Training Technicians to Conduct Trial-Based Functional Analyses via Telehealth

by

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Abstract

Title: Training Technicians to Conduct Trial-Based Functional Analyses via Telehealth

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Previous studies have supported the use of trial-based functional analysis performed by teachers in classroom settings. The purpose of this study was to determine the efficacy of training technicians to conduct trial-based functional analyses via telehealth. Telehealth-based training was effective for producing high-integrity implementation by technicians and that using Trial-Based Functional Analyses in classrooms resulted in an efficient means of conducting functional analysis in areas with limited resources.

Keywords: behavior analysis, telehealth, trial-based functional analysis, problem behavior
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Dedication

I would like to dedicate my thesis to my family, my closest friends, and my boyfriend, the unending support and encouragement throughout the years was as meaningful as it was necessary for my success.
Training Teachers to Conduct Trial-Based Functional Analyses via Telehealth

**Problem Behavior in Children Diagnosed with Autism Spectrum Disorder**

Problem behavior such as aggression, tantrums, self-injury, and self-stimulation occur for about 10 to 15% in individuals with intellectual or developmental disabilities (Emerson, Kieman, Alborz, 2001). Previous findings have shown that these excess behaviors may lead to peer and teacher rejection, high-risk violent behavior, and academic underachievement (Carr & Durand, 1985; Hinshaw, 1992; Tremblay et al., 2004; Wood, Cowan, & Baker, 2002).

Researchers have validated a variety of assessments and treatments to target and reduce these excess behaviors by identifying the environmental variables that support problem behavior (Carr & Durand 1985; Iwata, Dorsey, Slifer, Bauman, Richman, 1982/1994).

**Functional Analysis**

Skinner (1953) introduced the term functional analysis as a means to establish the experimental variables of which behavior is a function. The broad goals, according to Skinner, include predicting and controlling behavior and establishing the “cause-and-effect” relation between the independent and dependent variables. The “cause-and-effect”, or functional relationship, is established empirically through observation and manipulation of observable events. Researchers initiate analysis through environmental observations, controlled field observations, and laboratory analogues of human and animal behavior (Skinner). Identifying the
function provides researchers with a considerable advantage in manipulating the environment to change behavior.

Carr (1977) described some potential motivational variables that might influence self-injurious behavior (SIB), a seemingly counterintuitive response class. Carr’s review indicated five hypotheses, three of which were operant-based. Carr’s first hypothesis was that SIB is a learned operant maintained by a stimulus with social properties being added, following a response, that increases the probability of that behavior in the future (i.e., social positive reinforcement; Catania, 2007). For example, providing attention contingent on the performance of SIB, such as statements of concern (e.g., “Don’t do that” or “You’re going to hurt yourself”), might maintain SIB. Research by Lovaas, Freitag, Gold, Kassorla (1965), Wolf, Risley, Johnston, Harris, & Allen (1967), and Lovaas and Simmons (1969) supported the social positive reinforcement hypothesis, with data demonstrating that attention provided contingent on the occurrence of problem behavior, specifically SIB, sharply increased response levels.

Voluminous assessment results support the hypothesis that both SIB and multiple other maladaptive responses are often maintained by positive reinforcement in the form of access to attention and/or tangibles. In a review of the functional analysis literature, Beavers, Iwata, and Lerman (2013) found that 32.7% of published functional analyses suggested that problem behavior was maintained by social positive reinforcement in the form of access to attention and/or tangibles. For example, Bowman, Hardesty, & Mendres-Smith (2013) performed a functional
analysis of negative vocalizations with one participant. Attention in the form of vocal sympathy and physical attention was indicated as the maintaining variable. O'Reilly et al. (2012) conducted a FA with three participants, the results suggested access to tangibles as the maintaining variable in all cases. In addition to assessment results, many studies show that problem behavior maintained by social positive reinforcement can be effectively treated. Treatment research for social positive reinforcement as a maintaining variable has explored weakening the contingencies between the behavior and consequence as a treatment to reduce problem behavior. There is a substantial body of literature indicating that the complete removal of social consequences can, in fact, greatly reduce or eliminate SIB (Bucher & Lovaas, 1968; Ferster 1961; Hamilton, Stephens, & Allen, 1967; Jones, Simmons, & Frankel, 1974; Lovaas & Simmons 1969; Tate & Baroff, 1966; Wolf, Risley, Johnston, Harris, & Allen, 1967; Wolf, Risley, & Mees, 1964). The results of Bucher and Lovaas suggest that eliminating attention as a consequence for SIB functionally serves as extinction (also see Lovaas & Simmons, 1969, and Romanczyk & Goren, 1975). More recently, researchers have studied different functional treatments for socially positive maintained problem behavior that decreases problem behavior to socially significant levels. Fahmie, Iwata, Querim, and Harper (2013) compared potential control conditions for use in FAs (Iwata et al., 1982/1994), each of which could be used in the context of treatment. The sequence of test conditions in the control comparison included an alone condition and a differential
reinforcement of other behavior (DRO) condition in addition to the toy play condition used in the traditional functional analysis. For participants whose behavior was controlled by attention, the DRO condition produced reinforcement at the end of the DRO-interval contingent on the absence of target behavior. All three participants with attention-maintained problem behavior had significant reductions in the DRO condition compared to the attention condition. Hammond, Iwata, Fritz, and Dempsey’s (2011) results were similar in their study of DRO schedules under signaled and un-signaled arrangements. All participants’ problem behavior decreased significantly with the use of a signaled or un-signaled fixed momentary DRO.

