



BRIEF REPORT

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Generality of the practical functional assessment and skill-based treatment among individuals with autism and mental health disorders

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Abstract

A practical functional assessment format was recently developed that informed a skill-based treatment for the problem behavior of children diagnosed with autism spectrum disorder. Since its inception there have been multiple replications of the procedures; however, the comprehensive model has rarely been applied to populations with more complex comorbid disorders and severe problem behavior such as those diagnosed with anxiety or depression. We conducted the current study to systematically replicate the entire practical functional assessment and skill-based treatment model with two participants diagnosed with multiple mental health disorders admitted to a severe behavior outpatient unit. The practical functional assessment identified reinforcers that were provided contingent on increasingly complex forms of communication. Problem behavior remained low for both participants after reinforcement was thinned by increasing a response requirement of completing difficult tasks. Furthermore, the results were socially validated by the parents and teachers and the treatment was extended to the home setting.

KEYWORDS

functional analysis, functional communication, mental health disorders, synthesized contingencies, tolerance training

This study was a dissertation conducted by the first author under the supervision of the sixth author in partial fulfillment for the doctoral degree in applied behavior analysis. Lesley A. Shawler is now at the Kennedy Krieger Institute, Baltimore, MD. Michael F. Dorsey is now at Amego Inc., Attleboro, MA.

1 | GENERALITY OF THE PRACTICAL FUNCTIONAL ASSESSMENT AND SKILL-BASED TREATMENT

1.1 | Among individuals with autism and mental health disorders

Hanley (2012) described a practical functional assessment model in a perspective piece that involved creating a unique contingency synthesized into a single test condition based on the ecology of the individual's immediate context in which problem behavior was occurring. At the time, the functional assessment procedures Hanley introduced had yet to be fully evaluated and served more as a call for improving the efficiency and practicality of the functional analysis for clinicians working with children who exhibit problem behavior.

Hanley, Jin, Vanselow, and Hanratty (2014) were the first to use the practical functional assessment model with three children diagnosed with autism spectrum disorder (ASD) who exhibited problem behavior. The assessment period began with an open-ended interview and observation to gather qualitative information from caregivers regarding individualized and contextually relevant events to be evaluated during the functional analysis. The single test condition from the functional analysis included the combination of reinforcers reflective of what the individual was likely to experience following problem behavior in the natural environment and was compared to a matched control of noncontingent continuous access to those same reinforcers. The functional assessment process was defined as being practical because the functional analysis required as little as 20 min to conduct and was completed in a mean of 2.3 outpatient visits.

This practical functional assessment was a departure from the standard model (Iwata et al., 1982/1994) that historically relied on five core procedural components (Jessel, Hanley, & Ghaemmaghami, 2020a). That is, the standard functional analysis included (1) multiple test conditions of (2) isolated contingencies with (3) putative reinforcers presented contingent on severe problem behavior (4) evaluating general classes of reinforcement (5) compared to an omnibus play control. In the seminal publication, Iwata et al. used these five core components to develop a functional analysis that uniformly evaluated the sensitivity of self-injurious behavior to attention in the form of reprimands, escape from academic materials, and automatic reinforcement compared separately in three different test conditions. The standard functional analysis was conducted with nine participants in an inpatient hospital setting requiring an average of 450 min to conduct across 8 days. This suggests that there may be some clinical barriers to the widespread use of the standard functional analysis model among clinicians working in the home, school, or outpatient setting. However, practicality is only relevant if the assessment procedures continue to inform effective, function-based treatment of problem behavior.

Hanley et al. (2014) developed a skill-based treatment informed by the results of the practical functional assessment that began with the presentation of the functional reinforcers contingent on increasingly complex social skills. As the treatment progressed, the three participants were taught how to tolerate periods of time without reinforcement using unpredictable and contingency-based delays. Participants were periodically denied access to the reinforcers after emitting an appropriate request (e.g., "May I have my way, please?") and were instructed to complete contextually relevant tasks such as self-help activities or homework assignments before reinforcers were re-presented. Problem behavior was eliminated by the final sessions and the caregivers validated the assessment and treatment procedures as acceptable and the improvements, both in the reductions in problem behavior and the skills their child acquired, as satisfactory.

Jessel, Hanley, and Ghaemmaghami (2016) later termed the functional analysis from the practical functional assessment model as the interview-informed, synthesized contingency analysis (IISCA) based on the defining procedural features. Jessel et al. collected 30 replications of the IISCA across participants of various ages and language abilities in different settings such as outpatient clinics, day habilitation centers, specialized schools, and the participants' home. In addition, the experience of the individuals implementing the IISCA procedures in session with the participants varied from a supervised caregiver to a doctoral level clinician. However, the diagnoses of the participants were relatively homogeneous, with 89% including a diagnosis of ASD or a related developmental

disorder (i.e., pervasive developmental disorder-not otherwise specified). The authors found the IISCA was likely to produce differentiated results in all participants with a mean analysis time of 25 min. This study provided evidence to support the generality of the IISCA typically among individuals diagnosed with ASD and solidified its use as an alternative option to more time-consuming functional analysis formats.

As an extension, Jessel, Ingvarsson, Metras, Kirk, and Whipple (2018) evaluated the entire IISCA and skill-based treatment model with an additional 25 participants who were admitted to an outpatient clinic due to the severity of their problem behavior. Once again, the collection of participants included a majority diagnosed with ASD (24 of 25). Participants attended the clinic for 7 h a day, 5 days a week, for 2 consecutive weeks. The IISCA required a mean of 36 min to conduct and the treatment began on the first visit for all participants. Furthermore, the authors reported that only treatment procedures informed by the IISCA were required (i.e., no supplemental reinforcement or punishment) and lead to a near elimination of problem behavior. Finally, all caregivers reported the assessment and treatment process as highly acceptable and helpful, and produced highly satisfactory improvements in problem behavior.

