Evaluation of a Self-Instructional Manual to Teach Functional Analysis to Assess Problem Behaviours for Persons with Developmental Disabilities

by

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Abstract

Functional analysis is an experimental method used to assess the environmental causes of behaviour by systematically manipulating the antecedents and consequences for that behaviour and observing their effects on the behaviour. The number of published studies on function analysis has increased as well as the number of studies that aimed to teach this procedure. This study aimed to evaluate the efficacy of a self-instructional manual on teaching university students and staff who work with people with developmental disabilities to conduct functional analysis as described by Iwata et al. (1982/1994). Specifically, I compared the effectiveness of a self-instructional manual to a procedural description of functional analysis described in the method section of the above paper. In Experiment 1, the self-instructional manual was evaluated using a concurrent multiple probe design across groups of three and two participants, totaling 11 participants. Participants received the method description during baseline, self-instructional manual during the intervention, and video modeling (for some participants) after the manual. Simulated assessments were conducted after each phase and a retention/generalization assessment was conducted after 1 to 4 weeks. Overall, mean correct performance across participants and conditions during simulated assessments were 73% after studying the method description, 92% after the self-instructional manual, and 94% correct after video modeling. Retention and generalization assessments (2 simulated and 7 client assessments) averaged 80% correct. In Experiment 2, the manual was modified based on the errors made in Experiment 1 and its efficacy was evaluated using a concurrent multiple probe design across two participants, and a concurrent multiple probe design across functional analysis conditions replicated across five participants. Overall, mean correct performance across participants and conditions during simulated assessments were 58% after studying the method description, 88% after the self-instructional manual, and 95% correct after video modeling. Retention and generalization assessments (2 simulated and 7 client assessments) averaged 91% correct. The results suggest that the self-instructional manual shows promise and further research is warranted.

Keywords: Functional analysis, self-instructional manual, behavioural assessment

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Introduction

The field of applied behaviour analysis (ABA) involves the application of learning-based principles derived from basic research (Skinner, 1938) to solving socially important problems (Baer, Wolf, & Risley, 1968). Over the last four decades, the field has provided major advancements in many areas such as education, organizational management, sports, and mental health, to name a few (Martin & Pear, 2015). ABA research in the habilitation of persons with developmental disabilities has had a particularly long history because this has been an area of interest since the field's inception in the 1960s.

Developmental disability has been offered as an alternative term (Warren, 2000), which is "a disability to a mental or physical impairment, manifested before 22 years of age, likely to continue indefinitely, resulting in substantial limitation in three or more specified areas of functioning and requiring specific and life long or extended care" (Developmental Disabilities Bill of Rights Act, Public Law 95-682, 1978). Thus, developmental disability is a broader term that includes individuals who may not have an intellectual disability, such as a person with autism spectrum disorder.

A major area of concern in people with developmental disabilities is the prevalence of problem behaviours (e.g., tantrums, self-injury, aggressive behaviours). Prevalence of problem behaviours in persons with developmental disabilities have ranged from 10-20% (McClintock et al. 2003) to as high as 64% (Murphy, Healy, & Leader, 2009), and prevalence in children with autism spectrum disorders has been reported to be as high as 94% (Matson, Wilkins, & Macken, 2009). Problem behaviours may interfere with learning, result in the removal of the individual from educational environments, preclude the individual from participating in community activities, and result in physical harm to the individual and others. Dealing with problem behaviours also presents significant stress for staff and it is a major cause of staff burn out (Mitchell & Hastings, 2001). Thus, considerable research has been conducted on developing effective assessment and intervention strategies to reduce or eliminate problem behaviours (Mace & Knight, 1986; Horner & O'Neill, 1994; Richman, Wacker, Asmus, & Casey, 1998; Johnson, McComas, Thompson, & Symons, 2004; Kodak, Grow, & Northup, 2004).

A major advancement in behavioural assessment methodology occurred in the early 1980s with the development of *functional analysis* (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994). Functional analysis represents an important advance because its results lead directly to the selection and design of interventions to reduce problem behaviours. Considerable research has supported the effectiveness of functional analysis since its development. To date, knowledge and application of functional analysis are among the required skills for board certification as a behaviour analyst (Behaviour Analyst Certification Board, 2005). Therefore, research on effective strategies to teach this skill to students and service providers working with people with developmental disabilities and/or autism would be extremely worthwhile.

The purpose of my research was to evaluate the effectiveness of using a self-instructional manual (Saltel & Yu, 2012) to teach functional analysis to students and staff. In the following sections, I will define functional assessment, discuss the roles of antecedents and consequences in maintaining behaviours, differentiate descriptive assessments from functional analysis, explain the functional analysis methodology and describe the advantages of functional analysis over descriptive assessments. Next, I will review research on functional analysis and on training staff to conduct functional analysis. I will then describe the methodology, and present and discuss the results of my research.

Functional Assessment

Functional assessment refers to a set of procedures that could be used to identify the environmental causes of behaviours (Horner, 1994; Gresham, Watson, & Skinner, 2001; Mace 1994; Iwata et al., 1982/1994; Martin & Pear, 2015). There are three general ways to conduct a functional assessment: (1) indirect assessment, which involves collecting information through reviewing historical/archival records, and completing checklists and rating scales through interviews with informants; (2) direct descriptive assessment, which refers to systematic observations of the relation between antecedent, behaviour, and consequence in natural settings; and (3) experimental assessment, also known as functional analysis, which consists of manipulating antecedents and consequences systematically to evaluate the potential environmental causes for behaviour. The main difference between indirect and direct functional assessments and functional analysis is that the first two assess the correlation between the antecedent, behaviour, and consequence, whereas functional analysis is an experimental approach that investigates the causal relation between the problem behaviour and its controlling or maintaining variables (Horner, 1994; Gresham et. al., 2001; Mace, 1994; Martin & Pear, 2015).

Functional assessment is based on the fundamental assumption that behaviours, be they desirable or undesirable, are learned, and that antecedents and consequences for behaviours play important roles in the behaviours' development and maintenance. Therefore, an understanding of these roles is needed in order to understand the rationale of functional assessment. Below, I first review the roles of antecedents and consequences in maintaining behaviours to provide the rationale for functional assessment. I then review each assessment procedure and compare their advantages and disadvantages.

Role of Consequences in Developing and Maintaining Behaviours

Consequences are environmental stimuli or events that immediately follow the occurrence of a behaviour, and some consequences may increase or strengthen the preceding behaviour (a *reinforcing* effect) while others may decrease or weaken the preceding behaviour (a *punishing* effect). In the process of reinforcement, a behaviour is followed by a stimulus or event that results in the strengthening of that behaviour in the future. In the process of punishment, a behaviour is followed by a stimulus or event that results in the decrease or weakening of that behaviour in the future. In the case of problem behaviours, we are more likely to be interested in identifying the reinforcing consequences that maintain the behaviour. Therefore, this section will focus only on the reinforcement processes.

Positive reinforcement. There are two types of reinforcement processes (positive and negative) and they both have a strengthening effect on behaviour. Positive reinforcement involves *presenting* a stimulus following a behaviour and it has the effect of increasing or strengthening that behaviour in future similar situations (reinforcing effect) (Martin & Pear, 2015). For example, while in a grocery store, if a child asks "may I have a candy?" and the parent buys the child a candy, the behaviour of asking politely for a candy will likely *increase* in future similar situations (e.g., next time the child is in a grocery store with the parent). If instead of asking politely, the child whines "I want a candy" and the parent buys the child a candy, the behaviour of whining for a candy will likely increase in future similar situations. Both examples involve *positive reinforcement* in that the consequence (receiving a candy) is *presented* following the behaviour, and that the behaviour is strengthened (reinforced) in each case. The examples also illustrate that the process of positive reinforcement will strengthen a behaviour regardless of its desirability.

Negative reinforcement. Negative reinforcement involves *removing* or *terminating* a stimulus (an unpleasant or aversive stimulus) following a behaviour, and it has the effect of strengthening that behaviour in future similar situations (reinforcing effect) (Martin and Pear, 2015). For example, after being told to stop playing and put away his toys (an unpleasant stimulus for the child), the child asks his parent, "may I play for 5 more minutes?" and the parent agrees. The behaviour of asking politely for more playtime will likely increase in future similar situations (when the child is asked to stop playing with his toys). If instead of asking politely, the child screams "No!" and throws his toys, and the parents say "Okay, you can play for a while longer", the behaviours of screaming and throwing toys will likely increase in future similar situations. Both examples involve *negative reinforcement* in that the consequence involves *removing* or *terminating* (or at least postponing) the parent's request to stop playing (an unpleasant stimulus for the child) and the behaviours (asking politely for more playtime or screaming and throwing toys) are strengthened or reinforced in each case. Again, the examples illustrate that the process of negative reinforcement will strengthen a behaviour regardless of its desirability. The process of negative reinforcement has also been referred to as *escape* conditioning in that the child has "escaped" from the parent's demand to stop playing by emitting a specific response.

Positive and negative reinforcement, therefore, could play crucial roles in establishing and maintaining behaviours, desirable or not. Once a behaviour has been strengthened, it may continue to occur even if it is reinforced only occasionally (e.g., the child receives a candy during some, but not all grocery store visits). Moreover, a behaviour that is reinforced only occasionally will likely increase in both frequency and intensity. Thus, an undesirable behaviour can be strengthened inadvertently through positive or negative reinforcement as illustrated in the above examples and the behaviour can become extremely persistent or more intense through intermittent reinforcement (Martin & Pear, 2015).

Role of Antecedents in Maintaining Behaviours

Antecedents refer to the environmental stimuli or events that immediately precede or are present during the occurrence of a behaviour. Through the process of positive or negative reinforcement, not only is the behaviour strengthened by the consequence, the antecedent correlated with reinforcement will likely become a *discriminative stimulus* (defined as a stimulus in whose presence a particular behaviour has been reinforced). Given a history of reinforcement, the presence of a discriminative stimulus may be sufficient to evoke the previously strengthened behaviour. In the grocery store examples above, if the setting has become a discriminative stimulus, the sight of the grocery store or walking into the grocery store will evoke the behaviour of asking or whining for a candy. Similarly, if the parent's demand to stop playing and put away the toys has become a discriminative stimulus, it will evoke the behaviour of asking for more time or screaming and throwing toys. Therefore, the antecedent stimuli also play an important role in maintaining an established behaviour.

Antecedents can also function as motivating operations (MO) which can be defined as an operation, environmental event, or stimulus condition that momentarily (a) alters the value and effectiveness of a reinforcer or punisher, and (b) alters the likelihood of occurrence of a response class related to those consequences (Michael, 1982; Michael, 1993). Some studies have investigated the role of these types of antecedents when conducting functional analysis assessment (Harding, Wacker, Berg, Wendy, Barretto, & Ringdahl, 2005; Call, Wacker, Ringdahl, & Boelter, 2005). Other studies have investigated the role of antecedents in decreasing the frequency of problem behaviours (McComas, Hoch, Paone, & El-Roy, 2000; McComas, Thompson, & Johnson, 2003).

Indirect Assessment

Indirect assessments consist of gathering information about behaviours through methods other than direct observation (Gresham et al., 2001; Tarbox et al., 2009). Indirect assessment methods may involve interviews with informants (e.g., staff and caregivers), review of historical records, and use of behaviour ratings/checklists. Behaviour ratings are usually questionnaires. In a rating checklist the behaviour is analyzed according to a set of selected functions (e.g., escape from demand, attention seeking, and automatic reinforcement) and it can be ranked as: 3 = “often”, 2 = “sometimes”, 1 = “rarely”, and 0 = “never”. The category that presents the higher score represents the function that the behaviour is serving (Tarbox et al, 2009).

Tarbox et al. (2009) compared the effectiveness of indirect and functional analysis assessments in finding the function of problem behaviour for seven children with autism. The indirect assessment used in this study was a questionnaire administered to the children caregivers. The authors found that the indirect and experimental assessment were in exact agreement (suggesting the same functions) for only three out of seven children and were in partial agreement (suggesting at least one of the same function) for six out of seven children.

The main advantage of indirect assessment is that it can be completed relatively quickly. It allows the behaviour therapist to define the behaviour, identify potential antecedents and consequences related to the behaviour, formulate a hypothesis of the function of the behaviour, and to identify a potential alternative behaviour that will produce the same consequence

(Gresham et al., 2001; Tarbox et al., 2009). The disadvantage of indirect assessment is that it is less reliable than direct observation since it relies on third-party informants.

Direct Descriptive Assessment

A direct descriptive assessment consists of observing the behaviour in question in the natural environment and recording the antecedents that preceded the behaviour and consequences that followed the behaviour (Gresham et al., 2001; Tarbox et al., 2009). Emphasis is placed on the importance of recording measurable properties of the behaviour such as frequency and duration (Gresham et al., 2001). If a consistent relation between the behaviour and its antecedents and consequences is detected, the results could allow the behaviour therapist to infer the function of the behaviour.