The second learned operant hypothesis on the maintaining variables of self-injurious behavior is negative reinforcement. Negative reinforcement is defined by the contingent removal of a stimulus following a response that increases the probability of that response in the future (Catania, 2007). Examples include removing a task or demand contingent on the performance of SIB. Several studies reported anecdotal observations of patterns of behavior in which a demand was placed, SIB occurred, and the therapists or parents terminated demands (e.g., Freud & Burlingham, 1944, pp. 74-75; Goodenough, 1931, p. 139; Jones, Simmons, & Frankel, 1974, pp. 634-645). Carr et al. (1977) compared rates of SIB in a classroom setting versus free-play without demands. Higher rates of SIB were observed in the demand condition, suggesting SIB to be an escape response in the presence of an aversive stimulus (demand).
Like positive reinforcement described above, voluminous assessment results support the hypothesis that both SIB and multiple other maladaptive topographies are often maintained by negative reinforcement in the form of escape from or avoidance of aversive stimulation. In a review of the functional analysis literature, Beavers et al. (2013) found that 32.2% of published functional analyses suggested that problem behavior was maintained by social negative reinforcement in the form of escape or avoidance. For example, Baker, Hanley, & Mathews (2006) administered a functional analysis with an elderly participant diagnosed with dementia. The results indicated that aggression was maintained by contingent escape from the bathroom routine. Harper, Iwata, and Camp (2013) conducted a functional analysis with four participants who engaged in aggressive behavior that was maintained by social negative reinforcement in the form of social demands. For three out of the four participants, the authors conditioned social interaction as a reinforcer and introduced differential reinforcement of an alternative response (DRA; appropriate requests for the removal of an aversive stimulus) with an extinction component. Aggression decreased to socially significant levels for all three participants.

Relatively more recent studies for treating behavior maintained by social negative reinforcement consist of teaching alternative behaviors, utilizing extinction, and increasing other appropriate behaviors while providing reinforcement for the absence of the problem behavior. These studies lend support for Carr’s (1977) hypothesis that negative reinforcement plays a role in the maintenance of SIB and
other problem behavior. For example, some studies taught alternative behaviors to replace problem behavior. Lerman, Kelley, Vorndran, Kuhn, and LaRue (2002) reduced problem behavior by teaching a card touch as an alternative to problem behavior. Harper et al. (2013) assessed and treated social avoidance. Participants were selected for inclusion following a functional analysis that identified social negative reinforcement as the maintaining variable. Differential reinforcement of an alternative behavior (DRA) and extinction reduced problem behavior to zero levels and increased compliance for all three participants. Other studies used escape extinction alone, which involves weakening the contingent relationship between a response and a consequence, to reduce problem behavior. Iwata, Pace, Kalsher, Cowdery, and Cataldo (1990) implemented a treatment package for escape-maintained behavior that included extinction through physical guidance for 5 participants and extinction, physical guidance, and response blocking for one participant. All six participants’ behavior reduced to socially significant levels following the intervention. These studies support the hypothesis that SIB and other topographies of problem behavior can be maintained by escape from aversive stimuli.