Due to the growing use of the IISCA in applied research, Coffey et al. (2020) conducted a review whereby they collated and summarized recently published studies. Coffey et al. found 17 empirical publications with 102 applications across four geographical locations since the original publication from Hanley et al. (2014). Interestingly, the majority of studies were conducted with young children who could speak in full fluent sentences and were diagnosed with only ASD (53%) with many others including a dual diagnosis with ASD (31%), such as attention-deficit/hyperactivity disorder (ADHD). Although the outcomes of the review provided positive support for a growing literature, there were two apparent gaps that should be addressed.

First, the practical functional assessment and skill-based treatment model has mainly been applied to participants diagnosed only with ASD. However, it is highly likely that as those children age they will also develop some comorbid anxiety and depression problems (Bitsika & Sharpley, 2015; Kim, Szatmari, Bryson, Streiner, & Wilson, 2000). It is important to ensure that a practical, outpatient model will be effective in reducing problem behavior in individuals with co-occurring mental health disorders because they are often at an increased risk of requiring psychiatric hospitalization (Righi et al., 2018). Second, many of the studies were conducted in controlled university based clinics with highly trained researchers. It is therefore important to ensure that the effectiveness of the assessment and treatment process will generalize to (a) those with more diverse disorders such as anxiety and depression, (b) practitioners in a community facility, and (c) caregiver implementers in the home and school environment.

The purpose of this study was to conduct a replication of the entire assessment and treatment process as originally reported by Hanley et al. (2014) with two individuals diagnosed with anxiety and depression admitted to an intensive outpatient clinic for individuals diagnosed with a range of comorbid mental health disorders uncommon to the larger population of children with intellectual and developmental disabilities. The participants were referred to the intensive outpatient clinic because multiple interdisciplinary treatments had previously failed and the individuals were an immediate risk to their own safety or the safety of others. In addition, we extended previous research by evaluating treatment integrity on all those who would conduct the treatment (i.e., clinicians, teachers, and parents) to ensure that the recommended procedures could be implemented by providers of typical services in natural settings. We also conducted follow-up observations to determine whether the positive outcomes were maintained across time.

2 | METHOD

2.1 | Participants, setting, and materials

Two participants were referred by a pediatrician and/or psychiatrist to an intensive outpatient program in Texas for the treatment of severe problem behavior. All funding for the services provided came from the participants' private

insurance. The first or second author served as the supervisors to the clinicians for all cases. The clinicians were staff members who were either graduate students pursuing a degree in Applied Behavior Analysis or recent Master's level graduates. The third and last authors served as long-distance advisors to the first author but did not work with any of the clinicians or participants directly.

Alan was a 10-year-old Hispanic male who spoke in full sentences. His diagnoses included ASD, fetal alcohol syndrome, ADHD, and depression. His birth parents had a history of drug and alcohol abuse, bipolar disorder, and domestic violence. His adoptive parents expressed concern and often had to involve the authorities when Alan was aggressing to keep the other children in the home safe. When he started the study, he took Vyvanse, Tenex, Zoloft and risperidone prescribed for his problem behaviors. His problem behaviors included physical and verbal aggression, property destruction, and elopement.

Ryan was a 9-year-old Caucasian male who spoke in full sentences and was diagnosed with ASD and a generalized anxiety disorder. At the time of this study, Ryan took Celexa to help manage problem behaviors. His problem behaviors included disruptive behavior, property destruction, and physical aggression. Frequently, he was removed from the classroom due to tantrums and physical aggression directed at peers. Although Ryan was not formally diagnosed with depression, he regularly exhibited symptoms such as vocalized self-deprecating statements, expressed self-loathing, and engaged in threats of life-threatening self-harm (e.g., "I want to die, I'm useless, I hate myself").

2.2 | Measurement

Clinicians used pencil and paper to collect data on the occurrence of problem behaviors within continuous 10-s intervals using a partial-interval observation procedure. This measurement system differed from previous studies because Alan and Ryan's problem behavior could occur in extended durations, with unclear on or offsets. An occurrence was scored if problem behavior or attempts occurred at any point during the 10-s interval. A nonoccurrence was scored if no problem behavior occurred during the 10-s interval. Problem behavior included different forms of aggression (e.g., hitting kicking, biting, and choking others) and disruption (e.g., flipping tables, ripping materials, and throwing items). Both participants also exhibited idiosyncratic topographies of problem behavior such as elopement (Alan) and disrobing (Ryan). In addition, loud vocalizations (e.g., crying, screaming, profanity, and pejorative language) were identified, when possible, as precursors to the more severe topographies. Precursors were targeted to reduce the possibility of severe injury during the functional analysis (Slaton, Hanley, & Raftery, 2017). Therefore, any loud vocalizations and idiosyncratic topographies were included in the measurement of problem behavior. The percentage of intervals of problem behavior was calculated by dividing the number of scored intervals, by the total number of intervals and multiplying it by 100.

Participants were taught individualized functional communication responses (FCRs) varying from simple to complex with Alan being taught an intermediary response. The number of FCRs and level of complexity were determined based on observations from the first and second authors and developmental appropriateness. The simple FCR included a less effortful vocal response. The complexity of each response was individualized and dependent on the participants' skill level. Alan's simple FCR was defined as saying, "Can I have my way please?" The intermediary response included Alan having to ask for the clinician's attention by saying "Excuse me" before asking if he could have his way. The final complex FCR for Alan maintained the same vocal topography but required the addition of eye contact and placing his hands into his lap (off any activities) during the entire request. We included the intermediary FCR without the nonvocal requirements for Alan because introducing so many requirements at once was likely to be too effortful and impact problem behavior (Ghaemmaghami, Hanley, Jessel, & Landa, 2018). Ryan's simple FCR was the question, "Can I have more time, please?" The complex FCR included the addition of "Excuse me." Much like Alan, after saying "Excuse me," Ryan had to wait until the clinician acknowledged him before continuing with the specific request for the reinforcers.