In their study, Tarbox et al. (2009) compared the effectiveness of direct descriptive assessments with functional analysis. The authors found that direct descriptive assessment agreed with functional analysis for only one out of seven children. Thompson and Iwata (2007) also compared descriptive assessments and functional analysis to identify the functions of problem behaviours. They found that descriptive assessments corresponded to the results of functional analysis for only three out of 12 participants.

An advantage of direct descriptive assessments over indirect assessments is that the assessor observes the antecedents, target behaviours and their consequences in the natural environment (Tarbox et al., 2009). However, direct descriptive assessment is more time consuming than indirect assessments and it may not be practical especially for problem behaviours that occur at a low frequency. Moreover, like indirect assessment, descriptive assessment has been shown to be less reliable than functional analysis (Tarbox et al., 2009).

Functional Analysis

Functional analysis is an experimental method to assess the environmental causes of a behaviour by systematically manipulating the antecedents and consequences for that behaviour and observing their effects on the behaviour (Horner, 1994; Gresham et. al., 2001). The antecedent and consequence manipulations may vary based upon the target behaviour and hypothesized behaviour-environment relations. Four typical manipulations or conditions, called Alone, Attention, Demand, and Play, are described below.

Alone. The purpose of the Alone condition is to assess whether the problem behaviour is maintained by positive reinforcement in the form of sensory stimulation produced by the problem behaviour itself (Iwata et al., 1982/1994). These behaviours often appear as repetitive motor behaviours (e.g., body rocking, hand flapping, eye poking) and/or vocal behaviours (e.g., making the same sounds or words) that serve no apparent function. Repetitive behaviours, also called stereotypic behaviours, could be reinforced and maintained by the sensory stimulation produced by the behaviours themselves as opposed to receiving reinforcement from other people. This type of reinforcement is also called *automatic* reinforcement in that the reinforcing consequence is not mediated by another person (Vaughan & Michael, 1982).

During the Alone condition, the individual is placed in a room alone without any toys or materials, observed through a two-way mirror, and each occurrence of the problem behaviour is recorded. If a therapist needs to be present in the room (e.g., for observation purposes), he/she does not interact with the individual and thereby removing any possible social consequence that might follow the target behaviour. In this case, the alone condition is called "ignore" because the experimenter is present in the same room but is ignoring all of the client's behaviours (Lambert, Bloom, Clay, Kunnavatana, Collins, 2014).

Attention. The purpose of the Attention condition is to assess whether the problem behaviour is maintained by positive reinforcement in the form of social attention (Iwata et al., 1982/1994). During this condition, the individual is placed in a room with some toys/leisure materials and the individual is free to engage in the leisure activities. An adult will interact with the individual immediately following each instance of the problem behaviour, for example, by saying "Please stop that; you may hurt yourself". The statement may be accompanied by briefly blocking the individual from further engaging in the problem behaviour. All other behaviours, appropriate or not, are ignored by the adult.

Demand. The purpose of the Demand condition is to assess whether the problem behaviour is maintained by negative reinforcement in the form of escaping from demands (Iwata et al., 1982/1994). During this condition, the individual is placed in a room with academic materials or learning tasks, the assessor will give instructions for the individual to complete a task (e.g., matching objects or printing letters). An adult will stop and postpone an instruction immediately following each occurrence of the problem behaviour. For example, upon the occurrence of the target behaviour, the adult will remove the task materials from the table, and avoid any kind of interaction with the child for 30 s. After this interval, the adult will reintroduce the instruction. In this condition, the individual will receive social reinforcement (i.e., praise) upon completion of each task.

Play (control). The Play condition serves as a “control” condition. During this condition, the individual is placed in a room with preferred toys/activities and is free to play or engage in leisure activities. The adult praises the individual (e.g., for playing appropriately) every 30 s if no target behaviour occurs. No consequence (i.e., approval or disapproval) is provided following the problem behaviour and no instructions or demands are issued throughout the condition.

Presentation of the conditions and evaluation. The conditions are usually presented in a random order, with each condition lasting at least five minutes (Wallace & Iwata, 1999). Since the initiation of the present study, there is some evidence to suggest that differential responding between conditions is more likely to occur when the conditions are presented in a fixed order (alone, attention, play, and demand) compared to a random order (Hammond, Iwata, Rooker, Fritz, & Bloom, 2013). The sessions are repeated until a clear function is identified, or until stability is reached, or after 20 sessions in total without identifying a clear function. To determine whether one or more conditions are responsible for maintaining the problem behaviour, the rate of occurrence of the target behaviour per minute during each session is computed and plotted for all conditions. For example, if the target behaviour is maintained by automatic reinforcement and not by attention or escape from demand, we might expect its rate of occurrence during the *Alone* condition to be higher than in the other conditions. If the problem behaviour is maintained by social attention and not by other conditions, we might expect its rate of occurrence during the Attention condition to be higher than in all other conditions. If the problem behaviour is maintained by escaping from demand and not by other conditions, we might expect its rate of occurrence during the Demand condition to be higher than in other conditions.

Sometimes, a target behaviour may be maintained by more than one variable. For example, we may see higher rates of occurrence during attention and demand conditions relative to the other conditions. Technically, although the behaviours observed during the Attention and

Demand conditions may appear the same (topographically similar), they are functionally different in that one is maintained by attention and the other, by escape from demand.

Lastly, no clear conclusion about a specific maintaining variable can be drawn if the rates of the problem behaviour are undifferentiated from the Play condition. In this case, additional assessment with different conditions (manipulations) will be needed. The conditions identified above represent the most common types of reinforcement, it is possible that a problem behaviour may be maintained by other types of consequences (e.g., positive reinforcement involving a tangible item).

Advantages and limitations of functional analysis. The advantage of functional analysis over indirect and descriptive methods is that by controlling specific antecedents and consequences related to the target behaviour, one can determine the behaviour's function experimentally with much higher confidence (Gresham et al., 2001). This experimental assessment of the behaviour's function has led to the development of highly effective interventions for decreasing problem behaviours and teaching more appropriate alternative behaviours (Mace and Knight,1986; Day, Horner, and O'Neill,1994; Vollmer, Northup, Ringdahl, LeBlanc, & Chauvin, 1996; Broussard and Northup, 1997).

Although most studies have investigated the efficacy of functional analysis assessment in school or residential settings, this assessment can be suitable in a variety of settings. For example, functional analysis has been found to be a useful tool to assess problem behaviours in outpatient clinic services by using telehealth technology (Wacker, et al., 1994; Wacker et al., 2013; Lee et al., 2015).

Another advantage of functional analysis assessment is that it can be used with any population. Although the majority of the studies have used this procedure with children with developmental disabilities, some studies have expanded the applicability of the functional analysis assessment to other populations such as children with brain injury (Moore, Gilles, McComas, & Symons, 2010).

Functional analysis also has some limitations. It can be lengthy and requires a person with expertise to conduct it accurately (Gresham et. al. 2001; Iwata et al., 2000). This limitation has been addressed by the development of brief functional analysis, which consists of fewer and shorter sessions (Northup et al., 1991). Another issue relates to the fact that the data are analyzed via visual inspection. Although visual inspection has been the primary technique used in single-subject research designs, sometimes even trained experimenters might not agree with the conclusion drawn from a given set of data. Hagopian et al. (1997) addressed this limitation by developing more objective criteria on how to interpret stability, trend and magnitude of effects when analyzing functional analysis data.

As mentioned above, functional analysis can be time consuming. Wallace and Iwata (1999) tried to address this limitation by evaluating retrospectively whether shorter exposures would produce similar results to longer exposures to functional analysis conditions. The authors used data from 46 clients who were referred for functional assessment due to self-injurious and aggressive behaviours. The procedure consisted of using the data (1) from the full 15-minute sessions, (2) from the first 10 min of each session, and (3) from the first 5 minutes of each session. Experienced raters blinded to the session duration were asked to identify the function of the target behaviour based on the data. The authors found that 10-minute and 15-minute sessions produced 100% of agreement and that 5-minute and 15-minute session produced 93% agreement (3 disagreements out of 46). The authors recommended that 5-minute sessions might be acceptable because it represented a significant reduction in session time with minimal loss of in the power of the assessment. Since the study is retrospective and all participants had been exposed to 15-minute sessions, a limitation is that it is not known whether exposure beyond 5 or 10 minutes could have influenced the response rate during the first 5 or 10 minutes in the next session or subsequent sessions.

Considerable research on functional analysis methodology has taken place since its introduction (Iwata et al., 1982/1994). Hanley, Iwata, and McCord (2003) reviewed studies that employed the functional analysis technology as a pre-treatment for problem behaviours. They included 277 empirical studies in which a functional analysis was conducted with at least two conditions. The majority of the studies involved children with a developmental disability. Hanley et al. (2003) found that self-injury was the most common target behaviour, found in 64.4% of the studies reviewed. This was followed by aggressive behaviours (40.8%), disruptive behaviours (19.1%), vocalizations (12.6%), property destruction (10.5%), stereotypic behaviours (9%), noncompliance and tantrums (3.6%), elopement (2.9%), and pica (ingesting non-edible items, 2.5%), respectively. In terms of functional analysis conditions, Hanley et al. (2003) found that social-negative reinforcement (i.e., escape from demand) was the most frequently assessed with 89.2%, followed by social-positive reinforcement and attention (85.6% and 82.7%, respectively), automatic reinforcement (59.6%), and tangible reinforcement (34.7%).

Beavers, Iwata, and Lerman (2013) extended the findings from Hanley et al. (2003) by reviewing studies that employed functional analysis technology from 2001 to 2013. They added 158 studies to the 277 found by Hanley et al. (2003). The majority of the studies still involved children with a developmental disability. However, they observed an increase on studies with individuals without developmental disabilities (from 9% in Hanley et al. to 21.5%). Different from Hanley et al. (2003), the most common target behaviour was aggression (47.5%), followed by vocalizations (39.9%), self-injury (37.3), property destruction (36.7%), disruption (26.6%), elopement (11.4%), non-compliance (8.2%), stereotypy and tantrums (7.6%), and pica (3.8%). In regards to functional analysis conditions, Beavers et al. (2013) found that the most assessed conditions were social positive reinforcement (94.3%), attention (92.4%), and social negative reinforcement (i.e., escape from demand – 91.8%), followed by tangible (50.6%), and automatic reinforcement (49.4%).

Research on Training Individuals to Conduct Functional Analysis

McCahill, Healy, Lydon, and Ramey (2014) evaluated 25 studies that reported training strategies to teach school staff to conduct Functional Assessment. The majority of the studies involved teachers, their experience and education levels varied and none of them had conducted a functional analysis before training. Twenty-one of the 25 studies used a variation of the functional analysis assessment, 15 of these 21 studies used the traditional functional analysis or the brief functional analysis. The remaining four studies taught some variation between indirect and direct behaviour assessments. The studies that aimed to teach functional analysis to school staff used a combination of the following methods: written protocols (n = 6), personal reading (n = 1), instructor feedback (n = 7), role play (n = 8), and modeling, video modeling and in vivo coaching (n = 4). McCahill et al. reported that modeling was found to be the most effective training component, and instruction and rehearsal were partially effective. The review below will focus on studies that evaluated the efficacy of written protocols and/or video modeling in training staff and students to conduct traditional or brief functional analysis.

Two studies that used written protocols and different types of modeling procedures to teach the analog or brief functional analysis (Shumate & Wills, 2010; Radstaake et al., 2013) did not present what the written instruction or video modeling procedure contained. One study that used modeling (Rispoli, Davis, Goodwin, & Camargo, 2013) focused on teaching trial-based functional analysis.

Iwata et al. (2000) investigated the effects of a training program design to teach students in an applied behaviour analysis laboratory course how to conduct functional analysis. The design used was a multiple-baseline design across participants. The participants were 11 students who had no experience in conducting functional analysis. Participants were taught to conduct the attention, demand, and play conditions. The alone condition was not trained because it did not required the presence of a therapist. During the baseline condition, participants were given the method section of the paper by Iwata et al. (1982/1994). Afterwards, participants were asked to conduct a functional analysis with a simulated client. During training, all 11 participants were instructed as a group on how to deliver the antecedents and consequences for the problem behaviours. Participants were given written procedures describing the purpose of the conditions, target behaviours, and how to conduct a functional analysis session. A graduate student reviewed the key components of each condition and showed a videotape simulation of each condition. After viewing the videotape, the participants took a 20-item written quiz about the assessment. The results, in group average, showed that the participants' performance accuracy during the simulated assessments improved from approximately 70% correct during baseline to above 95% accuracy after training, requiring an average of two hours. A limitation of this study is that no assessment was conducted with a client following training.