The third operant-based hypothesis, self-stimulation, suggested that when stimulation is sufficiently low, an organism may engage in stereotypic behaviors, such as SIB, to reach the desired levels of stimulation (Baumeister & Forehand, 1973; Cain 1961; Cleland & Clark, 1966; Green, 1967; Kulka, Fry, & Goldstein, 1960; Lourie, 1949; Rutter, 1966, p.80; Silberstein, Blackman, & Mandell, 1966).
Several studies demonstrated that isolated, barren environments with very little stimulation (such as restriction to an empty crib or physical restraints) can increase SIB relative to enriched environments (such as availability of toys or objects that provide tactile and/or kinesthetic stimulation). For example, Collins (1965) eliminated headbanging in an adult with disabilities who was typically restrained and isolated by providing sensory stimulation in the form of activities, toys, and a radio. These results appear to be a generalized phenomenon, as non-human animals engage in primal behavior when exposed to similar conditions. For example, Harlow and colleagues (Cross & Harlow, 1965; Harlow & Griffin, 1965; Harlow & Harlow, 1971) observed self-injurious behavior, and other stereotypic behavior, with monkeys that were raised in small cages.

Like socially maintained problem behavior, voluminous research supports the hypothesis that both SIB and multiple other maladaptive responses are often maintained by automatic reinforcement. That is, behaviors maintained by automatic reinforcement produce the stimulation that maintains the response. In a review of the functional analysis literature, Beavers et al. (2013) found that 16.3% of published functional analyses suggested that problem behavior was maintained by automatic reinforcement. For example, Piazza, Adelinis, Hanley, Goh, and Delia (2000) conducted FAs with three participants for aberrant behavior. Results suggested the maintaining variable to be maintained by automatic variables in all cases. Neil and Jones (2016) assessed bruxism, motor stereotypy, and door
closing. Functional analyses for all three responses suggested that the behaviors were maintained at least in part by automatic reinforcement.

Treatment of behavior maintained by automatic reinforcement might consist of extinction (often executed with the use of protective equipment), noncontingent access to preferred stimuli or competing stimuli, or differential reinforcement (e.g., differential reinforcement of other behavior). Roscoe, Iwata, and Zhou’s (2013) research on automatically maintained hand mouthing revealed that noncontingent reinforcement (NCR) was successful for decreasing hand mouthing and increasing object manipulation in six out of seven participants. Noncontingent reinforcement consisted of free access to highly preferred leisure items. Berg et al. (2016) studied the use of NCR and differential reinforcement (DR) with a response cost (RC) for SIB under the control of automatic variables. If participants had differentiated rates of responding in the pairwise assessment of NCR and an alone condition, then NCR was selected for treatment. If the participants did not have differentiated rates of responding, then DR+RC was implemented. Differential reinforcement and response cost reduced the problem behavior for three out of four participants. One participant had differentiated rates of responding in the NCR condition. NCR was implemented as treatment and successfully reduced problem behavior for this participant. The results from Berg et al. suggest the variables affecting stereotypic behavior are idiosyncratic. These studies support the hypothesis that stereotypy can be a result of an impoverished environment.
Carr’s (1977) fourth and fifth non-operant based hypotheses included the organic hypothesis and the psychodynamic hypothesis. The organic hypothesis stated that self-injurious behavior is the product of aberrant physiological processes. Data to support this theory does not include clear procedures, treatment integrity, and/or experimental control. The psychodynamic theory is a group of hypotheses purporting that SIB stems from guilt or trying to distinguish reality. Interestingly, Lovaas et al. (1965) tested the guilt hypothesis by observing the effects on the rate of SIB following statements such as “I don’t think you’re bad”. Data did not support this hypothesis. In fact, when the participant was delivered statements designed to reduce guilt, SIB increased rather than decrease, suggesting that the behavior was likely maintained by social positive reinforcement.

Carr’s (1977) hypotheses on the maintaining variables for problem behavior were first experimentally demonstrated by Iwata et al.’s (1982/1994) seminal study demonstrating the relationship between common environmental conditions (deprivation of attention; presentation of aversive stimuli; a barren environment) and SIB. Functional Analysis (FA; Iwata et al. 1982/1994) is considered the gold-standard for assessment of problem behavior (Hanley, Iwata, & McCord, 2003). Generally, FA procedures involve environmental manipulations to identify the variables that maintain the behavior. Hanley et al. defined FA as “hav(ing) at least two conditions involving manipulation of some environmental variable in attempt to demonstrate a relation between the antecedent events to find a relation between the environment and the behavior”
Following a FA, a treatment program based on function can be implemented to reduce the problem behavior to socially significant levels. In contrast, previous research on the treatment of SIB, before functional analysis, produced mixed findings across treatments such as DRO/DRI, extinction, timeout, and overcorrection, with the only exception being treatments based on punishment, which have been consistently effective in reducing SIB. While punishment-based treatments may reduce responding, it has been recommended to only be used in situations in which other interventions have failed (May et al., 1975). The purpose of Iwata et al.’s study was to identify the conditions that maintained an individual’s SIB and select an effective and efficient treatment to reduce severe injurious behavior and saving the time and resources that have been lost in ineffective treatments.