In addition to FCRs, each participant was taught to say “Okay” as a form of denial acknowledgment. We measured the denial acknowledgment as a free operant and it was not reliant on any verbal cues to be scored. In other words, the denial acknowledgment could have occurred and been measured during any session if the participant said “Okay.” We recorded any occurrences of FCRs and denial acknowledgments as prompted or independent throughout the entire session. The number of independent responses for each session was converted to a rate and represented in any further data analysis. The use of rate, instead of count, was particularly appropriate as a measurement of behavior because the session duration often varied; however, this will not impact the rate of responding.

The percentage of time in reinforcement was calculated by dividing reinforcement duration by session duration then multiplying the quotient by 100. The time started as soon as the reinforcers were delivered and stopped when reinforcers were removed. Compliance with tasks was scored as a correct if participants independently started and/or completed each task (defined below) within 5 s. For each session, percentage of compliance was calculated based on the total number of independently completed tasks out of the total number of tasks and multiplied by 100.

2.3 | Interobserver agreement

Interval-by-interval interobserver agreement (IOA) was calculated by having a second observer independently collect data on either the occurrence or nonoccurrence of problem behaviors, and independent or prompted responses to tasks. An agreement was defined as both observers scoring a “+” or “−” in the same interval. A disagreement was defined as one observer marking a “+” in one interval, and another observer marking a “−” for the same interval. Total IOA was also collected for all FCRs, denial acknowledgments, and reinforcement time. It was calculated by dividing the smaller number of occurrences or time within a session, by the larger number, and multiplying it by 100. Overall, observers collected IOA for 70.5% of Alan's sessions and 56.7% of Ryan's sessions.

IOA was collected for both participants across the IISCA, treatment, treatment extensions, and follow-up probes. During the IISCA, the mean IOA for Alan's problem behavior, FCRs, and reinforcement was 100%, 99.6% (range, 94.4%–100%), and 95.9% (range, 87.7%–100%), respectively. The mean IOA for Ryan's problem behavior, FCRs, and reinforcement during the IISCA was 86.1% (range, 72.2%–100%), 100%, and 92.5% (range, 72.4%–100%). During treatment, the mean IOA for Alan's problem behavior, FCRs, reinforcement, and compliance was 99.4% (range, 89%–100%), 99.9% (range, 94.4%–100%), 98.3% (range, 75%–100%), 96.2% (range, 75%–100%), 95.5% (range, 84.5%–100%), and 95.2% (range, 40%–100%), respectively. Finally, for Ryan's treatment, the mean IOA for problem behavior, FCRs, reinforcement, and compliance was 98.6% (range, 90%–100%), 100%, 97.1% (range, 50%–100%), 96.1% (range, 67%–100%), 93.8% (range, 75%–100%), and 97% (range, 60%–100%), respectively.

2.4 | Treatment integrity

Treatment integrity data for clinician implementation were collected for 37% of all sessions for Alan and 54% of all sessions for Ryan across all treatment conditions. A secondary data collector was either present to directly observe sessions or watched the recorded session. The observer used a checklist to determine whether the clinician implemented the procedures as prescribed for each condition. The overall treatment integrity was 96.8% (range, 50%–100%) for Alan and 99.6% (range, 89%–100%) for Ryan.

We collected treatment integrity data for caregivers following the delay tolerance training. Treatment integrity for parents and teachers was collected using the same checklist. The number of training trials ranged from 5 to 13 and depended on the individual's performance. In total, four caregivers (two parents and two teachers) were trained and the treatment integrity was 97.2% (range, 91.7%–100%) for Alan and 95.9% (range, 91.7%–100%) for Ryan.

2.5 | Experimental design

A multielement design was used to compare the test and control conditions of the IISCA. Functional control was demonstrated in the rapid alternation of the two conditions when problem behavior was elevated in the test sessions and eliminated in the control sessions.

We used a multiple baseline design across behaviors to measure treatment effects. Functional control was demonstrated when FCRs and denial acknowledgments increased during the stepwise and staggered introduction of reinforcement for the respective complexity. We used the multiple baseline design because the targeted communication responses were free operants and could be emitted at any time across all phases. Similar studies have used the stepwise criteria targeting progressively more complex topographies of communication to evaluate control without a reversal (e.g., Ferguson et al., 2020; Ghaemmaghami et al., 2018; Jessel et al., 2018; Rose & Beaulieu, 2019).

3 | PROCEDURES

3.1 | Practical functional assessment

The practical functional assessment process involved three steps: An open-ended interview, a brief contingency probe, and the IISCA. All three steps of the practical functional assessment were completed within the first visit.

3.1.1 | Open-ended interview

During the open-ended interview, the first author gathered information from the caregivers to better inform the contingencies to be evaluated. The interview included questions related to the individual's current skill level, language abilities, topographies of problem behavior, and concerning contexts in which the problem behavior was likely to occur (see appendix of Hanley [2012] for the complete list of questions). Preferred items identified during the interview were provided by the caregivers to be used during the brief contingency probe and IISCA when possible. The participants' personal items were used because of a potential specific preference for those items and to improve the ecological relevance of the functional analysis. The mean duration of the interview across both caregivers was 29.5 min (range, 25–34 min).

3.1.2 | Brief contingency probe

A 20-min brief contingency probe was conducted for both participants (Jessel, Metras, Hanley, Jessel, & Ingvarsson, 2020b). At this time, the clinician unsystematically probed hypothesized contingencies based on the information collected during the interview. The clinician repeated these steps in various arrangements to gain a better understanding of the evocative properties of the events that occasion problem behavior. The procedures of the brief contingency probe shares many similarities with the trial-based IISCA that presents 20 trials of a synthesized establishing operation during the test segment and compares problem behavior to that of a control segment when the synthesized reinforcers are available (Curtis et al., 2020). The core differences being that the brief contingency probe (a) only presents a few trials, (b) is complete after problem behavior is consistently evoked, and (c) the contingency evaluated can shift unsystematically based on the participant's performance and in situ caregiver feedback.