Moore et al. (2002) taught three teachers to conduct two functional analysis conditions (attention and demand) also in a multiple-baseline design across participants. The teachers had no prior experience in applied behaviour analysis. During baseline, teachers were given written information about the functional analysis conditions and were required to answer questions about the written material. After the teachers had answered all questions with 100% accuracy, they conducted a functional analysis session with a simulated client. No feedback was provided during the session. The teacher's baseline performance was generally low, ranging from 0% to 60% correct. During training, each participant was provided with feedback on their baseline performance. Next, the experimenter modeled the procedures for the attention and demand conditions. The teachers then conducted another functional analysis with a simulated client in the attention and demand conditions, and they were provided with direct feedback on their performance. Following training, the teachers' performance during the simulated assessments exceeded 95% accuracy.

The last phase of the study consisted of conducting a functional analysis in the classroom with students for whom the teachers had previously referred for problem behaviours (yelling). During this phase, the teachers continued to receive feedback on their performance after conducting the attention and demand conditions with their students. During the assessments in the classroom, the teachers' performance were above 80% accuracy. This study extended the Iwata et al. (2000) study by showing that teachers could learn to conduct functional analysis accurately with appropriate training, and that their performance also generalized to the natural environment (in their classrooms) and with students who exhibited problem behaviours. However, this study has several limitations. First, feedback was provided during the functional analysis conducted with students in the classroom following training. Thus, the teachers' performance during this phase was not a pure measure of generalization. Second, teachers were not taught to conduct a control condition (i.e., play). Third, no information was provided on the extensiveness of the written instruction or on the questions, making replication difficult. Lastly, the amount of training time required was not reported, making it difficult to compare training efficiency with other training studies.

Wallace, Doney, Mintz-Resudek, and Tarbox (2004) used a workshop training format to teach two teachers and one psychologist to conduct functional analysis. The participants had no previous experience on conducting functional analysis. A multiple-baseline across participants design was used to evaluate the effectiveness of the workshop. During baseline, the participants were given the method section of Iwata et al. (1982/1994) to read and were then required to conduct a simulated assessment with actors for attention, demand, and play conditions. All participants scored below 50% correct during the simulated assessment.

After baseline, all participants attended a 3-hour workshop. This workshop consisted of providing a description and purpose, videotape demonstration, and simulated assessment conducted by participants, role playing with each other. A feedback phase was introduced if the participant failed to score above 90% accuracy during the simulated assessment condition. In this case, the participants would receive immediate feedback on their performance and repeated the simulated assessment. After participation in the workshop, all participants scored above 96% correct during simulated assessments.

One participant was exposed to a generalization probe 12 weeks after the workshop. The generalization probe consisted of conducting the functional assessment in a classroom with a child who was engaging in moderate levels of head hitting. Sessions were five minutes long and the teacher demonstrated maintenance of the skills taught in the workshop at above 96 % accuracy. Although generalization was assessed with only one participant, this study provided independent replication that individuals with no or minimal experience in behaviour analysis could be taught to conduct a functional analysis.

Bessete and Wills (2007) evaluated the efficacy of brief written materials on teaching a paraprofessional to conduct Attention, Demand, and Play functional analysis conditions. The paraprofessional had no previous experience with functional analysis assessment. A multi-element design was used to evaluate the efficacy of the written material. The written material consisted of three units (one per condition), which included the rationale/goal of the condition, definitions of target and non-target behaviours, and brief guidelines on how to provide antecedents and consequences for the student's behaviours. The functional analysis sessions were conducted with the participant's student who was engaging in the target problem behaviour. The participant also received some *in vivo* coaching during the sessions. The participant's average accuracy in conducting the functional analysis conditions was 91.6%, 94.9%, and 99.6% in the Attention, Demand, and Play conditions, respectively. No generalization probes were planned in this study. The authors found that their written material was effective in teaching a paraprofessional to conduct functional analysis assessment. However, their study has some limitations: (1) there was no baseline data; (2) they only had one participant; and (3) there was no generalization probe.

Moore and Fisher (2007) assessed the efficacy of video modeling in teaching staff to conduct functional analysis assessment. More specifically, they compared the effects of complete versus partial video modeling. The participants were three staff who had their BA in Psychology and had no experience in conducting functional analysis. They were taught to conduct the Attention, Demand, and Play conditions. The authors found that during baseline, all participants' accuracy was low. The lecture training and partial video modeling produced an improvement in performance; however, this improvement did not reach the mastery criterion of 80% correct. The complete video modeling produced a clear improvement in performance with the participants reaching the mastery criterion in eight out of nine sessions. All participants maintained their performance during the generalization probes. The result suggests that the complete video modeling training was effective in teaching staff to learn to conduct functional analysis assessment and in promoting generalization to clients.

Pence, St. Peter, and Giles (2014) evaluated the efficacy of pyramidal training to teach functional analysis. The authors defined pyramidal training as experienced professionals training staff who will train other staff. Six teachers were the trainers and another six teachers were the trainees. The trainers participated in a workshop about functional analysis and conducted role plays with immediate feedback from a behaviour analyst. A multiple-baseline across participants design was used to evaluate the efficacy of the pyramidal training.

During baseline, the trainees received some reading material, which consisted of studies such as Iwata et al. (1982/1994) on functional analysis. They were asked to conduct a simulated assessment with an undergraduate student who followed a script. All participants showed low to moderate levels of accuracy (approximately 0-70%) during the baseline assessment. After baseline, the trainer reviewed each condition with the trainees emphasizing the main components, modeled the procedures and gave the trainees opportunities to ask questions, and provided explicit feedback during role play with the trainee playing the therapist role. After training, all participants showed high level of accuracy (70-100%) during simulated assessments. After the training, the trainees conducted the conditions trained in the classroom with a student who was presenting problem behaviours and all participants showed high level of accuracy (78-100%). It is important to note that these sessions were followed by feedback if the participant made an error. For this reason, these results do not represent “pure” generalization. This study shows that the pyramidal training was effective in teaching teachers to train less experienced teachers to conduct the attention, escape, play, and tangible conditions.

Lambert et al. (2014) trained 10 residential supervisors and four assistants to conduct the alone, attention, escape, play, and tangible conditions in a multiple-baseline design across participants. During baseline, participants received the procedure from Iwata et al. (1982/1994) and their performance averaged 48% accuracy. Training consisted of a 45-minute presentation, followed by written descriptions of the target conditions with group discussion. Participants also viewed a videotaped simulation of all conditions and collected data from it, followed by any questions they had. After that, the participants received a 24-item quiz about the assessment process. The participants only moved on to the post-assessment phase if they scored at or above 90% correct on the quiz. During post-training simulated assessments, participants conducted the alone, attention, escape, play, and tangible conditions and received feedback at the end on each condition. If the participants scored below 90%, they watched their own videotaped session, discussed the correct and incorrect performance and were asked to repeat the condition until they have scored at or above 90% accuracy for that condition. The participants' accuracy averaged 94% during the post-training assessments. Lambert et al. found that the participant's data collection improved after training, but it did not reach an acceptable level of accuracy (27% at baseline to 72% post-training). They found similar results regarding graphing (14% at baseline to 81% post-training). This study shows that it is possible to train residential care providers in a relatively short period of time to conduct functional analysis. However, this training was not sufficient to teach staff to collect and graph data to a high level of accuracy.

Alnemary, Wallace, Symon, and Barry (2015) taught teachers to conduct the alone/ignore, attention, demand, and play conditions of a functional analysis by videoconference.

Four teachers who have not conducted functional analysis previously and a student with ASD participated in this study. During baseline, all teachers received Iwata et al. (1982/1994) study to review. All teachers conducted a simulated assessment with a student actor. During this simulated assessment, three of the four teachers showed above 90% accuracy in the alone condition, the fourth teacher showed an average of approximately 33% accuracy (average based on visual inspection on the plotted data). One of the four teachers showed above 90% accuracy in the attention condition, the other three teachers presented a group average of 63% accuracy. The group average for the demand condition was approximately 24% accuracy, and approximately 73% for the play condition.

The videoconference training consisted of a 3-hour training in which the trainer discussed functional assessments emphasizing functional analysis, followed by role play and a questionnaire regarding the protocol for each condition. After training, a simulated assessment with the four conditions was conducted by the teachers. If the teachers scored below 90% in any of the four conditions, then they received individualized feedback followed by video modeling. If the teachers scored above 90% (mastery criterion) across all four conditions, then they would conduct a generalization probe with a client with ASD who engages in problem behaviours. Alnemary et al. (2015) found that all teachers mastered at least two of the four functional analysis conditions, and one of the teachers mastered all four conditions with minimal training.

Only one teacher conducted the generalization probe with a client with ASD who engaged in problem behaviours. During the generalization, the teacher maintained performance above 90% in all except the demand condition. This study shows that the videoconference was able to improve the teachers' performance accuracy in all conditions of the functional analysis assessment that were below the mastery criterion. Even though the teachers did not master all four conditions of the functional analysis assessment, they demonstrated improvement in performance in all conditions.

Purpose of Study

Considering the high prevalence of problem behaviours (McClintock et al., 2003; Murphy et al., 2009; Matson et al., 2009) and their adverse impact on individuals with developmental disabilities as well as their caregivers (Mitchell & Hastings, 2001), effective methods are needed to teach practitioners about functional analysis, how to apply it, and how to use its results to select and design interventions. Although there is an increasing trend in the field on studies that aim to teach practitioners to conduct functional analysis, these studies still present some limitations that need to be addressed. First, the number of studies that focused on traditional functional analysis, considered to be the most reliable, is relatively small. Second, not all studies taught the same or same number of functional analysis conditions. This needs to be considered when interpreting the amount training reported. Another need in functional analysis training research is to evaluate whether skills learned during training and under simulated conditions will transfer to assessing clients. Third, of the training studies that focused on traditional or brief functional analysis and that used either written materials or any type of modeling, assessment with clients was evaluated for all participants in three studies (Moore et al., 2002; Moore & Fisher (2007); Pence et al., 2014) and with only one participant in two studies (Wallace et al., 2004; Alnemary et al., 2015). It is important to note that in two of the three studies that planned generalization for all participants, the generalization probes contained a feedback component (Moore et al. 2002 & Pence et al., 2014). This poses a limitation to their generalization results. All of them required face-to-face contact with the trainee. In addition to the cost benefit of a self-instructional manual, a manualized approach, if effective, will present a consistent and invariant training program for all trainees. This should facilitate the dissemination of a procedure that is in high demand amongst behaviour analysts and staff who works with people who present problem behaviours. In response to these needs, I prepared a self-instructional manual on functional analysis and evaluated the efficacy of the manual for teaching university students, staff working with persons with developmental disabilities, and special education teachers to conduct functional analysis. The primary research questions were (1) whether the self-instructional manual was effective in teaching university students and staff to conduct functional analysis, and (2) whether skills acquired would be maintained during retention and generalization assessment with clients.

Two experiments were conducted. In Experiment 1, the initial version of the manual was used to evaluate its efficacy in teaching functional analysis assessment with nine university students and two staff members who worked with people with developmental disabilities. Based on the results of the common errors made by participants during the first experiment, the manual was revised and evaluated in Experiment 2 with an additional five university students and two staff members. In both experiments, participants received the method section of the paper by Iwata et al. (1982/1994) during baseline, and the instructional manual during the intervention. Participants who did not show mastery following the self-instructional manual received video modeling. Retention and generalization assessments with clients with developmental disabilities were conducted for most participants.

Ethics approval was obtained from the University of Manitoba Psychology/Sociology Research Ethics Board before the study began. Research access approval was obtained from St.Amant before the study began. Written informed consent was obtained from all student and staff participants, and from the legal guardians of individuals with developmental disabilities before the study began.

EXPERIMENT 1: SELF-INSTRUCTIONAL MANUAL

The purpose of Experiment 1 was to evaluate the efficacy of the self-instructional manual to teach participants to conduct functional analysis. During baseline, all participants received the method section from Iwata et al. (1982/1994) followed by a simulated assessment. If the participants scored below the mastery criterion of 85% accuracy during the simulated assessment, then they received the self-instructional manual, followed by a simulated assessment. If the participants scored below the mastery criterion during the post-manual simulated assessment, then they received the video modeling and manual, followed by a simulated assessment. If a participant met the mastery criterion during any of the simulated assessments, they were asked to conduct a retention/generalization assessment. The phases of this experiment are depicted in Figure 1.

Method

Participants and Setting

Eleven participants received training in Experiment 1. Trainees included nine university students with no experience in behaviour analysis or developmental disabilities and two individuals who were working with individuals with developmental disabilities. These two groups of participants were selected because they represent the typical population who will likely receive training on functional analysis. Student trainees were recruited through posters displayed at various locations at the University of Manitoba Fort Garry campus. One staff trainee was recruited through a school division and the other heard about the project and contacted the researcher. The characteristics of the student and staff participants for Experiment 1 (P1-P11) are shown in Table 1. All training and assessment sessions took place in a session room at the St.Amant Research Centre.