Iwata et al. (1982/1994) were successful in designing a functional assessment tool that allowed for the proper identification of a treatment plan based on the maintaining variable. Functional analysis sessions for Iwata et al.’s (1982/1994) study took an average of eight days and 30 sessions per participant. A clear pattern of responding dependent on a specific stimulus condition was observed for six out of nine participants, and results were undifferentiated for three participants. The patterns of responding were idiosyncratic, which provided an early indication of FA’s generality. Overall, there was a relatively low level of SIB in the unstructured play condition, suggesting that a rich environment is one potential treatment component in the treatment of SIB. That is, FA showed how
one can determine the function of behavior on an individual level. Researchers did not include treatment data but did state that the results of function-based treatment were very encouraging in cases where self-injury was clearly differentiated (Iwata et al. 1982/1994). These findings lead to a precise and scientifically validated means of treating SIB, without the use of punishment.

The Generality of Functional Analysis

Since the publication of Iwata et al. (1982/1994), voluminous research supports the robust generality of FA procedures. Generality refers to the maintenance of treatment effects across settings, situations, and participants (Baer, Wolf, & Risley, 1968). Beavers et al.’s (2013) review of the FA literature included over 400 published articles in just under 20 journals since 1982. Subjects of the studies were predominantly children (74.9%) and/or developmentally disabled (87.8%). Other demographics included adults (32.6%), those diagnosed with autism (26.9%), and without disability (13.6%). Sessions were conducted in hospitals (41.2%), schools (36.1%), outpatient clinics (12.6%), homes (10.6%), institutions (18.4%), vocational programs (3.4%), and in the community (0.06%). Studies have been conducted across over 11 response topographies (i.e., aggression, pica, disruptions, etc.), with aggression being the most prevalent (43.2% of the studies). Beavers et al. noted that 25.3% of the behaviors published on FAs are typically less frequently observed, such as licking, mouthing, or sniffing objects (Stichter, Sasso, Jolivette, & Carr, 2004), ruminating, vomiting, or gagging (Najdowski et al., 2008), expelling or packing bites of food (Patel,
Piazza, Santana, & Volkert, 2002), spitting (Carter & Wheeler, 2007), hyperventilating (Asmus et al., 2004), disrobing (Kuhn, Hardesty, & Luczynski, 2009), engaging in inappropriate sexual behavior (Fyffe, Kahng, Fittro, & Russel, 2004), nail biting (Woods, et al., 2001), and off task or out-of-seat behavior (Flood & Wilder, 2002). As noted by Hanley, Iwata, & McCord (2003), FA methodology has yet to be applied to behaviors such as cigarette smoking and those associated with mental illness.

Since Beavers et al. (2013), several studies have contributed to the body of literature showing the generality of functional analyses. Researchers furthered the research in the application of FA, such as functional communication training to access rituals (Rispoli, Camargo, Machalicek, Lang, & Sigafoos, 2014), body and object placement (Torres-Viso, Strohmeier, & Zarcone, 2018), physical activity in children (Larson, Normand, Morley, & Miller, 2014), skin picking (Hall, Hustyi, Chui, & Hammond, 2014), and canine stereotypy and compulsive behavior (Hall, Protopopova, & Wynne, 2015). Researchers also focused on training school personnel (Loman & Horner, 2014) and parents (Lingren, et al., 2016). Even with these advancements on application and training, there are still limitations to implementing FA.

**Functional Analysis Limitations**

There exists research that supports the value of FA to create a function-based treatment to reduce problem behavior (e.g., Iwata et al., 1990), but the standard FA’s potential limitations might hinder it from being widely applied in
all environments. Functional Analysis often requires significant training to demonstrate high levels of procedural integrity. Jenkins & DiGennaro Reed (2016) taught 18 undergraduates to conduct functional analyses through behavior skills training (BST) (Shayne & Miltenberger, 2013), specifically evaluating the quantity of rehearsals needed for accurate implementation. While rehearsals were effective in increasing treatment integrity in just one trial, it took supplemental rehearsals to reach criterion, taking an upwards of 40 rehearsals before reaching mastery. A significant amount of the research on training staff to conduct FA does not specify the amount of time the training took (Lambert, Bloom, Clay, Kunnavatana, & Collins, 2014; Philips & Mudford, 2008).