For example, a caregiver may report difficulties with removing the child's iPad while he were playing his favorite game and also note during the interview that the only way to calm their child down would be to allow independent access to the iPad without further interruption. The brief contingency probe would then begin with the participant given access to their iPad with the specified game. The therapist would then begin conducting probes of the parental instruction to end access to the iPad and the re-presentation of the iPad following problem behavior. If no or inconsistent problem behavior was observed during the contingency probe, the therapists would have returned to questioning the caregivers for more information on environmental events that may have been overlooked. The contingency probe was also useful in refining behavioral definitions to include topographies of problem behavior that may have not been reported during the interview (e.g., precursor behaviors) and probing language abilities to determine communication responses to be taught during treatment.

3.1.3 | Interview-informed synthesized contingency analysis

All items and materials included in each IISCA were individualized and selected based on the information from the interview and brief contingency probe. Systematic preassessments were not conducted to identify preferred items because doing so could introduce items unlikely to contribute to problem behavior (Shirley, Iwata, & Kahng, 1999). The IISCA included a single test condition compared to a matched control in the sequence of control, test, control, test and test. Sessions were three min. During the control condition the clinician provided continuous access to the putative reinforcers identified during the interview and brief contingency probe, with no tasks delivered. No consequences were programmed for problem behavior. In the test condition, the clinician arranged for the same reinforcers from the control condition to be provided contingent on problem behavior. During the test condition, the clinician started to remove all reinforcing items and presented the specific task for each individual using a least-to-most 3-step prompting sequence (i.e., verbal prompt, model prompt, and full-physical guidance). If problem behavior occurred, the specific task was terminated, and the participant was provided 30-s access to the identified putative reinforcer.

The results of the interview and brief contingency probe suggested that Alan's problem behavior was likely to occur during academic tasks and the only way to calm him down was to allow him to engage with other more preferred activities. Therefore, Alan's test condition of the IISCA included escape from academic instruction and access to child-directed play. The results of the interview and brief contingency probe for Ryan suggested a similar evocative context of academic work; however, it was reported that he did not enjoy interacting with others and preferred to play alone with his tablet. Based on this information, Ryan's test condition of the IISCA included escape from academic instruction and access to independent play with his tablet.

3.2 | Skill-based treatment

The test sessions from the IISCA served as the baseline for the treatment evaluation. Prior to the start of each training phase during the skill-based treatment (i.e., simple FCR, intermediary FCR, complex FCR, denial acknowledgment), the clinician used a behavior skills training package (BST) to teach Ryan and Alan the targeted forms of communication. The BST training package began with the clinician providing instructions and rationale on using the communication response. Two clinicians then modeled what the participant was going to experience and how to respond in order to regain access to their reinforcers. Lastly, a clinician role-played with the participants and provided feedback when necessary. For both participants, they needed to independently demonstrate the communication response at least two times during the role-play before moving on to treatment.

3.2.1 | Functional communication training

During functional communication training (FCT) sessions, both participants learned a simple FCR followed by an intermediary or complex FCR. The clinician instructed the participants to terminate their preferred activity and to begin to work. If problem behavior occurred, the reinforcers continued to be withheld (i.e., extinction) and the 3-step prompting procedure was used. Following the relevant FCR, the task was terminated and access to preferred items was made available for 30 s. The clinician increased the complexity of the FCR once participants met mastery. Mastery criteria for all phases was based on a visual analysis of stable FCRs, across two consecutive sessions, with zero rates of problem behavior and a minimum of three sessions conducted per phase. Each session was 3 min.

3.2.2 | Delay tolerance training

Delay tolerance training began with the participants being taught a denial acknowledgment when access to their reinforcers were denied (e.g., saying "Okay") using the same BST training package that was used to teach the FCRs. The participant was denied access to the reinforcers, by being told, "nope, not right now." When a denial was presented the clinician only returned access to the reinforcers following emission of the participants' denial acknowledgment. Problem behavior remained on extinction. Tolerance training sessions were 3 min, with the same mastery criteria as used for the FCT phases.

Delay tolerance training continued with the introduction of tasks for the participants to complete in order to earn the reinforcers after the denial of an FCR. Each presentation of the cue to terminate an activity and start to work, was considered a trial. Each session included five trials and was no longer dependent on a programmed period of time. Session durations varied and were progressively extended as the amount of time required to complete all five trials was increased based on programmed task requirements. Therefore, session durations were extended as behavioral requirements progressively increased. The mean session duration during delay tolerance training for Alan and Ryan was 7.4 min (range, 3–22.4 min) and 19.1 min, respectively (range, 3–140.3 min).

One of the five trials resulted in immediate reinforcement for the complex FCR (20%) and one for the denial acknowledgment (20%). The remaining three trials resulted in the delivery of tasks following the denial acknowledgment. Using Ryan as an example, the clinician began the task trial by saying, "Ok, it's time to work" and removed all reinforcers while preparing the academic material. Ryan had to then first say, "Excuse me" to regain the clinician's attention before continuing with, "Can I have more time please?" Because this trial includes the completion of instructions, the clinician would have denied Ryan's mand and waited for him to say "Ok" before continuing with the presentation of academic tasks. The reinforcers were then returned once Ryan completed the programmed number of tasks without problem behavior. Participants were not aware of the sequence of the presented trials and the order was randomized after every session with the exception that each session had to have one of each possible trial.

Tasks were systematically introduced in increasing quantity and difficulty, starting with one and a terminal goal of 10 tasks. Both participants began with simple motor tasks (Level 1) then increased in difficulty to academic tasks (Level 2) and finally self-help tasks (Level 3). The academic tasks required completing rows of math problems on a worksheet, writing, or reading pages in a book. The self-help tasks were similar across participants and involved changing clothing, wiping tables, brushing hair, or brushing teeth. Task levels were systematically introduced based on the first author's visual analysis of (a) low levels of problem behavior, (b) stable use of target communication skills, and (c) stable and elevated percentages of compliance across two sessions. Although the delay during reinforcement thinning is often increased using time-based increments (Ghaemmaghami, Hanley, & Jessel, 2016), we used performance-based increments because the ultimate goal of delay tolerance training is to teach appropriate skills when reinforcement is unavailable for unpredictable periods of time. Thus, goals should be increased based on successful performance and not a specific delay interval.

