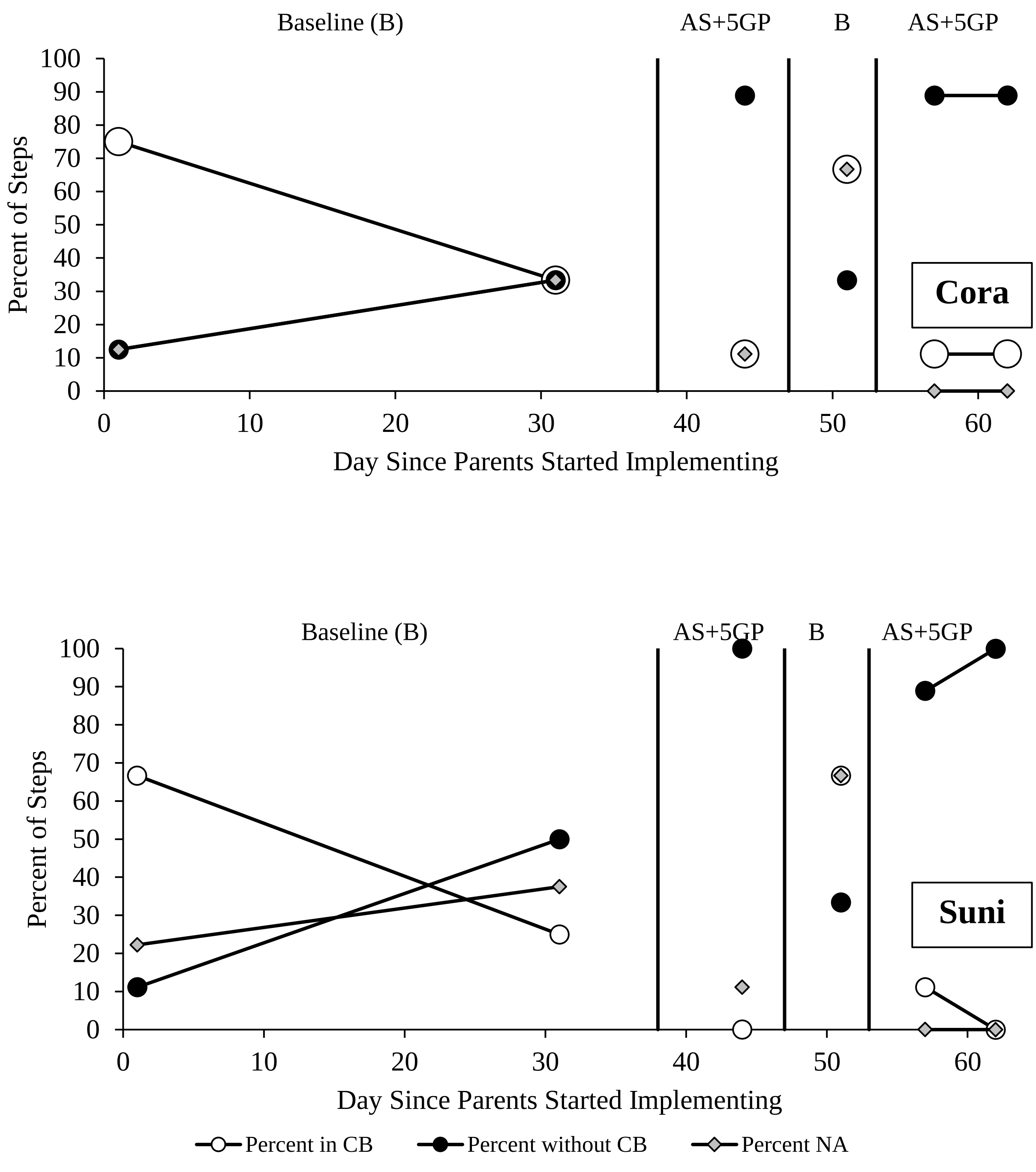


Figure 4

Minutes it Took Cora and Suni to Fall Asleep on Nights the Routine Was and Was Not Used