Another limitation is the potential time commitment to conduct a FA. For example, repeated 10-to-15-min sessions can be impractical with respect to time and resources in certain settings such as schools. While training staff to conduct FAs to high procedural integrity can be time-consuming, there have been cases of success of FAs conducted in places previously deemed difficult or impossible. Mueller, Nkosi, and Hine (2011) conducted 90 FAs in the public schools, 61% of which were performed in the classroom, usually where an area was partitioned off to control for external variables. The teacher was selected to act as the therapist if variables allowed (i.e., could take time away from students, behavior wasn’t too dangerous, didn’t require extensive training). Mueller et al.’s large-scale study exemplifies the restrictions imposed on the client and staff in order to successfully conduct a FA.
Another limitation is the potential risk of prolonged exposure to antecedents that occasion problem behavior usually at targeted high rates, which anecdotally can place the client in danger, depending on the topography (Repp, 1994). Sigafoos and Saggers (1995) proposed a variation of the standard FA, called the Trial-Based Functional Analysis (TBFA). This brief model decreases exposure time, and therefore session time and resources. The TBFA is performed in discrete trials, manipulating the antecedent and consequent events to identify contingencies that maintain the target behavior (Bloom, Iwata, Fritz, Roscoe, & Carreau, 2011). Each trial is marked with the occurrence or nonoccurrence of the target behavior, and the session is terminated upon the occurrence of the target behavior. This assessment is conducted in the natural environment and is composed of 2-min sessions, with a 1-min test condition and 1-min control condition within each session. Results of LaRue et al. (2010) supported the efficacy of TBFA, showing high correspondence between TBFA and standard FA results. LaRue et al. showed that TBFA could be conducted in environments that could not easily support the standard functional analysis, such as school settings, yet still demonstrate functional relations between responses and the environment.

With the high need for behavior-based interventions in school settings, researchers have begun to evaluate teacher-implemented FA. Teachers conducting TBFA is a more viable option for the start to treatment of problem behavior in classrooms. A number of studies directly trained teachers to implement the TBFA in the classroom, resulting in high treatment fidelity while performing the TBFA
(Bloom, Lambert, Dayton, & Samaha, 2013; Flynn & Lo, 2016; Rispoli, et al. 2013). These findings warrant further examination of their potential to extend to a telehealth medium for training in order to directly benefit students and teachers in underserved areas and through a cost-efficient platform.

Towards a Brief-FA Telehealth Model

Bloom et al. (2013) and Flynn and Lo (2016) successfully taught teachers to conduct TBFA within their typical classroom sessions. These training models have the capability of reducing cost and resources needed to effectively treat students within the classroom setting. In a relevant, parallel line of research, multiple studies analyzed the effectiveness of training caregivers and staff through telehealth. Wacker et al. (2013) trained 20 parents with no previous experience in Applied Behavior Analysis (ABA) to successfully complete FA. Each parent received 1-to-2 hr of training and the help of a parent assistant who also had no previous experience. Forty-five min of training on Functional Communication Training (FCT) reduced target behaviors across all participants from 50 to 80 percent of baseline levels (Suess, Wacker, Schwartz, Lustig, & Detrick, 2016). Telehealth training and services has the potential to bridge the gap in services, and is also a more cost-effective model, with significantly less overhead than the in-home model (similar to contracting services in school) and most cost-effective when delivered directly from the telehealth hub to the clients (Lingren, et al., 2016). This will make services more accessible to school districts with lower funding.
**Purpose**

The purpose of the proposed study is to evaluate the potential use of telehealth as a delivery system for timely and cost-effective training for teachers to conduct TBFA in the classroom and implement function-based treatments to reduce problem behavior to socially significant levels, potentially bridging the gap for those in areas with limited support.

**General Methods**

**Participants and Settings**

There were two groups of participants in this study: Registered Behavior Technicians (RBT) and clients who exhibit disruptive classroom behavior. None of the RBT had a prior training in FA or TBFA. Following training to conduct the TBFA, the RBT served as the facilitator of the assessment within their classrooms. All RBT’s highest degree earned was a bachelor’s degree. The client participants’ ages ranged from three-to-four years old. Each client met eligibility for inclusion by engaging in a target behavior that was deemed necessary for reduction at least 15 times a week. Continuous data were collected on all target behavior while clients were in session, and the data were then reviewed to ensure they met eligibility for the study. Consultants conducted sessions two-to-three days per week, for up to 3 weeks to complete the TBFA. Training for the TBFA occurred in an early intervention clinic, via telehealth, before or after client sessions.
Response Measurement and Interobserver Agreement (IOA)

**Technician Behaviors.** The technician presented each trial within the functional assessment and recorded data on the provided datasheet. The trial consisted of a control condition and a test condition. Each trial was presented two times within a session. If no problem behavior occurred in the trial (a paired control and test condition), it lasted a total of 4 min with a 60-s break between each trial. Experimenters used a procedural fidelity checklist (“Appendix 1”) to score whether there were any procedural errors during each trial and if each trial and consequence was presented appropriately according to the control or test condition.