On each trial, tasks could range from one task to the highest number of tasks for that phase. In other words, the three of five trials with tasks might vary from easy (least amount of tasks), moderate (middle amount of tasks), and difficult (most amount of tasks) and the participant experienced one of each in a session. For example, if Ryan was working on a phase of six tasks, one trial from the session could be completing one task, another trial could be completing five tasks, and the remaining trial could be completing six tasks. Once Level 1 tasks were mastered, only Level 2 and Level 3 tasks were interspersed for the remainder of the study. These tasks were considered more socially appropriate and related to concerns at home or school (e.g., reading, writing, and dressing). If problem behavior occurred during a task, the clinician prompted through that task using least-to-most prompting, and the sequence was reset (Jessel et al., 2018). In other words, participants had to complete the entire sequence of tasks without problem behavior in order for the reinforcers to be presented. We incorporated this resetting requirement to ensure that the successful chain of task completion was reinforced and reduce the possibility of problem behavior being adventitiously strengthened. The terminal goal for the treatment in clinic was set at a completion of up to 10 consecutive tasks, zero occurrences of problem behavior, at least 80% compliance with tasks, and consistent use of FCRs and denial acknowledgments across two consecutive sessions.

3.3 | Caregiver training

Training was conducted at the clinic once participants mastered completing at least eight of the 10 tasks. Caregivers were trained on all components of the treatment program. We trained caregivers using BST techniques beginning by summarizing the outcomes of the treatment evaluation and the specific procedural components. We then modeled each possible trial (i.e., FCR, tolerance, and task presentation) before role-playing randomized trials. These first steps of BST were completed with the caregivers within 30 to 60 min on a single visit. The caregivers were free to ask any questions throughout the BST training and once they indicated that they were comfortable with the procedures, we provided in situ training with their child and real-time feedback on their performance. The caregiver training was completed when the parent/teacher scored at least an 80% overall across three trials on the same treatment integrity checklist used with the clinicians and problem behavior remained low. Ryan's mother and teacher required five trials before meeting mastery, whereas Alan's father and teacher required 13 and 12 trials, respectively.

3.4 | Treatment extension

Sessions were moved to the home setting with the clinician for generalization purposes following caregiver training. The first in-home visit was a full 6-h day, similar to the clinic setting. The primary clinician began the in-home visits until mastery criteria were met at 10 tasks (same criteria as in the clinic). Then a second clinician was introduced to conduct sessions. The second clinician was introduced because she was responsible for the typical services provided in the home and was expected to continue to implement the treatment after the study had concluded. During this time, parents observed the sessions and the clinicians were available to answer any further questions the parents may have had. For both participants, the remaining visits varied between 2 and 3 h each day and occurred after the participants' typical school day. Similar to delay tolerance training, each session included five trials and the duration of the session was dependent on the completion of those trials. The mean duration of sessions during the treatment extension for Alan and Ryan was 13.7 min (range, 8.4–35.4 min) and 72.7 min (range, 23.7–205.1 min), respectively. All after-school sessions continued until mastery criteria were met at home, across two consecutive days. The clinicians made three in-home visits with Alan and 7 in-home visits with Ryan.

3.5 | Follow-up probes

Follow-up probes were conducted at the clinic with the clinician, 4 to 5 weeks after the termination of the treatment extension phase. Follow-up probes were conducted identical to treatment sessions to evaluate the effects over time.

3.6 | Social validity

The teachers and parents were given a questionnaire at the conclusion of treatment (see Jessel et al., 2018 for questions). The survey asked questions using a Likert-type scale to assess the overall experience that the caregiver had with the assessment and treatment process, and satisfaction with the results. Ratings ranged from (1) not satisfied to (7) highly satisfied, as well as an open-ended section for "additional comments" for the team.

4 | RESULTS

The individualized contingencies evaluated for each participant and the results of the IISCAs are presented in Figure 1. For both participants, zero levels of problem behavior occurred during the control conditions. Elevated levels of problem behavior were observed during the test conditions for both Alan ($M = 20.3\%$; range, 11%–39%) and Ryan ($M = 29.7\%$; range, 28%–33%). These results suggest that the problem behavior exhibited by Alan and Ryan were influenced by the socially mediated consequences informed by the interview and brief contingency probe.

Alan's treatment evaluation is presented in Figure 2. Problem behavior was completely eliminated during all phases of FCT. Simple FCRs were exhibited ($M = 1.6$ responses per min [rpm], range, 1–2 rpm) when reinforcement was made contingent on those responses. During the reinforcement of intermediary FCRs, the simple FCR no longer occurred and elevated rates of the intermediary FCR were observed ($M = 1.4$ rpm, range, 0.7–1.7 rpm). During the final FCT phase, the intermediary response reduced ($M = 0.1$ rpm, range, 0–0.3 rpm) and the complex FCR was exhibited at elevated levels ($M = 1.5$ rpm, range, 1.3–1.7 rpm). When delay tolerance training was introduced, problem behavior remained low ($M = 0.5\%$, range, 0%–6%) and Alan began to exhibit the denial acknowledgment ($M = 0.7$ rpm, range, 0.2–1.7 rpm). In addition, the rate of Alan's complex FCRs was on a decreasing trend ($M = 0.8$ rpm, range, 0.2–1.4 rpm) corresponding with the increase in the number of tasks introduced (i.e., Alan was completing more work and asking for the reinforcer less). By the final thinning level, Alan was complying with 98% of instructions and spending 35% of the session in reinforcement. During the treatment extension, including the follow-up probe, Alan's problem behavior remained low ($M = 3.5\%$; range, 0%–44.4%) and he continued to comply with adult instruction ($M = 95.6\%$; range, 82.6%–100%).