One 39-year-old female client participant (not shown in Table 1) with a developmental disability and a mild problem behaviour was recruited to participate in generalization assessment. The problem behaviour was making throat noises and did not pose a risk of physical harm to the client or others. This client engaged in the behaviour almost continuously throughout the day.

Each student and staff participant received $40 during the first meeting for participating in this study. The honorarium was provided regardless of performance. The client participant received a $10 gift card for her participation in this study. The gift card could be used at a local store for various leisure items (e.g., games, music, movies, etc.) and it was provided to the client’s legal guardian or primary caregiver who could assist her to make the purchase.

Materials

A video camera was used to record all sessions. A variety of academic materials (e.g., pictures, puzzle, shape sorter, common objects) and leisure activities were used during the assessments. Datasheets, timer, and pencil were provided to the trainees during all assessment sessions.

Training materials included a brief Method Description (adapted from the procedural description of Iwata et al., 1982/1994), a 43-page Functional Analysis Self-Instructional Manual, and Video Modeling clips based on the manual. More information about the training materials is described later in the Procedure section under the headings: method description (baseline) and self-instructional manual intervention.

Research Design

A concurrent multiple-probe design (Murphy & Bryan, 1980) across participants was used with each of four groups of trainees. The first three groups consisted of three students each (P1 to P3, P4 to P6, and P7 to P9) and the last group consisted of two staff (P10 and P11). The multiple-probe design is a variation of the mutliple-baseline design. Instead of continuous sampling of the target behaviours typically found in single-case designs (Kazdin, 2011), probes of the target behaviours are conducted for practical reasons or when the target behaviour is complex and expected to be stable (Horner & Baer, 1978). This design has been commonly used in previous research that involved teaching complex skills to reduce trainees' frustration from being asked to perform the same skills multiple times (e.g., Fazzio, Martin, Arnal, & Yu, 2009; Salem et al., 2009; Thiessen et al., 2009).

Procedure

Functional analysis target behaviours. The expected correct behaviours of a trainee in conducting a functional analysis differed across the four assessment conditions (Alone/Ignore, Attention, Demand, and Play) as described in the introduction. In general, behaviours varied in the presentation of leisure materials, antecedents (e.g., instructions), and consequence. The correct and incorrect behaviours and a sample data sheet for each condition are shown in Appendix A.

The trainee's behaviours were scored from all video recorded sessions using a 5-s interval recording method. Each 5-min session was divided into 60 5-s intervals and a behaviour was scored as "present" in an interval regardless of its frequency (Kazdin, 2011).

An interval was determined as correct if the trainee emitted the correct behaviour either in the same interval as the antecedent that occasioned the behaviour or in the next interval. Intervals without any behaviour were not used in the correct percent calculation.

Method description (baseline). During the baseline phase, trainees received the method section of the Iwata et al. (1982/1994) paper on functional analysis. Trainees had as much time as they needed to study it before conducting the session. Trainees were told the following at the beginning of the study session:

Thank you for helping me with this study. Today, you will study how to do a functional analysis assessment using the method described in a previously published paper. (Give participants a copy of the method description.) Take as much time as you need to familiarize yourself with the procedure. After you have finished studying, I'll ask you to conduct a functional analysis assessment with my assistant who will play the role of a person with developmental disabilities and a problem behaviour. You will not be able to refer to the written procedure during the assessment. Let me know when you are finished with your studying. Do you have any questions? (Answer questions.) If there are no more questions, let's start.

Post-method simulated assessment. When the trainee finished studying the method description, he/she was asked to conduct one session for each condition of the functional analysis separately with a simulated client (graduate student playing the role of a client). The trainee was given the materials needed for each condition, a datasheet, pencil, and timer, and received the following verbal instructions:

The next step is for you to conduct a functional analysis using the procedure you have just studied. You will be conducting the assessment with <name>, who is a student and *she will be playing the role of a client. Take your time to get set up for each condition. For the purpose of the study, you will conduct each condition for only 5 minutes. I will let you know when the time is up and when you should change to another condition. I cannot provide you with any further information about the assessment procedure. Just do your best. Let me know when you are ready to begin.*

If a trainee scored below 85% accuracy in a functional analysis condition during the simulated assessment, he/she would receive training using the self-instructional manual in the next phase. If a trainee scored 85% or higher in a functional analysis condition after studying the manual, he/she would proceed to the retention/generalization phase (described below). However, if a trainee scored below 85% accuracy in a functional analysis condition after studying the self-instructional manual, he/she would be exposed to video modeling. These criteria applied to all trainees except in eight instances, which will be described later.

Scripted behaviours of the simulated client. During each simulated assessment, the frequencies of the target problem behaviour being assessed (e.g., hitting) and other non-target behaviours (e.g., playing appropriately or shouting) were scripted. The ratio of target problem behaviour to non-target behaviours was 1:10 in all conditions, meaning one instance of target problem behaviour for every 10 instances of either appropriate or inappropriate non-target behaviours. The actor wore a wireless earbud and was cued to emit the scripted behaviours at predetermined times during the session by another person outside the session room. Several versions of the scripts were used throughout the study for each condition. Each version presented the behaviours in the same proportion but in different orders. After the simulated assessments were completed for all conditions, I thanked the trainee and scheduled their return on another day to complete the next phase.

Self-instructional manual intervention. The training manual provides the reader with a general overview of functional analysis assessment and a step-by-step description of its procedures (the Table of Contents for the manual is shown in Appendix B). The manual is written in nontechnical language and consists of seven sections, which are briefly described below.

(1) The *Introduction* presents the purpose and characteristics of the manual, and discusses clients with developmental disabilities, problem behaviours, behavioural assessments, and functional analysis.

(2) Section 2, *Functional Analysis Overview*, presents some general procedures and considerations regarding the functional analysis conditions such as duration of session, number of sessions, and criterion for changing the conditions.

(3) Sections 3 through 6 describe the procedures for each of four conditions, respectively. They are: Alone or Automatic Reinforcement Condition, Attention or Social Positive Reinforcement Condition, Demand or Social Negative Reinforcement Condition, and Play (Control) Condition.

(4) The last section, *Review*, provides a review of the previous sections regarding the correct target behaviours outlined for each condition.

Study questions are provided at the end of each section. The study questions were planned in a way that half of them would be fill in the blank and half of them required short answers. The number of questions varied from unit to unit, ranging from six to 15. The number depended on the amount of information presented in the unit. The manual instructs the trainees to answer the questions without referring to the materials, check the accuracy of their answers using the answer key provided in the manual, and if the trainee scored below 100% correct, he/she should re-study the section. However, no experimental contingencies were implemented to require the trainees to do so.

During the manual training phase, trainees were given the manual and allowed to spend as much time as needed to study the manual and complete the study questions. Trainees received the following instructions:

> *Thank you for helping me with this study. Today, you will study how to do a functional analysis assessment using a self-instructional manual. (Give participants a copy of the manual.) The functional analysis procedure is described in this manual. Take as much time as you need to study the procedure and complete the exercises in the manual. After you have finished studying, I'll ask you to conduct a functional analysis assessment with my assistant who will play the role of a person with developmental disabilities and a problem behaviour. You will not be able to refer to the written procedure during the assessment. Let me know when you have finished studying the manual.*

I collected the manual at the end of the day. Upon completion of the manual I asked the trainees to complete a brief questionnaire about the manual (Appendix C).

Post-manual simulated assessment. After the trainees have finished studying the manual, they were asked to conduct a functional analysis with a simulated client. The procedures were the same as those described above for Post-Method simulated assessment. If a trainee scored below 85% accuracy in a functional analysis condition during the simulated assessment, he/she received training using video modeling plus self-instructional manual in the next phase. If a participant trainee scored 85% or higher in a functional analysis condition, he/she proceeded to the retention/generalization phase (described below).

Video modeling. The video modeling phase provided the trainee a set of videos clips displaying the expected way to conduct each functional analysis condition (e.g., how the tester should behave after the occurrence of a target problem behaviour, a non-target appropriate behaviour, and non-target inappropriate behaviour). A trainee was shown the videos for all four functional analysis conditions if they have scored below 85% accuracy in any of the four conditions during the Post-Manual simulated assessment. During the video modeling phase, a trainee watched the videos on a computer with a 56 cm screen and he/she could spend as much time as needed to watch them. Each video started by describing how to respond to the client's behaviour, followed by showing someone implementing the procedure. The trainees also received the self-instructional manual in case they wanted to review each condition using the manual as well. However, none of the trainees referred to the manual during this phase.

Trainees received the following instructions at the beginning of this phase.

Thank you for helping me with this study. Today, you will watch a video showing a person conducting the functional analysis assessment. You will also have access to the self-instructional manual that you already studied. The functional analysis procedure is demonstrated in the video and described in this manual. Take as much time as you need to watch the video and study the procedure in the manual. After you have finished watching the video and studying, I'll ask you to conduct a functional analysis assessment with my assistant who will play the role of a person with developmental disabilities and a problem behaviour. You will not be able to refer to the written procedure or video during the assessment. Let me know when you have finished watching the video and studying the manual.

Post-video simulated assessment. After the trainees have finished watching the video and studying the manual, they were asked to conduct a functional analysis assessment with a simulated client. The procedures were the same as those described above for Post-Method simulated assessment. If a trainee scored below 85% accuracy in a functional analysis condition during the post-video simulated assessment, his/her participation in the study ended. If a trainee scored 85% or higher in a functional analysis condition, he/she proceeded to the retention/generalization phase.

Retention/generalization assessment with a client. If a trainee performed at 85% correct or higher during the simulated assessment, I scheduled them to return on another day to conduct an assessment with a client. The trainee conducted only conditions that he/she scored at or above 85% accuracy. I gave them the materials necessary to conduct each condition separately and instructed them which condition they should conduct. At the beginning of the assessment, I gave the following instructions to the trainees:

> *Thank you for helping me with this study. Today, you will be conducting a functional analysis assessment just like you did with my assistant previously, except that you will be assessing a client today. His/her name is < name>. For the purpose of the study, we will conduct each condition for only 5 minutes. I will let you know when the time is up and when you should change conditions. You have 20 minutes to review the procedures using the self-instructional manual. Let me know when you are ready to begin.*

Although I did not anticipate that the client recruited for this study would present safety concerns, I was present in the room while the trainee conducted the assessment with the client. I would have interrupted or terminated the assessment if there were any concerns about the safety of the client or trainee, although that was not needed for any of the sessions.

Reliability Checks

Trained observers conducted all reliability checks. Observer training consisted of reading and applying a set of rules on how to record the target behaviours per interval. Each condition was taught separately. First the observer scored 1-2 sessions with the researcher, discussing each interval and how to apply the rules. Second, the observer scored 1-2 sessions independently and immediately received feedback on the videos scored. Training continued until the observer has achieved at least 85% accuracy.

Reliability checks were conducted on the functional analysis target behaviours of the trainees during all simulated and retention/generalization assessments. Observers were blind to the study phase and type of participant (e.g., staff or student). The experimenter and the observer scored each video recorded condition independently and compared their recordings. An agreement consisted of both the experimenter and observer recording an instance of the trainee's behaviour in the same way (i.e., presence or absence of a target behaviour) in a 5-s interval, plus or minus one interval. This rule was used because the observers were timing the intervals manually and by doing so some discrepancies in the recording were happening due to timing issues. Another reason for the rule was that some behaviours occurred exactly during the transition from one interval to the other; in these cases, scoring the behaviour in either interval was considered correct. If one person recorded an instance of a target behaviour and the other did not, it was considered a disagreement. Percent agreement for each observed condition was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplied by 100%. Table 2 shows the percent agreement in each condition for each phase (post-method, post-manual, post-video modeling, and retention/generalization) in Experiment 1. The average percent agreements across all phases were 94% (range 60-100%) for the Alone condition, 95% (range 83-100%) for Attention, 83% (range 55-100%) for Demand, and 91% (range 73-100%) for the Play condition.

Social Validity

After completing the simulated assessment at post-method and at post-manual, I asked each trainee to complete a brief questionnaire (Appendix C). The questionnaire included four statements about the importance of learning the functional analysis procedure, whether the reading materials were helpful and understandable, and whether the trainee felt ready to conduct the functional analysis assessment. The trainees indicated the extent to which they agreed with each statement on a 5-point scale anchored to the following: strongly agree, agree, neutral, disagree, and strongly disagree. All except Participants 1 through 3 completed the questionnaire. Participants 1 through 3 did not receive the questionnaire due to an oversight.