**Client Behaviors.** Experimenters also collected client behavior data during the TBFA to determine the maintaining variables of the target behavior. Ethan’s target behavior, elopement, was defined as any instance of moving more than one foot away from the table. Quora’s target behavior, negative vocalizations, was defined as any vocal utterance in the form or crying, screaming, or whining that could be heard from 3ft away and accompanied a negative effect, such as a frown and/or tears. Non-examples were laughing, singing, or crying when hurt. Nova’s target behavior, disruptions, was defined as any instance of climbing on furniture, or attempts such as placing feet or torso on the furniture. Non-examples of disruptions included placing feet on chair while sitting or leaning on table with elbows.
Interobserver agreement (IOA) was calculated for the percentage of steps performed correctly by the technicians and the data collected during the trial-based FA. IOA was calculated by using item-by-item method (Cooper, Heron, & Heward, 2007), which consisted of dividing the number of items with which both observers recorded the same outcome for the item by the total number of items for that session and multiplying by 100% (Flynn & Lo, 2016). Interobserver agreement was collected for 25% to 40% of the sessions. For TBFA sessions agreement across participants for the occurrence of the target behavior was 100%. For treatment integrity the mean agreement across baseline and training was 96.23% (range, 83.32% to 100%).

Materials

A computer with video conferencing technology (i.e., VSee) was used to conduct and record sessions. Each RBT received an explanation of each trial-type based on Bloom et al. (2011), a detailed explanation of the procedures, and a datasheet to collect data on the TBFA trials. The client’s identified reinforcers were placed visibly in their usual locations.

Procedures

All correspondence and training were conducted via Telehealth, an online model for delivering services. Upon enrollment in the study, RBTs were interviewed about the client’s disruptive behavior and briefed on the study’s procedures. The target behaviors were selected by the clients Board Certified
Behavior Analyst (Ethan and Quoara) or by the researcher following observation (Nova).

**TBFA Pretraining - Baseline**

Registered Behavior Technicians were given written procedures to review. This document included materials and trial-specific procedures. They were also given brief descriptions of each test condition (i.e., Demand, Attention, Tangible, Ignore) and the control condition, including enlarged placards (20.3 cm in by 28 cm), placed within view in the classroom for the RBT to reference during the TBFA sessions. The RBT had access to these documents for 24-hrs, then the researcher contacted the RBT to confirm he or she reviewed the procedures before initiating the following procedures. No other training occurred. Trial-based functional analysis sessions were embedded in the regular routine of ongoing instruction. The RBT presented each trial two times during the TBFA sessions. A 2-min control segment preceded every test segment. The test segment lasted 2 min or until the target behavior occurred.

**Attention.** The control segment lasted 2 min and consisted of the availability of a reinforcing activity and attention from the RBT delivered on a 20-s fixed-time schedule. No programmed consequences were delivered for the targeted behavior during the control segment. At the end of the 2-min control segment, the 2-min attention test segment began. When the test segment began, the RBT moved away from the client, withholding all attention. If the client emitted the target behavior, the RBT moved closer to the client and provided a
consoling statement or reprimand. Following the delivery of the consequence, the test segment ended.

**Demand.** The control segment lasted 2 min and consisted of the availability of leisure items, the removal of all work items, and attention from the RBT delivered on a 20-s fixed-time schedule. No programmed consequences were delivered for the targeted problem behavior during the control segment. At the end of the 2-min control segment, the 2-min demand test segment began. When the test segment began, the RBT issued a demand and followed through using a three-step response prompting procedure (i.e., vocal prompt, model prompt, and physical prompt). Any attempts to leave were blocked by the RBT, and prompts continued. If the client emitted the target problem behavior, the RBT removed all work demands and moved away. Following the delivery of the consequence, the test segment ended.

**Tangible.** The control segment lasted 2 min and consist of attention from the RBT delivered on a 20-s fixed-time schedule. No programmed consequences were delivered for the targeted problem behavior during the control segment. At the end of the 2-min control segment, the 2-min tangible test segment began. When the test segment began, the RBT removed preferred items from the client’s reach, but they were kept within view. If the client emitted the target problem behavior, the RBT immediately presented the client with the preferred item(s). Following the delivery of the consequence, the test segment ended. All RBT were trained on the protocol for this test condition, but the tangible condition was only
conducted with the client if there was suspected tangible function. There was a suspected tangible function for two out of three of the clients.