The treatment evaluation for Ryan is presented in Figure 3. When simple FCT was introduced, problem behavior reduced ($M = 0.9\%$, range, 0%–5.6%) and the simple FCR increased ($M = 1.2$ rpm; range, 0–1.7 rpm). When complex FCT was introduced, problem behavior and the simple FCRs no longer were exhibited by Ryan and the complex FCR increased ($M = 1.6$ rpm; range, 1.3–1.7 rpm). When delay tolerance training began, Ryan's problem behavior reduced from the mean baseline levels ($M = 5.4\%$; range, 0%–68%). The denial acknowledgments were emitted and decreased ($M = 0.5$ rpm; range, 0–1.7 rpm) along with the complex FCR ($M = 0.5$ rpm; range, 0–1.7 rpm) as the duration of the delays increased. By the final sessions Ryan was complying with 84% of the instructions and spending 10% of the time in reinforcement. Ryan continued to comply with instructions ($M = 88.7\%$; range, 73.2%–100%) during the treatment extension and problem behavior remained at low levels ($M = 1.8\%$; range, 0%–12%).

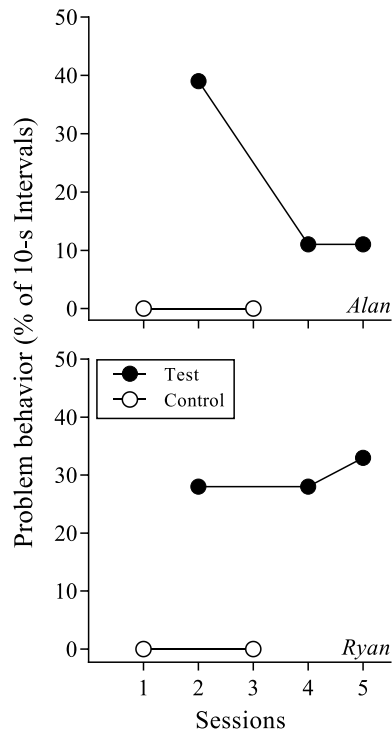


FIGURE 1 Results of the interview-informed, synthesized contingency analyses (IISCAs)

Overall, the parents and teachers found the treatment to be highly acceptable ($M = 6.5$; range = 6–7). The caregivers were generally satisfied with the improvements in problem behavior ($M = 5$; range = 3–7), communication skills ($M = 5.5$; range = 4–7), and found the assessment helpful ($M = 5.5$; range = 4–7); however, the mean was impacted by Alan's mother who provided somewhat neutral ratings. It is important to note that Alan's mother verbally reported to the clinicians that she would improve her ratings if we continued to provide additional behavioral programs for other unrelated targets of concern.

5 | DISCUSSION

This study was a replication of a skill-based treatment package designed from the results of an IISCA for two participants exhibiting symptoms of depression in addition to their other comorbid diagnoses. To the best of our knowledge this is the first extension of the assessment and treatment model to this particular population. Furthermore, the entire process was evaluated from the clinical setting to the home with the caregivers. This is an important extension to consider given that we were able provide effective treatment for these participants with comorbid mental health disorders while avoiding the need for costly psychiatric hospitalization. In fact, inpatient admission can be a cause of substantial stress for the individuals in need of behavioral services as well as the family members personally invested in their care (Palucka & Lunskey, 2007). Therefore, the practical functional assessment and skill-based treatment package may be a preferred alternative in many cases. In addition, we presented a comprehensive evaluation that ended with the successful return of the participants to their home and school environment. Much of the research tends to focus on treatment efficacy rather than treatment extensions to effectiveness (Ghaemmaghami, Hanley, & Jessel, 2020).