Data Analysis

The concurrent multiple-baseline design controls for extraneous, temporally related variables by introducing the intervention across participants successively at different times such that each participant provides his/her own control (baseline phase) for the intervention phase. In addition, the baseline phases of the second and third participants, respectively, serve as a control for the intervention of the preceding participant. Therefore, if the results show an immediate change in performance levels (e.g., from baseline to training) with few or no overlapping data points between phases, and if a similar change occurs for every participant only after the phase change has taken place (and not before), then we may conclude with confidence that the behaviour change is a result of the intervention and not due to extraneous variables (Kazdin, 2011; Martin & Pear, 2015).

Results

The results of Experiment 1 are presented in Figures 2 through 6. In Experiment 1, each participant conducted between 2 and 4 simulated assessments for each condition, with a total of 144 simulated sessions across all participants in Experiment 1. Each participant conducted 1 session per condition with a client, with a total of 27 sessions across all participants.

Figure 2 shows the performance accuracy (percent correct) of Participants 1 through 3 in applying the procedures in each functional analysis condition during simulated assessments conducted after training using the method description and self-instructional manual. Participants 2 and 3 received video modeling and Participants 1 and 3 participated in the retention/generalization phase. Participant 2 withdrew from the study before conducting the retention/generalization sessions. The bottom graph shows the mean performance accuracy across the three participants for each functional analysis condition during each phase. The horizontal dash line in each graph indicates 85% correct. During post-method simulated assessments, 3 out of 20 sessions (15%) were at or above 85% correct across the three participants. Overall, higher performance accuracy was observed in the Alone and Play conditions. During the post-manual simulated assessments, performance improved in all but one session relative to the previous phase (Attention condition for P2) and 8 out of 12 sessions (67%) were at or above 85% correct across the participants. The average performance accuracy increased in all four functional analysis conditions at post-manual compared to post-method assessments, and Alone and Play conditions showed higher accuracy than the other conditions although the difference between conditions was smaller than in the previous phase (Figure 2, bottom graph). Since the Attention and Demand conditions were below 85% for P2 during post-manual assessments, he was exposed to video modeling. Performance accuracy for these two conditions was above 85% at post-video assessments. Since the Play condition was below 85% for P3, he was exposed to the video modeling. Performance accuracy for this condition was unchanged at post-video modeling. Participants 1 and 3 completed a simulated assessment 2 and 4 weeks later, respectively. Performance was above 85% in 5 of the 8 sessions, with one session at 84% (Demand, P3) and two sessions above 70% (Play, P1 and Alone, P3). The generalization session was conducted with a graduate student role playing the role of a person with disabilities who engages in problem behaviours because the client was not available for assessment at the time. Participant 2 was not available for the retention/generalization assessment.

Figure 3 shows the performance of Participants 4 through 6 during simulated assessments at post-method and post-manual. Participants 4 and 5 completed their retention/generalization assessments 6 and 5 weeks later, respectively. Participant 6 received video modeling and was not available for retention/generalization assessment. During the post-method simulated assessments, 11 of the 20 (55%) sessions were at or above 85% accuracy. The mean performance across participants showed that the Attention, Demand, and Play conditions were below 85%, ranging from 69% (Demand) to 83% (Play). At post-manual, all 12 sessions (100%) were above 85% accuracy across the participants. Participant 6 maintained her performance accuracy in three of the four conditions after receiving video modeling. During retention/generalization assessments with a client for P4 and P5, 5 of the 8 sessions (63%) were above 85% accuracy. Mean performance accuracy during retention/generalization was at/above 85% for Alone and Play conditions, with Attention at 79% and Demand at 38% (Figure 3, bottom graph).

Figure 4 shows the results of Participants 7 through 9. Participants 7 and 8 received method description, self-instructional manual, and video modeling, whereas Participant 9 received method-description only. All three participants took part in the retention/generalization assessments one week later. At post-method, performance on simulated assessments was at or above 85% correct in 9 out of 20 (45%) sessions across the three participants. At post-manual for P7 and P8, 6 of the 8 (75%) sessions were at or above 85% correct. Participants 7 and 8 maintained their performance accuracy above 85% correct in all conditions after receiving video modeling. During retention/generalization client assessments, 6 of 11 sessions (54%) were at/above 85% accurate. Mean performance accuracy during retention/generalization was at/above 85% for the Play condition only, with Alone and Attention conditions at 62% and Demand at 41% (Figure 4, bottom graph).

Figure 5 shows the performance of the two staff participants, P10 and P11. Both participants received the method and manual. Participant 11 received video modeling following the manual. Both participants completed the retention/generalization client assessments 3 weeks and 2 weeks later, respectively. During post-method simulated assessments, 7 of the 12 (58%) sessions were at or above 85% accuracy. At post-manual, 7 of the 8 (88%) sessions were at or above 85% accuracy. Performance accuracy for P11 maintained above 85% in all four conditions after video modeling. During retention/generalization client assessments, 4 of the 8 sessions (50%) were at or above 85% accuracy. Compared to assessments in the previous phase, Participant 10 showed a performance decline in the Demand condition and Participant 11 showed a decline in the Attention and Play conditions.

The results of the social validity questionnaire for Experiment 1 are presented in the top half of Table 3. The trainees rated the importance to learn functional analysis assessment similarly after the method ($M = 4.3$) and after the manual ($M = 4.1$). They also rated both the method description and manual to be quite helpful (means of 4.3 and 4.4, respectively). However, the trainees found the manual slightly easier to read ($M = 4.3$) than the method description (*M* = 3.9) and they felt more ready to conduct the assessment after studying the manual (*M* = 3.7) than the method description (*M* = 2.9).

Summary and Discussion for Experiment 1

In summary, of the 10 participants who received the self-instructional manual following method description, performance accuracy either increased in almost all conditions or maintained at a high level when baseline performance was already above 85% accuracy at post-method. Performance accuracy declined at post-manual for only two conditions (Play, P8 and Play, P10). Despite improved performance, only five (P4, P5, P6, P7, and P11) of the 10 participants achieved an average of 85% or higher accuracy across conditions at post-manual (see Table 4).

Six of the 11 participants were exposed to video modeling, with three (P6, P7, and P11 in Table 4) of them already presenting performance at or above 85% accuracy before their exposure. Of the three remaining participants, two presented performance accuracy at or above 85% in all conditions. During retention/generalization, however, none of the participants maintained their performance at or above 85% accuracy in all conditions (see Table 4).

It is important to note that three of the 11 participants presented an increasing baseline in some of the conditions probed. This could be a limitation to drawing conclusions about the internal validity of the self-instructional manual since it could be argued that performance could continue to improve with repeated exposures to the method description. However, it should be noted that only 16 out of 126 (12.7%) of the probed conditions during baseline showed increased performance. Thus, the overall results did suggest that the manual intervention was effective in increasing performance accuracy.

Overall, the mean performance accuracy across all 11 participants after reading the method description was 73%, ranging from 65% (Attention) to 80% (Play) across the four functional analysis conditions (see Figure 6). Mean performance accuracy across conditions for 10 participants after studying the self-instructional manual increased to 92%, ranging from 88% (Demand) to 99% (Alone). For the six participants (P2, P3, P6, P7, P8, and P11) who were exposed to video modeling, their average performance accuracy at post-manual for the four conditions were: 98% (Alone), 86% (Attention), 85% (Demand), and 89% (Play) (not shown in Figure 5). At post-video, their average performance accuracy for the four conditions were: 100% (Alone), 97% (Attention), 87% (Demand), and 91% (Play) (see Figure 5). For the nine participants who completed retention/generalization assessments, mean performance accuracy across the four conditions was 80%, ranging from 59% (Demand) to 97% (Alone). In general, mean performance accuracy in the Demand condition was the lowest among the four conditions during all phases and the Alone condition was the highest or second highest by only 1% difference at post-method among the four conditions in all phases. This was not surprising in that the procedures for the two conditions were the most and least complex among the four conditions. Others have also found that the Demand condition was more difficult for new trainees to learn (Lambert et al., 2014; Pence et al., 2014).

EXPERIMENT 2: REVISED SELF-INSTRUCTIONAL MANUAL

An examination of the errors made by the participants in Experiment 1 showed that the most frequent error in the Alone condition was reacting to the client's appropriate and inappropriate behaviours: 52 instances during the post-method session, 4 during the post-manual, and 5 during the retention/generalization. The most frequent error in the Attention condition during the post-method session was initiating interaction with the client (160 instances). During the post-manual, post-video, and retention/generalization the main error was reacting to the client's target problem behaviours: 30, 3, and 151 instances respectively. In the Demand condition, the errors were categorized in: 1) Not delivering the demand within 30 seconds; 2) Not prompting after an error; and 3) Not removing the demand/materials after the occurrence of a target problem behaviour. The most frequent error during post-method, post-manual, and post-video in the Demand condition was not prompting after error with 190, 38, and 8 instances respectively. The most frequent error during the retention/generalization was not removing the demand/materials after the occurrence of a target problem behaviour (132 instances). In the Play condition, the errors were categorized in: 1) Not interacting with the client within 30 sec; 2) Reacting to the client's inappropriate behaviours; and 3) Reacting to the client's target problem behaviours. The most frequent error during post-method, post-manual, and post-video in the Play condition was reacting to the client's inappropriate behaviours with 78, 25, and 9 instances respectively. The most frequent error during the retention/generalization was reacting to the client's target problem behaviour (58 instances). Therefore, the self-instruction manual was revised and evaluated in Experiment 2.

Method

Participants and Setting

Two special education teachers and five university students participated in Experiment 2 (P12 through P18 in Table 1). The teachers were recruited from a School Division in Winnipeg through e-mail from the School Division Coordinator; and the students were recruited from the University of Manitoba through posters displayed in various locations on campus.

One 45-year-old male client with a developmental disability (not shown in Table 1) was recruited from a community agency to participate in the retention/generalization phase of Experiment 2. The target problem behaviour for this client was vocal stereotypy (e.g., "uh uh" or "right now!"). This behaviour tended to occur in bursts and it presented no physical risk to the client or others.

The teachers, student, and client participants received the same amount of honorarium and in the same manner as described in Experiment 1. The setting was the same as in Experiment 1.

Research Design

Two designs were used in Experiment 2. A concurrent multiple probe design (Murphy & Bryan, 1980) across two participants was used for Participants 12 and 13. This design was applied across the participants as in Experiment 1.

However, a concurrent multiple-probe design across behaviours (functional analysis conditions) was used for each of Participants 14 through 18. This design was used to alleviate the difficulties of scheduling multiple participants. In this design, the manual was divided into four sections. The first included the Introduction, Functional Analysis Overview, and Alone or Automatic Reinforcement Condition (see Appendix B); the second included Attention or Social Positive Reinforcement Condition; the third included Demand or Social Negative Reinforcement Condition; and the fourth included the Play condition. All participants started with the first section, but the order of the remaining sections varied depending on their performance during the simulated assessments. All participants received the review section following the last intervention.

Procedures

Functional analysis target behaviours. The target behaviours and the methods of recording and scoring were the same as in Experiment 1.

Method description. The procedure for this phase was the same as in Experiment 1.

Post-method simulated assessment. The procedure for this phase was the same as in Experiment 1.

Scripted behaviours of the simulated client. The procedure for this phase was the same as in Experiment 1 with the following exception. The scripted frequency of target problem behaviours during the Alone, Attention, and Play conditions was the same in each condition (i.e., 8 instances per condition). However, the target problem behaviour in the Demand condition occurred at the same rate as appropriate and non-target problem behaviours. This change was made to increase the opportunities for the participant to respond to the target problem behaviour.

Self-instructional manual intervention. Based on the results of Experiment 1, the self-instructional manual was revised to include emphasis on the common errors made in each functional analysis condition. Reminders about the correct behaviours, highlighted in textboxes, were added in the appropriate sections. For example, a reminder in the Attention condition for the participants to only interact with the client when the client engaged in the target problem behaviour was presented as follows:

> REMINDER: Provide attention only after the target problem behaviour and ignore any other behaviours.

Another modification was the inclusion of a summary of the correct behaviours related to each condition at the end of each unit.

Post-manual simulated assessment. The procedure for this phase was the same as in Experiment 1.

Video modeling. The procedure for this phase was the same as in Experiment 1, except that in the multiple-probe across behaviors design, participants watched the video for only the condition they were being trained in the multiple-probe across behaviours design.

Post-video simulated assessment. The procedure for this phase was the same as in Experiment 1.

Retention/generalization assessment with a client. The procedure for this phase was the same as in Experiment 1.

Reliability Checks

All simulated and retention/generalization assessments were evaluated by two observers and the procedure for computing percent agreement between observers was the same as in Experiment 1. Table 5 shows the mean and range of percent agreement in each condition for each phase (post-method, post-manual, post-video modeling, and retention/generalization) in Experiment 2. The average percent agreements across the fours phases were 92% (range 43-100%) for the Alone condition, 95% (range 58-100%) for Attention, 90% (range 54-100%) for Demand, and 97% (range 90-100%) for the Play condition.