**TBFA Training**

The RBT participated in a one-on-one training session, through video conference, with a certified behavior analyst (i.e., experimenter). This training followed a BST model (Shayne & Miltenberger, 2013). The behavior analyst first reviewed the purpose of conducting a FA, and how to identify the maintaining variable and why it is important for selecting the appropriate intervention when teaching a replacement behavior. Next, the experimenter reviewed the procedures and purpose of each trial. The experimenter then clarified how to collect and interpret data (i.e., comparing test conditions to the control and against each other). The RBT then had the opportunity to practice analyzing data and determining the function independently.

The experimenter used a pre-recorded video to model each trial type and answer any questions the RBT had regarding the conditions. Then, the RBT practiced implementing each trial type with a confederate acting as a client, with immediate feedback provided after each trial. Rehearsal of the test conditions with feedback continued until the RBT conducted all three test conditions and the control condition with 100% accuracy. Following this training, the RBT ran three full TBFA sessions with the confederate student. During this phase all feedback was delivered after the completion of each session.
**TBFA with Feedback.** Once the training was complete, the RBTs began conducting the TBFA with the client during his or her regular classroom routine. The experimenter prompted the RBT to begin and end sessions with a textual prompt, or written cue (MacDuff, Krantz, & McClannahan, 2001), for the corresponding test condition. The textual prompt signaled the start of each condition (i.e., start control, start demand), and controlled on the computer screen by the experimenter. The computer screen was within view of the RBT at all times during the TBFA sessions. Descriptions of each trial type continued to be hung up on the wall, available for the RBT to reference for reminders. Trials were presented in a randomized order and occurred back-to-back, with a 60-s break between trials. If the RBT provided a programmed consequence or if the client independently obtained the possible source of reinforcement being tested during the test condition, the trial was marked unsuccessful and be represented later in the TBFA session. This did not occur during any of the TBFA sessions.

Contingent on the RBT’s procedural integrity falling below 85%, the experimenter provided supplemental opportunities for practice (i.e., verbal explanations, video models, and role-playing) before the next TBFA session. If the RBT’s procedural integrity met or exceeded 85%, they were provided behavior specific praise. Once the RBT met mastery criteria (i.e., five sessions at 85% or above), he or she was provided with an opportunity to review the client’s TBFA graph. Once the TBFA was completed, the RBT compared the percentage
of problem behavior between test and control segments and used that information to determine the function, then receive feedback from the experimenter.

Results

Therapist Treatment Integrity of TBFA. Results of BST training are shown in Figure 1. Treatment integrity of the TBFA protocol was low across all participants during baseline (i.e., 51.75% average for Therapist 1, 56.26% average for Therapist 2, and 54.46% average for Therapist 3). Correct implementation of the protocol increased significantly following BST training and mastery criteria of 85% were met for all three participants when conducting the TBFA with the confederate client (range, 87.9%-100% for Therapist 1, 91.9% to 100% for Therapist 2, 91.66% to 95.83% for Therapist 3). Mastery criteria were also met across all five TBFA-sessions when the therapist conducted the protocol with the client, except for Therapist 3 who only was able to conduct 4 sessions because of the unexpected unavailability of the subject (range, 100% for Therapist 1, 98.43% to 100% for Therapist 2, 85.2% to 100% for Therapist 3).

TBFA Results for Clients. Results of the three TBFA are shown in Figure 2. Ethan’s target behavior did not occur in the demand, attention, or control conditions. One instance of elopement occurred in the tangible condition. These results do not indicate a possible function, due to overall low responding. No failed trials occurred during Ethan’s TBFA.
During Quora’s TBFA the target behavior occurred at elevated levels in the demand and tangible conditions. The target behavior was not observed during the attention or control conditions. These results indicate that the target behavior is multiply controlled by social negative reinforcement (escape) and social-positive reinforcement (access to tangibles). No failed trials occurred during Quora’s TBFA.

Nova’s target behavior occurred during the tangible and the control condition. The target behavior did not occur when exposed to the demand or attention conditions. Following two TBFA sessions without the occurrence of the target behavior, a tangible condition was added. Two more TBFA sessions were conducted before the variables maintaining the target behavior could be identified. One failed trial occurred during Nova’s TBFA due to the client’s toilet training protocol, the trial was represented later in the clinical session.