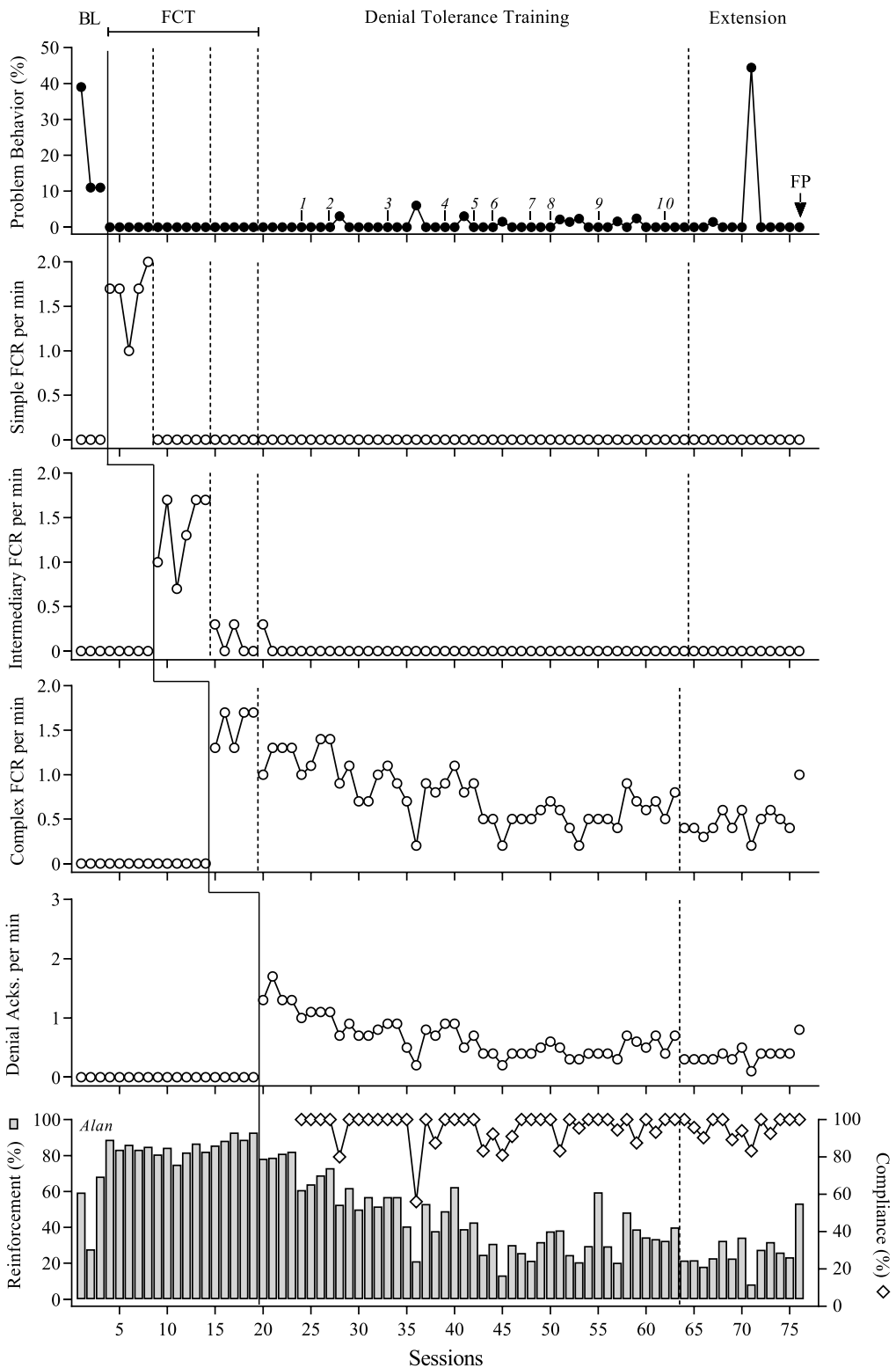


FIGURE 2 Results of Alan's skill-based treatment evaluation. BL refers to baseline. FP refers to follow-up probe. Denial Acks. refers to denial acknowledgments; FCR, functional communication responses; FCT, functional communication training

Efficacy refers to the initial demonstration that a treatment can work in a highly controlled environment with well-trained researchers. Effectiveness, on the other hand, focuses on the generality of the treatment and extending the procedures across time, to clinically relevant individuals, and socially important contexts. Ghaemmaghami et al. (2020) conducted a review of 208 studies with a total of 744 applications of FCT and found that the majority of studies were conducted in controlled settings with experts using dense schedules of reinforcement. Thus, the literature is somewhat limited to conclusions of minimal social relevance leaving clinicians with the uncertainty of obtaining positive outcomes when the participant returns to the home.

The results of our study provides further evidence of the effectiveness of the practical functional assessment and skill-based treatment model. Parents and teachers of the participants successfully implemented the intervention at the clinic during caregiver training and were reported to generalize these procedures to either the school or home. In fact, both the environments for the participants were so severely restricted prior to the introduction of this study that they were removed from school due to the severity of their problem behavior. Alan specifically was suspended and referred to a crisis center prior to receiving our outpatient services. Following the completion of the study, Ryan and Alan were admitted back to school and teachers continued to anecdotally report on their success two years after they returned to the classroom. In addition, we found that teachers and caregivers were not only able to maintain the reductions in problem behavior but they could also implement the treatment with high levels of integrity in the intended setting.

An additional element of effectiveness to consider is the practicality of the assessment and treatment process. The IISCAs for both participants produced differentiated outcomes, identifying socially mediated functions of problem behavior in 15 min. Previous research has identified that this brief analytic duration may be a probable outcome when using the IISCA (Jessel, Metras, Hanley, Jessel, & Ingvarsson, 2020b). Jessel, Metras et al. conducted the IISCA with 10-min sessions for 18 participants admitted to an outpatient clinic. The authors then reanalyzed the rates of problem behavior during the first 5-min and 3-min of each session and found that differentiated outcomes were obtained regardless of the session duration. Furthermore, the authors conducted an additional eight consecutive cases using 3-min sessions creating total analysis durations as brief as 15 min (i.e., five 3-min sessions) and found similar results. The current study replicated this efficient IISCA format and extended the procedures by including treatment outcomes, suggesting that reductions in analytic duration is unlikely to negatively impact the effectiveness of a function-based treatment. Thus, the IISCA format seems like a more practical alternative for clinicians compared to other extended functional analysis procedures.

When considering the efficiency of the treatment process, the original Hanley et al. (2014) study lasted 8 to 14 weeks, and the participants were required to attend 22 to 32 1-h per day treatment sessions. The current study's session scheduling was more similar to Jessel et al. (2018), lasting 3 to 4 weeks for 6 h a day. The difference in time could possibly be attributed to this study using a more intensive approach and providing treatment on a full-time schedule. However, the comparison in treatment efficiency should be interpreted cautiously because the determination of "meaningful effects" varied and are dependent on the caregivers. Furthermore, the addition of training, treatment extensions, and follow-up extends the overall time requirement greatly.

The inclusion of elements of practicality are intended to reduce clinical barriers to the use of functional analyses that can inform effective, function-based treatment of problem behavior (Hanley, 2012). As an added element, we included precursors in our definition of problem behavior because opening the contingency class during a functional analysis to include precursors to dangerous topographies has been suggested as a potential strategy for improving safety (Slaton et al., 2017; Smith & Churchill, 2002). In addition, Warner et al. (2020) implemented extinction sequentially for increasingly severe problem behavior and found that caregiver-informed precursors were likely to exist within the same functional class as the more severe topographies. Although we included caregiver-informed precursors during the assessment and treatment process of the current study, we are unable formally to address any concerns of safety because all problem behavior was recorded as an aggregate. Considering this study was conducted in a clinical setting, the decision to aggregate