Social Validity

All seven participants in Experiment 2 completed the questionnaire (Appendix C) at post-method and at post-manual. For participants who received the self-instructional manual in a multiple-probe design across conditions, they completed the questionnaire after the first post-method simulated assessment and after the last post-manual simulated assessment.

Data Analysis

The guidelines used for visual inspection were the same as in Experiment 1.

Results

The results of Experiment 2 are presented in Figures 7 through 13. In Experiment 2, each participant conducted between 1 and 4 simulated assessments for each condition, with a total of 90 simulated sessions across all participants. Each participant conducted 1 session per condition with a client, with a total of 27 sessions across all participants.

Figure 7 shows the performance accuracy (percent correct) of Participants 12 and 13 in applying the procedures in each functional analysis condition during simulated assessments conducted at post-method, post-manual, and post-video. These two participants completed the retention/generalization assessments 2 and 1 week after training, respectively. During post-method simulated assessments, only 1 of the 12 (8%) sessions was at or above 85% accuracy. At post-manual, 4 of the 8 (50%) sessions were at or above 85% accuracy. Since both participants presented performance below 85% accuracy in at least one of the conditions during the post-manual session, they were exposed to the video modeling. At post-video, 6 of the 8 (75%) sessions were at or above 85% accuracy. Both participants maintained their performance at or above 85% accuracy in all conditions probed during the retention/generalization session.

Figure 8 shows the performance accuracy (percent correct) of Participant 14 in a multiple-baseline across behaviours (conditions) design. Performance accuracy at post-method was consistently above 85% for the Alone and Attention conditions; therefore, P14 did not receive the manual for these two conditions. Performance accuracy increased from 34% at post-method to 83% at post-manual for the Demand condition. Performance increased to above 85% at post-video for the Play condition. Performance accuracy in the play condition was already quite high at approximately 80% at post-method. Exposure to the self-instructional manual increased performance to 97% correct. A client assessment was conducted 1.5 weeks following training and performance was above 85% in all four conditions.

Figure 9 shows the performance accuracy (percent correct) of Participant 15 in a multiple-baseline across behaviours (conditions) design. Performance accuracy at post-method was below 85% in all conditions. Performance accuracy increased from 24% at post-method to 93% at post-manual for the Alone condition; from a mean of 46% at post-method to 87% at post-manual for the Attention condition; from a mean of 59% to 86% in the Demand condition; and from a mean of 50% to 90% in the Play condition. Performance accuracy in the Attention condition showed an increase in the second post-method session. A client assessment was conducted 1week following training and performance was above 85% in all four conditions.

Figure 10 shows the performance accuracy (percent correct) of Participant 16 in a multiple-baseline across behaviours (conditions) design. Performance accuracy at post-method was above 85% for the Alone condition; therefore, P16 did not receive the manual for this condition. Performance accuracy increased from 50% at post-method to 70% at post-manual for the Attention condition. Performance increased to above 85% at post-video for the Attention condition. Performance accuracy in the Demand condition increased from a mean of 52% at post-method to 90% at post-manual; and from a mean of 57% to 93% in the Play condition. A client assessment was conducted 1 week following training and performance was above 85% in three of the four conditions (Alone, Attention, and Demand).

Figure 11 shows the performance accuracy (percent correct) of Participant 17 in a multiple-baseline across behaviours (conditions) design. Note that the order of conditions for P17 was changed. The manual was introduced for the Demand condition first because it showed a smaller increase compared to the Attention condition. Performance accuracy at post-method was below 85% for all conditions. Performance accuracy increased from 12% at post-method to 100% at post-manual for the Alone condition. Performance also increased from a mean of 44% at post-method to 92% at post-manual for the Demand condition; and from a mean of 68% to 88% for the Play condition. Performance accuracy in the Attention condition showed an increasing baseline with a mean of 43% at post-method to 100% at post-manual. A client assessment was conducted 1 week following training and performance was above 85% in three of the four conditions (Alone, Attention, and Play).

Figure 12 shows the performance accuracy (percent correct) of Participant 18 in a multiple-baseline across behaviours (conditions) design. Note that the order of conditions for P18 also differed from the preceding participants. Performance accuracy at post-method was below 85% for all conditions. Performance accuracy increased from 5% at post-method to 100% at post-manual for the Alone condition. Performance also increased from a mean of 53% at post-method to 78% at post-manual for the Demand condition. Performance increased to above 85% at post-video for the Demand condition. Performance increased from a mean of 38% to 95% for the Attention condition; and from a mean of 67% to 100% for the Play condition. A client assessment was conducted 1 week following training and performance was above 85% in two of the four conditions (Alone and Attention).

The results of the social validity questionnaire for Experiment 2 are presented in bottom half of Table 3. The trainees rated the importance to learn functional analysis assessment highly after method description and after the manual (*M* = 4.8 for both). They rated the manual (*M* = 4.8) to be more helpful than the method description (*M* = 4.0). The trainees also found the manual easier to read and understand than the method description (*M* = 4.7 vs. 3.5) and they felt more ready to conduct the assessment after studying the manual than the method description (*M* = 4.5 vs. 2.8).

Summary and Discussion for Experiment 2

In summary, of the seven participants who received the self-instructional manual following method description, performance accuracy either increased in almost all conditions or maintained at a high level from post-method to post-manual simulated assessments. Performance accuracy declined at post-manual for only two conditions (Demand and Play, P12). Despite improved performance, only two of the seven participants achieved 85% or higher accuracy for all conditions that received the manual intervention (see Table 6).

Overall, the mean performance across all 7 participants after reading the method description was 58%, ranging from 53% (Demand) to 66% (Play) across the four functional analysis conditions (see Figure 13). Mean performance accuracy across the four conditions after studying the self-instructional manual was 88%, ranging from 81% (Demand) to 99% (Alone). For the five participants (P12, P13, P14, P16, and P18) who were exposed to video modeling in at least one functional analysis condition, their average performance accuracy at post-manual for the four conditions were: 100% (Alone), 85% (Attention), 74% (Demand), and 81% (Play) (not shown in Figure). At post-video, however, their average performance accuracy for the four conditions were: 100% (Alone), 100% (Attention), 90% (Demand), and 90% (Play) (see Figure 13). Mean retention/generalization performance across all 7 participants showed 100% (Alone), 100% (Attention), 82% (Demand), and 81% (Play), respectively.

The errors were categorized in the same way as in Experiment 1. The most frequent error in the Alone condition during the post-method session was initiating interaction with the client (74 instances). During the post-manual, the most error was reacting to the client's appropriate/inappropriate behaviours (1 instance). The most frequent error in the Attention condition during the post-method session was initiating interaction with the client (148 instances). During the post-manual, the main error was reacting to the client's target problem behaviours (13 instances); during the retention-generalization sessions there was only one error, reacting to the client's appropriate/inappropriate behaviours. The most frequent error during post-method, post-manual, post-video, and retention/generalization in the Demand condition was not prompting after error with 63, 24, 7, and 29 instances respectively. The most frequent error during post-method, post-manual, and retention/generalization in the Play condition was reacting to the client's inappropriate behaviours with 81, 20, and 29 instances respectively. The most frequent error during the post-video session was not interacting with the client within 30 sec (5 instances).

For comparison between experiments, Figures 6 and 13 have been reproduced in Figure 14. During the post-method sessions the mean was below the 85% accuracy in all conditions in both Experiments, with Experiment 2 having a lower mean performance than Experiment 1 in all conditions. The mean performance increased to above or just below the 85% criterion in all conditions, except for Demand and Play conditions in Experiment 2. It is important to note that although mean performance has not reached the criterion in Experiment 2 for the Demand and Play conditions, the improvement in mean accuracy was higher in Experiment 2 than in Experiment 1 for both conditions with an increase of 19% in Experiment 1 and 28% in Experiment 2 for the Demand condition; and an increase of 11% and 17% in Experiments 1 and 2, respectively, for the Play condition. Video modeling increased or maintained mean performance accuracy above 85% in all conditions in both Experiments. During the retention/generalization phase, the mean performance accuracy was above 85% in the Alone condition for Experiment 1 and above the criterion in the Alone and Attention conditions in Experiment 2. Considering that the improvement in the mean performance was higher in Experiment 2 than in Experiment 1 and that performance accuracy was maintained at a higher level in the Alone, Attention, and Demand conditions during the Retention/Generalization sessions, it could be said that the changes in the manual produced a slightly better performance than its previous version (Experiment 1).

GENERAL DISCUSSION

This study aimed to evaluate the efficacy of a self-instructional manual to teach students and staff to conduct functional analysis assessment with individuals with developmental disabilities. It seems that the revisions in the manual and changes in the scripts produced a better performance during the post-manual simulated assessments. In Experiment 1, there was an improvement in accuracy from post-method to post-manual of 20%, 26%, 19%, and 11% in the Alone Attention, Demand, and Play conditions, respectively. In Experiment 2, performance improved by 39%, 34%, 28%, and 17% in the Alone, Attention, Demand, and Play conditions, respectively. The larger effect observed in Experiment 2 could have been due to several reasons. First, the revised self-instructional manual could have resulted in larger improvements compared to the first version used in Experiment 1. Second, changes in the experimental design could have contributed to the effect. In the multiple-probe across participants design used in Experiment 1 and for two participants in Experiment 2, each participant received and had to study the entire manual before the post-manual assessments. In the multiple-probe across behaviours design (for five of the seven participants in Experiment 2), however, each participant received only the relevant sections of the manual for each condition before each post-manual assessment. Lastly, the larger effect observed in Experiment 2 could have been due to the lower baseline performance shown by participants (see Figure 14).

Across both experiments, 8 out of 8 (100%) participants who did not meet the mastery criterion for the Alone condition in baseline (after studying the method description) reached mastery after the manual; 9 out of 13 (69%) participants did so for the Attention condition; 8 out of 14 (57%) participants did so for the Demand condition; and 8 out of 12 (67%) participants did so for the Play condition. Across both experiments, in 21 cases where the participants had reached mastery in at least one session of the four conditions during baseline and subsequently received the self-instructional manual, only 3 (14%) participants performed below the mastery criterion after the manual intervention. These results suggest that the self-instructional manual had a substantial positive impact on the participants' performance.

In terms of retention and generalization, mean performance accuracy across conditions was 80% (range 59-97%) in Experiment 1 and 91% (range 81-100%) in Experiment 2 (see Figure 14). It should be noted that several participants received only the method description for all or some of the functional analysis conditions (P9, P14, and P16), and a number of participants received video modeling following the self-instructional manual. After excluding these participants, the mean performance accuracy during retention and generalization assessment across conditions and participants was 82% (Alone 100%, Attention 89%, Demand 57%, and Play 82%) in Experiment 1 (P1, P4, P5, and P10) and 90% (Alone 100%, Attention 99%, Demand 85%, and Play 74%) in Experiment 2 (P15 and P17). Therefore, additional exposure to video modeling did not appear to have influenced performance during retention/generalization.

In general, performance accuracy was usually higher in the Alone and Attention conditions than in the Demand and Play conditions. This finding is consistent with previous research by Almenary et al. (2015), who also found that their participants made more errors during the Demand and Play conditions. Lambert et al. (2014) and Pence et al. (2014) also reported that one of the most difficult conditions for new assessors was Demand. Perhaps the reason for the increase in errors during the Demand and Play conditions is that these conditions have more than one simple rule to follow making more difficult for the participants to conduct these conditions with a higher level of accuracy.

Results from Experiments 1 and 2 showed that there was not a large or consistent difference in overall performance between staff and students. The mean performance accuracy across the four conditions was 60% for students and 67% for staff at post-method, and 91% for students and 86% for staff at post-manual. At post-video modeling the mean performance accuracy was 96% and 93% for students and staff, respectively. During retention/generalization, the mean performance was 86% for students and 89% for staff. Both students and staff received the same version of the manual and both received the same script set. Staff participants who had some experience with persons with developmental disabilities could have an advantage over university students in dealing with a client’s behaviour in general. However, the problem behaviours emitted by the clients were not very intensive or harmful, and since both the staff and student participants did not have any experience with conducting functional analysis, the staff participants’ advantage might have been diminished.

The ratings on the social validity questionnaire were consistent across both experiments. In general, the trainees felt that it is important to learn to conduct functional analysis assessment and the manual was slightly more helpful than the method description in providing information on how to conduct the sessions. Participants also found the manual easier to read and understand than the method description, and felt more ready to conduct the functional analysis sessions after reading the manual.

Each client was exposed to 6 assessments, each consisted of all four conditions of the functional analysis. Both clients had one assessment in which three conditions were administered instead of four. A question was raised concerning whether the multiple exposure could have increased their target problem behaviours. This was very unlikely since each assessment was separated by at least one week. In addition, their behaviour pattern (i.e. frequency, latency, and intensity) appeared to be very stable throughout their participation in this study.