Discussion

This study evaluated the effectiveness of a training package for brief functional analysis when delivered via telehealth. Results of this study indicated that therapists can be adequately trained to conduct TBFA through teleconferencing technology. We observed an increase in correct protocol implementation as a function of the training. These results suggest that a telehealth model for training practitioners to conduct functional analyses is comparable to in-vivo delivery (Flynn & Lo, 2016).
Based on the data for all three participants, modeling and feedback was an integral component of the training package. RBT averaged 54.14% correct procedural integrity when provided written explanations or visual cues on how to conduct the procedures. Proper implementation of the protocol increased following the addition of the training protocol. We hypothesize the low occurrence of target behavior was due to a clinician implementing escape extinction, according to clinical protocol, shortly before starting the TBFA sessions.

The total training time for the experimenter to train the participants, including the didactic portion of training explaining why functional analyses are beneficial and how to read TBFA graphs, was only 1-hr. Thus, the tele-health based training was both effective and practical. Low-resource training packages are essential not only for training in settings like schools but also for training practitioners on all levels in the field of behavior analysis. There is a shortage of behavior analysts who have proper training and supervision needed to conduct functional analyses ethically.

Researchers (Bloom, Lambert, Dayton, & Samaha, 2013; Flynn & Lo, 2016) have validated the effectiveness of training teachers to conduct TBFA within the classroom. This model of training via telehealth could potentially bridge the gap for accessible services in areas with limited resources and reduce the overhead cost of job responsibilities such as transportation to clientele. With a
reduction in time traveling between clients, the number of clients seen in a day could also increase.

In the current study, we assessed the extent to which a telehealth-based platform could produce accurate implementation of assessment procedures. However, one limitation of this study is that we did include training for a subsequent treatment protocol. Future research should continue to evaluate the extent to which the telehealth platform might be useful for training staff to conduct treatment protocols before bringing a telehealth model to novel environments such as the school setting. Also, while all communication concerning training for this study occurred via teleconferencing software, the experimenter and the participants were located in the same building. During this study, one baseline had to be canceled, and one training session was delayed due to software or internet malfunction. With an increase in the distance, there is a possibility for an increase in technical difficulties.

Another limitation of this study is that Participant 1 did not get as many opportunities to implement the relevant consequences of the protocol due to lack of occurrences of the target behavior. That is, the therapist generally should have multiple opportunities to engage in incorrect and incorrect protocol implementation behaviors during both the antecedent and consequences portions of the test and control conditions, and that was not the case for Participant 1. If subjects do not engage in problem behavior, the extent to which a therapist’s treatment integrity may be evaluated is limited to arranging the antecedent
conditions, and then the extent to which the therapist does not exclusively make
errors of commission during the consequence portion of the session. That is,
during both antecedent and consequence portions of the conditions, therapists may
correctly engage in specific behaviors, correctly not engage in specific behaviors,
incorrectly engage in specific behaviors (error of commission; do something that
was not supposed to be done), or incorrectly not engage in specific behaviors
(error of omission; not engage in something that should have been done). We did
not have the opportunity to evaluate the full range of potential treatment integrity
for Participant 1. Finally, Participant 3 was not able to finish conducting the
TBFA due to the unexpected absence of the subject. However, the majority of
sessions (all except 1 session) were implemented. Thus, we did have the
opportunity to evaluate the majority of the relevant conditions with Participant 3,
despite not having finished the entire protocol.

Environmental confounds that we encountered were the placement of the
camera in relation to the client. If the client was free to move, they occasionally
left the view of the camera. The therapists were prompted to move the camera
when appropriate, but depending on the environment and set up, this might not be
possible. Intermittently, there were malfunctions with sound or video streaming. It
was helpful for the experimenter and technician to keep another route of
communication readily available (i.e., cell phone) to navigate these issues. A
teacher might not be able to stop her classroom sessions from dealing with these
types of problems, so having an aide in the classroom would be helpful, and a
plan on how to deal with these issues when they come up. It was important that both computers used for communication have the screen saver option on the laptop turned off. These confounds have the potential to interrupt and delay effective delivery of services, but with a proper plan can be mitigated.

Future research can continue to evaluate the boundaries for the use of telehealth in clinical situations. For instance, researchers might evaluate the use of video-conferencing software in the classroom to train teachers to conduct TBFA. The generality of this system to a group setting is unknown. Researchers should also study training practitioners or teachers via telehealth to conduct function-based treatments and determine what materials are needed for the most efficient training package.

In summary, the results from this research support the use of a telehealth model for training bachelor’s level practitioners to conduct trial-based functional analysis. This could increase the amount of function-based treatment in environments with limited or no training and resources.
References


*American Journal of Mental Deficiency*, 852-856.


Figure 1: This figure shows the baseline, and training data for conducting a TBFA with procedural integrity.
Figure 2: Figure 2 shows the results of the TBFA with each client.
**Figure 3**: Integrity checklist adapted from Flynn and Lo (2016).