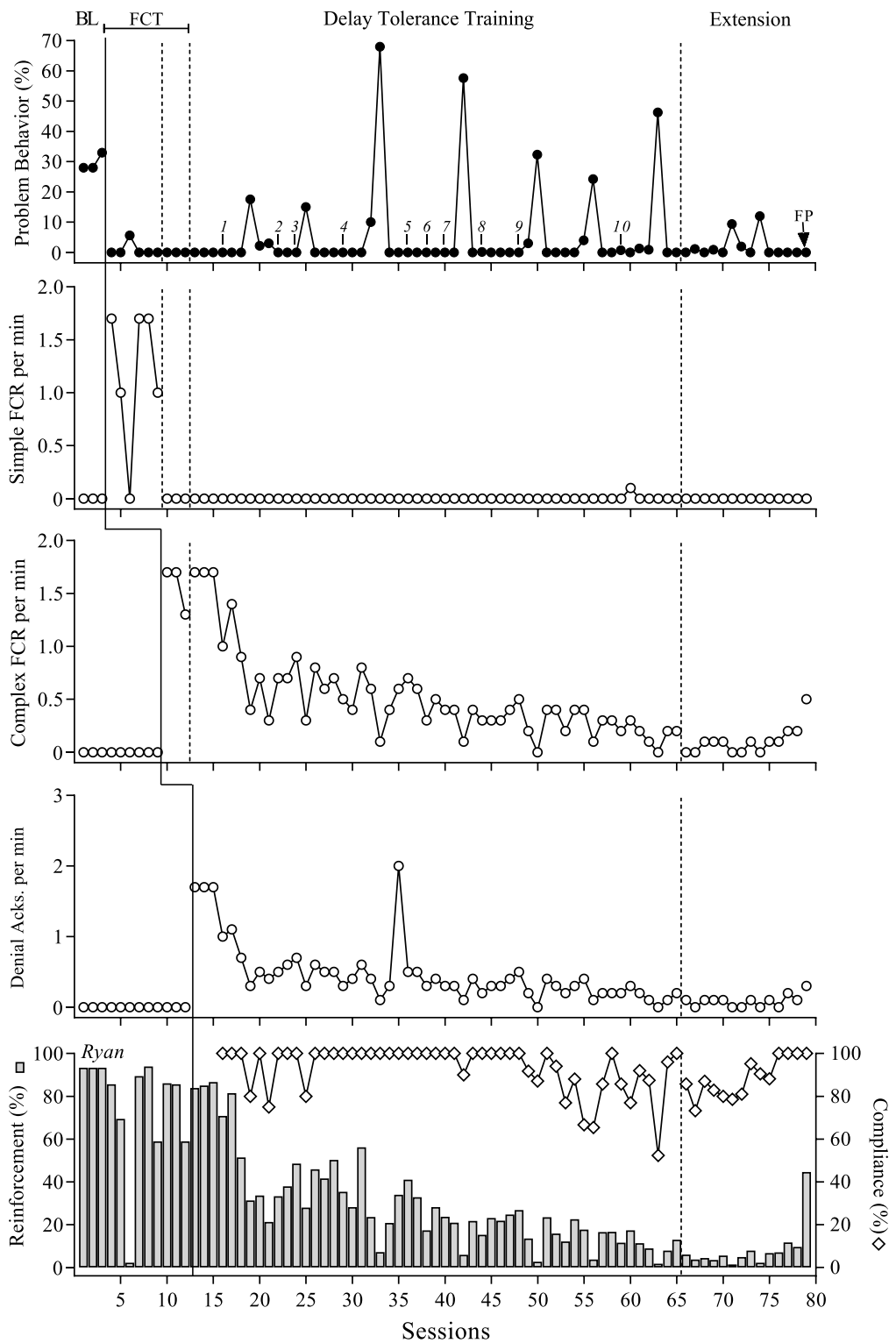


FIGURE 3 Results of Ryan's skill-based treatment evaluation. BL refers to baseline. FP refers to follow-up probe. Denial Acks. refers to denial acknowledgments; FCR, functional communication responses; FCT, functional communication training

response topographies was done for practical purposes. Anecdotally, we tended to observe precursors during the IISCA and more instances of the dangerous problem behavior during the delay tolerance training as the behavioral requirement was progressively expanded. That is, the contingencies during the IISCA evoked only mild instances while the dangerous behavior within the same functional class was more likely to emerge during the extended periods of delays to reinforcement. Future researchers may want to evaluate safety during the entire process of the practical functional assessment and skill-based treatment by measuring each precursor or dangerous topography separately or by including other measures such as injury reports completed by medical professionals (Kahng et al., 2015). Doing so could help identify (a) periods when more staff members or safety equipment will be needed to prevent injury or exposure to harm and (b) points in the treatment that require reducing thinning steps or increased access to reinforcement to ensure the successful completion of the treatment while avoiding bursts of dangerous behavior.

A limitation of this study was the lack of more experimentally conservative designs, such as a reversal back to problem behavior. Using a reversal design or a delay and denial baseline phase (Hanley et al., 2014) would have improved overall interpretations of experimental control. Our intention was to create a more practitioner oriented and caregiver preferred design because (a) experimental control was represented with each implementation of the next phase in treatment, as would be naturally guided in clinical practice, and (b) caregivers would not have to witness a return to a worsening in behavior. Other researchers could improve the demonstration of experimental control while continuing to avoid a reversal by including increasingly complex FCR topographies.

Another limitation is that although follow-up probes were conducted, they were completed 4 to 5 weeks postmastery of treatment and with only the trained clinicians. Moreover, as the participants continued to receive behavior analytic services postexperiment, these checks did not purely test for maintenance in the absence of treatment. For example, Ryan continued to receive therapy a couple hours a week. However, at the time the study concluded, it was agreed that both participants needed to continue services to produce socially significant outcomes. Future research could include maintenance data over longer periods of time and with the caregivers in the relevant settings. This will provide much needed evidence that those implementing the practical functional assessment and skill-based treatment model can obtain sustainable, socially meaningful reductions in problem behavior.

CONFLICT OF INTEREST STATEMENT

Amanda L. Coffey declares no conflict of interest. Lesley A. Shawler declares no conflict of interest. Joshua Jessel declares a part-time consultative role in FTF Behavioral Consulting. Taylor Bain declares no conflict of interest. Maggie Nye declares no conflict of interest. Michael F. Dorsey declares no conflict of interest.

ETHICS STATEMENT

Informed Consent: Informed consent was obtained from all individual participants included in the study. **Ethical Approval:** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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