It is important to note that although the goal of this study was to evaluate the efficacy of a self-instructional manual in teaching university students and staff to conduct functional analysis assessment, some considerations have to be made about the context in which this type of training is desirable. First, this manual should be used by Board Certified Behaviour Analysts (BCBAs) as a supplement to train new clinicians. Therefore, the person studying this manual should be supervised by a BCBA. The self-instructional manual is not intended for the general population. Second, this manual would not be appropriate to teach functional analysis when the behaviour is too severe or low in frequency.

A number of limitations should be noted. First, the self-instructional manual was always preceded by the method description. Therefore, the effects of the method description cannot be ruled out from the observed results following the self-instructional manual. Another limitation is the small number of simulated assessment probes conducted during baseline and an increasing baseline was observed in a number of cases (24% of the baseline phases). For these cases, additional exposures to the method description could have resulted in further improvement. It is perhaps not surprising for some learning to occur after reading the method description.

Another limitation of the study is the inconsistent application of video modeling. Although video modeling was not the focus of the evaluation, the rule was for participants to observe the video when they did not meet mastery criterion in at least one of the functional analysis conditions. However, deviation from this rule occurred in five instances in Experiment 1: video modeling was provided in three cases where it was not needed (P6, P7, and P11) and it was not provided in two cases where it was needed (P1 and P10). The deviations were a result of a scoring error in the previous phase, which has been corrected in the results presented. Another limitation of this study is that not all behaviours related to functional analysis were taught. The trainees in this study were not required to define the target problem behaviour, to prepare materials for the sessions, to take data on the target problem behaviour, and to apply the information collected from the assessment. This limitation seems to be shared by other studies. For example, Lambert et al. (2014) reported that their training was enough to teach individuals to conduct functional analysis but not sufficient to teach them to collect data. Almenary et al. (2015) did not mention any other component other than conducting functional analysis. Pence et al. (2014) reported that data analysis and planning intervention based on the functional analysis results are tasks that would require a more experienced behaviour analyst.

The present study raises a number of questions that requires further research. First, future research comparing different versions of the manual is needed in order to establish a more effective version to teach the functional analysis procedure. To improve the effectiveness of the manual, future research should also evaluate the effects of additional contingencies on the completion of unit quizzes. In the present study, trainees were asked to review relevant sections if they did not answered all exercise questions correctly at the end of a unit, but there was no contingency to ensure that that was done. For example, future research could impose a contingency for trainees to re-do the exercise questions until 100% accuracy before being allowed to study the next unit. Future research should also examine the effectiveness of a training package that incorporates both self-instruction and video modeling. Lastly, it would be important for future research to investigate if the self-instructional manual would be effective without it being preceded by the method description.

The results of this study supports the results found by Iwata et al. (2000), Moore et al. (2002), Wallace et al. (2004), Pence et al. (2014), Lambert et al. (2014), and Almenary et al. (2015), showing that participants, with no experience in functional analysis and in developmental disabilities could learn to conduct functional analysis with minimal training. This study extends the literature in training FA assessment by adding a training that does not require the presence of the trainer during the training session. In this study, some participants learned to conduct the four main conditions (Alone, Attention, Demand, and Play) in a relatively short period of time (i.e., up to 10 hours in total) and without the presence of a trainer. This manualized approach presents a consistent and impartial training program for all trainees. The advantage of such an approach is the rapid dissemination of a procedure that is in high demand among behaviour analysts and staff who work with people who present problem behaviours. The self-instructional manual examined in this study holds promise as a low-cost training option that warrants further research.

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Table 1

Characteristics of Student and Staff Participants in Experiments 1 and 2

Participants	Gender	Age (Yrs)	Occupation	Program Year or Work Experience
Experiment 1				
P1	Female	25	Graduate student	Masters, Engineering
P2	Male	23	Undergraduate student	2nd year, Economics
P3	Male	22	Undergraduate student	3rd year, Psychology
P4	Female	21	Undergraduate student	3rd year, Psychology
P5	Female	22	Undergraduate student	5th year, Psychology
P6	Female	23	Undergraduate student	5th year, Psychology
P7	Female	25	Undergraduate student	2nd year, Nursing
P8	Male	23	Undergraduate student	4th year, Chemistry
P9	Female	27	Undergraduate student	3rd year, Film
P10	Female	32	Staff, Special education teacher	8 years
P11	Female	28	Staff, Music Therapist	6 years
Experiment 2				
P12	Female	43	Staff, Special education teacher	6 years
P13	Female	34	Staff, Special education teacher	3 years
P14	Male	25	Graduate student	Masters, School Psychology
P15	Male	25	Undergraduate student	3rd year, Economics
P16	Male	19	Undergraduate student	1st year, Engineering
P17	Male	36	Graduate student	PhD, Engineering
P18	Male	21	Undergraduate student	3rd year, Dentistry

Table 2

Mean (range) percent agreement in each condition for each phase (post-method, post-manual, post-video modeling, and retention/generalization) in Experiment 1.

	Post-method	Post-manual	Post-video modeling	Retention/ Generalization
Alone	91% (60-100%)	94% (82-100%)	96% (95-100%)	93% (88-98%)
Attention	95% (92-100%)	97% (90-100%)	94% (87-100%)	93% (83-98%)
Demand	87% (68-97%)	84% (75-93%)	79% (55-98%)	80% (55-100%)
Play	90% (75-100%)	92% (87-97%)	93% (83-98%)	87% (73-97%)

Table 3

Mean (range) ratings on the social validity questionnaire at post-method and post-manual in Experiments 1 and 2.

Statement	Post- Method	Post-Manual
Experiment 1 (*n* = 9)		
1. It is important to learn how to conduct functional analysis assessment.	4.3 (4-5)	4.1 (4-5)
2. The reading material was helpful in teaching me how to conduct functional analysis assessment.	4.3 (3-5)	4.4 (4-5)
3. The reading material was easy to read and understand.	3.9 (1-5)	4.3 (3-5)
4. I feel ready to conduct functional analysis assessment.	2.9 (1-4)	3.7 (2-5)
Experiment 2 (*n* = 7)		
1. It is important to learn how to conduct functional analysis assessment.	4.8 (4-5)	4.8 (4-5)
2. The reading material was helpful in teaching me how to conduct functional analysis assessment.	4.0 (3-5)	4.8 (4-5)
3. The reading material was easy to read and understand.	3.5 (2-5)	4.7 (4-5)
4. I feel ready to conduct functional analysis assessment.	2.8 (2-4)	4.5 (4-5)

Table 4

Participant's average performance at or above 85% accuracy during each condition in Experiment 1.

Phase	Condition	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
Post-Method Simulated Assessment	Alone	N	N	N	Y	Y	Y	N	N	Y	Y	Y
	Attention	N	N	N	N	Y	Y	N	N	N	N	N
	Demand	N	N	N	N	N	N	Y	N	Y	N	Y
	Play	N	Y	N	Y	N	N	N	Y	N	Y	Y
Post-Manual Simulated Assessment	Alone	Y	Y	Y	Y	Y	Y	Y	Y	–	Y	Y
	Attention	Y	N	Y	Y	Y	Y	Y	Y	–	Y	Y
	Demand	N	N	Y	Y	Y	Y	Y	N	–	Y	Y
	Play	Y	Y	N	Y	Y	Y	Y	N	–	N	Y
Post-Video Simulated Assessment	Alone	–	Y	Y	–	–	Y	Y	Y	–	–	Y
	Attention	–	Y	Y	–	–	Y	Y	Y	–	–	Y
	Demand	–	Y	Y	–	–	N	Y	Y	–	–	Y
	Play	–	Y	N	–	–	Y	Y	Y	–	–	Y
Retention/ Generalization	Alone	Y	–	N	Y	Y	–	Y	Y	Y	Y	Y
	Attention	Y	–	Y	Y	N	–	Y	N	Y	Y	N
	Demand	Y	–	N	N	N	–	N	N	N	N	Y
	Play	N	–	Y	Y	Y	–	Y	–	N	N	N

"Y" means at or above 85% accuracy. "N" means below 85% accuracy. "–" means not applicable.

Table 5

Mean (range) percent agreement in each condition for each phase (post-method, post-manual, post-video modeling, and retention/generalization) in Experiment 2.

	Post-method	Post-manual	Post- video modeling	Retention/ Generalization
Alone	99% (95-100%)	99% (95-100%)	100% (no range)	69% (43-95%)
Attention	96% (93-100%)	99% (98-100%)	100% (no range)	86% (58-100%)
Demand	84% (67-100%)	91% (83-98%)	94% (85-98%)	89% (54-100%)
Play	97% (90-100%)	97% (93-100%)	99% (98-100%)	94% (90-100%)

Table 6

Participant's average performance at or above 85% accuracy during each condition in Experiment 2.

Phase	Condition	P12	P13	P14	P15	P16	P17	P18
Post-Method Simulated Assessment	Alone	N	N	Y	N	Y	N	N
	Attention	N	N	Y	N	N	N	N
	Demand	N	N	N	N	N	N	N
	Play	N	N	N	N	N	N	N
Post-Manual Simulated Assessment	Alone	Y	Y	–	Y	–	Y	Y
	Attention	N	Y	–	Y	N	Y	Y
	Demand	N	Y	N	Y	Y	Y	N
	Play	N	N	Y	Y	Y	Y	Y
Post-Video Simulated Assessment	Alone	Y	Y	–	–	–	–	–
	Attention	Y	Y	–	–	Y	–	–
	Demand	N	N	Y	–	–	–	Y
	Play	Y	Y	–	–	–	–	–
Retention/ Generalization	Alone	Y	Y	Y	Y	Y	Y	Y
	Attention	Y	Y	Y	Y	Y	Y	Y
	Demand	–	Y	Y	Y	Y	N	N
	Play	Y	Y	Y	Y	N	N	N

"Y" means at or above 85% accuracy. "N" means below 85% accuracy. "–" means not applicable.

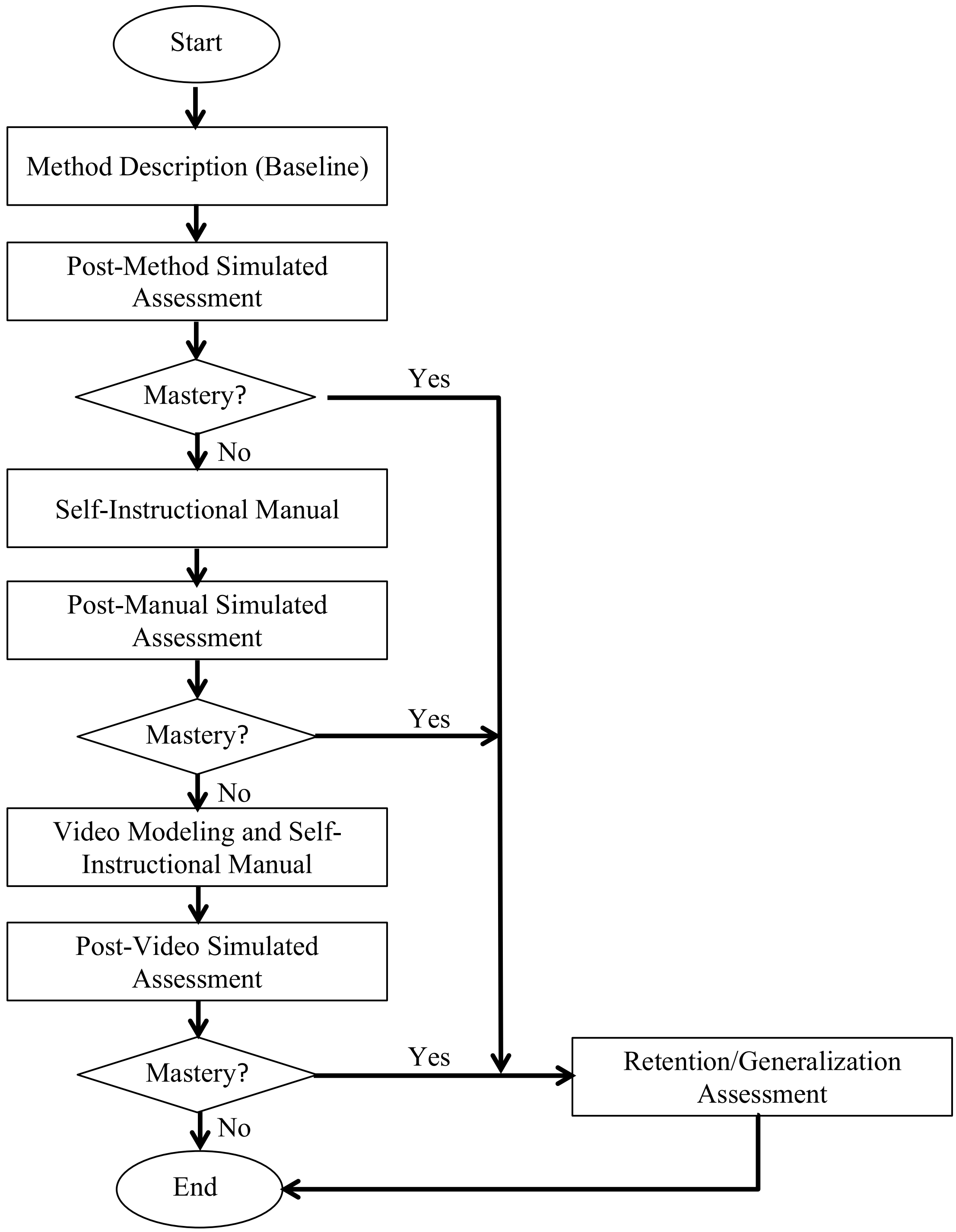

Figure 1. Overview of phases in Experiment 1.

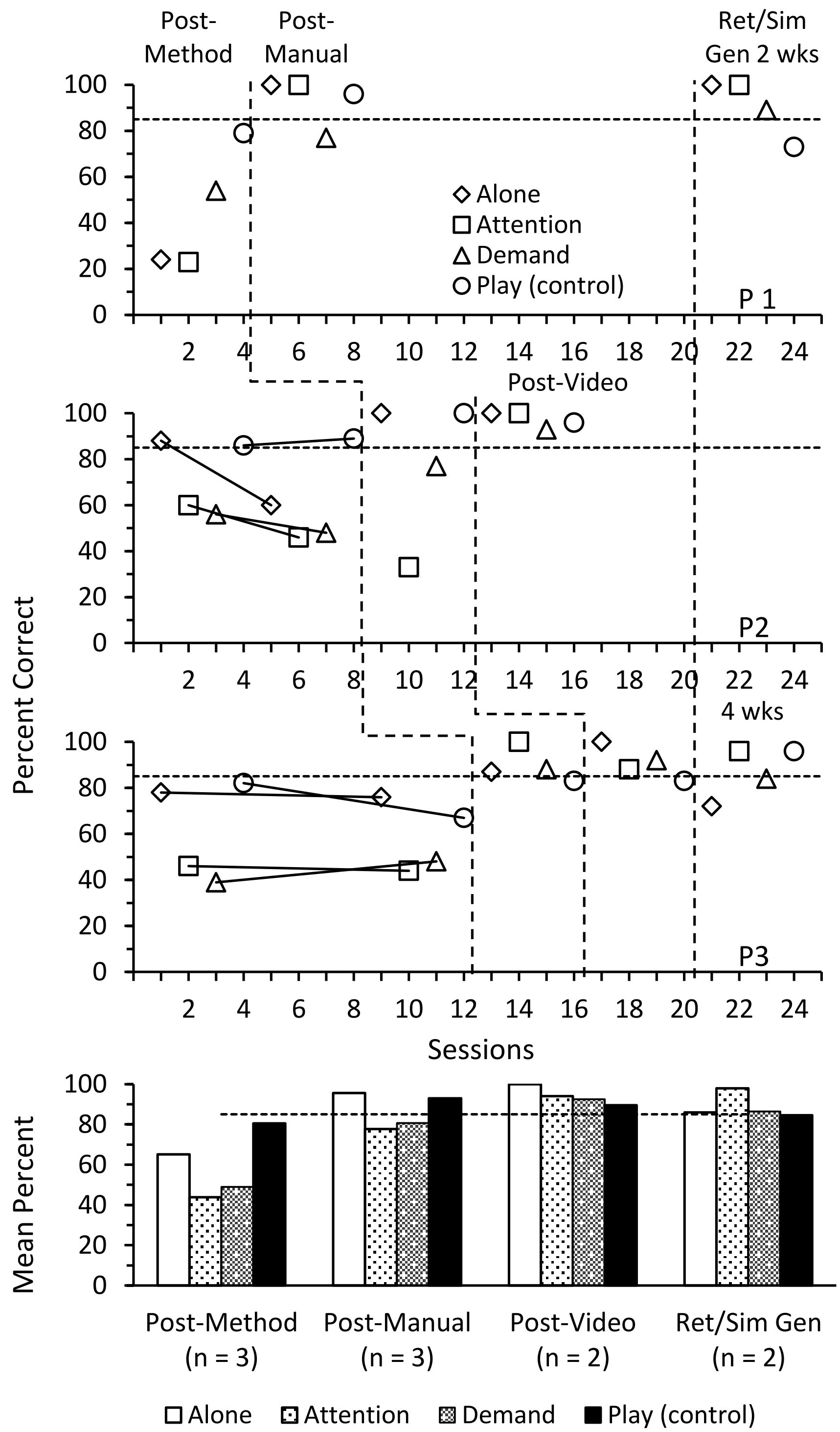

Figure 2. Performance accuracy (percent correct) of student Participants 1 through 3 during simulated assessments at post-method, post-manual, post-video, and retention/generalization. Horizontal line represents 85% correct. Bottom graph shows the means across participants.

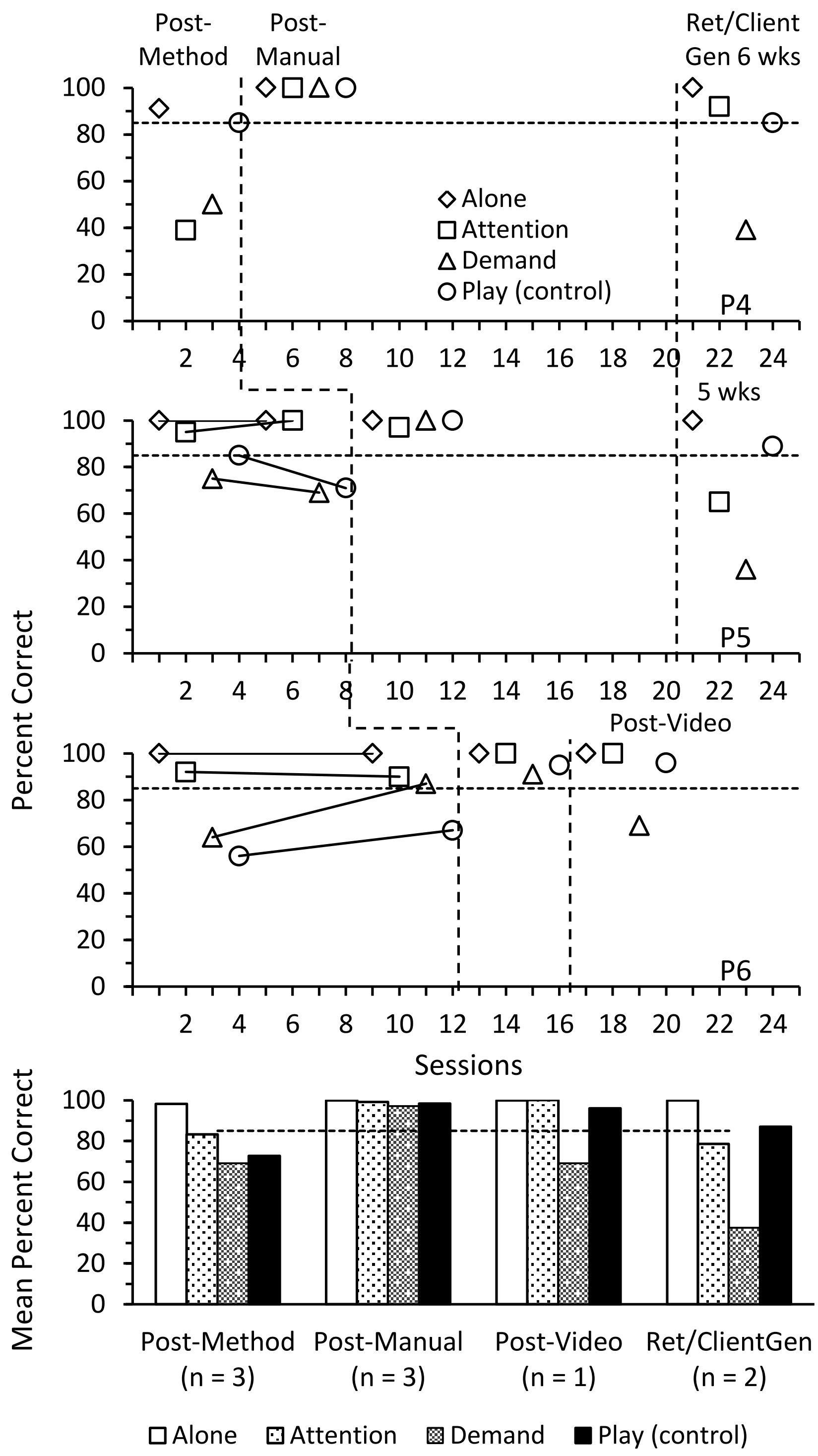

Figure 3. Performance accuracy (percent correct) of student Participants 4 through 6 during simulated assessments at post-method, post-manual, post-video, and client assessments at retention/generalization. Horizontal line represents 85% correct. Bottom graph shows the means across participants.

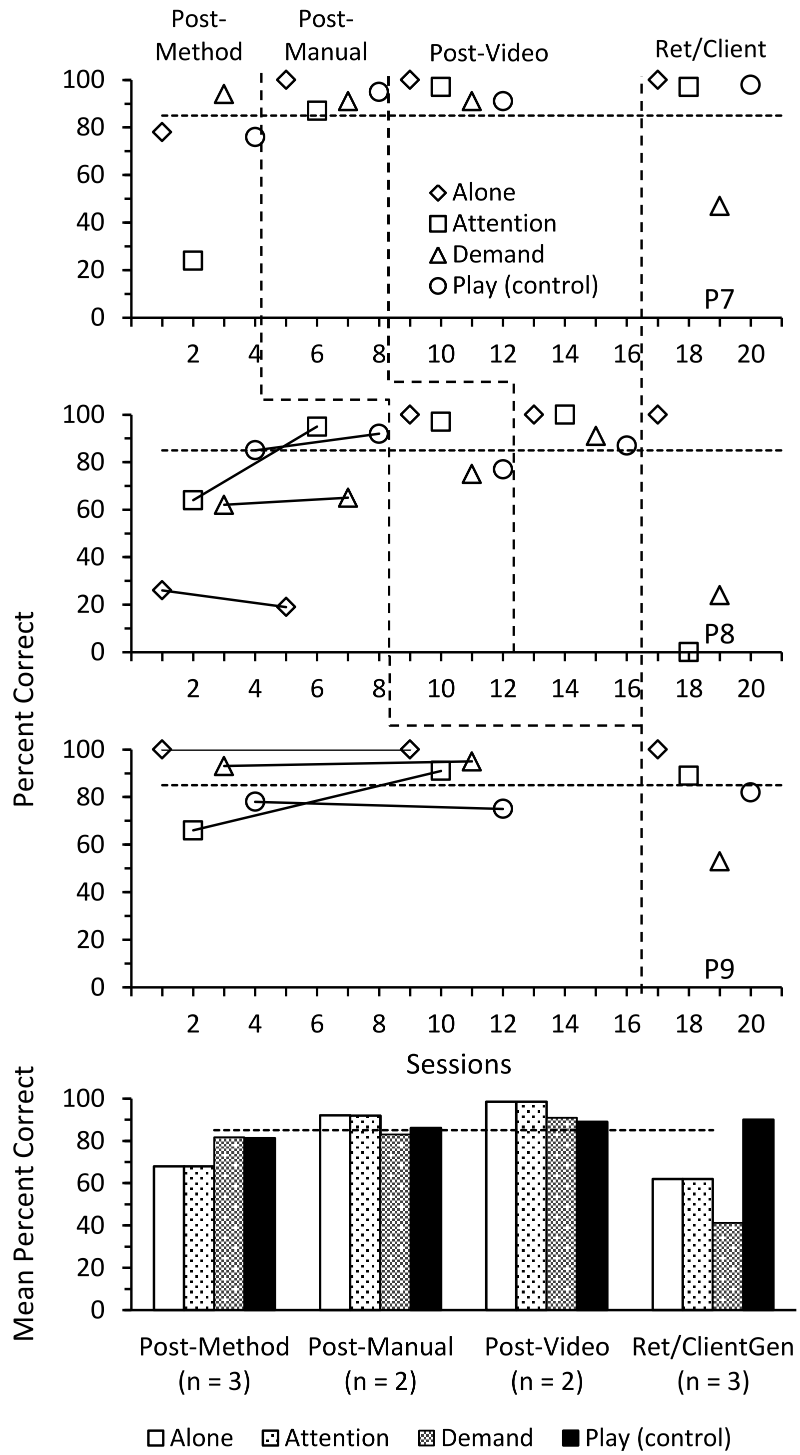

Figure 4. Performance accuracy (percent correct) of student Participants 7 through 9 during simulated assessments at post-method, post-manual, post-video, and client assessments at retention/generalization. Horizontal line represents 85% correct. Bottom graph shows the means across participants.

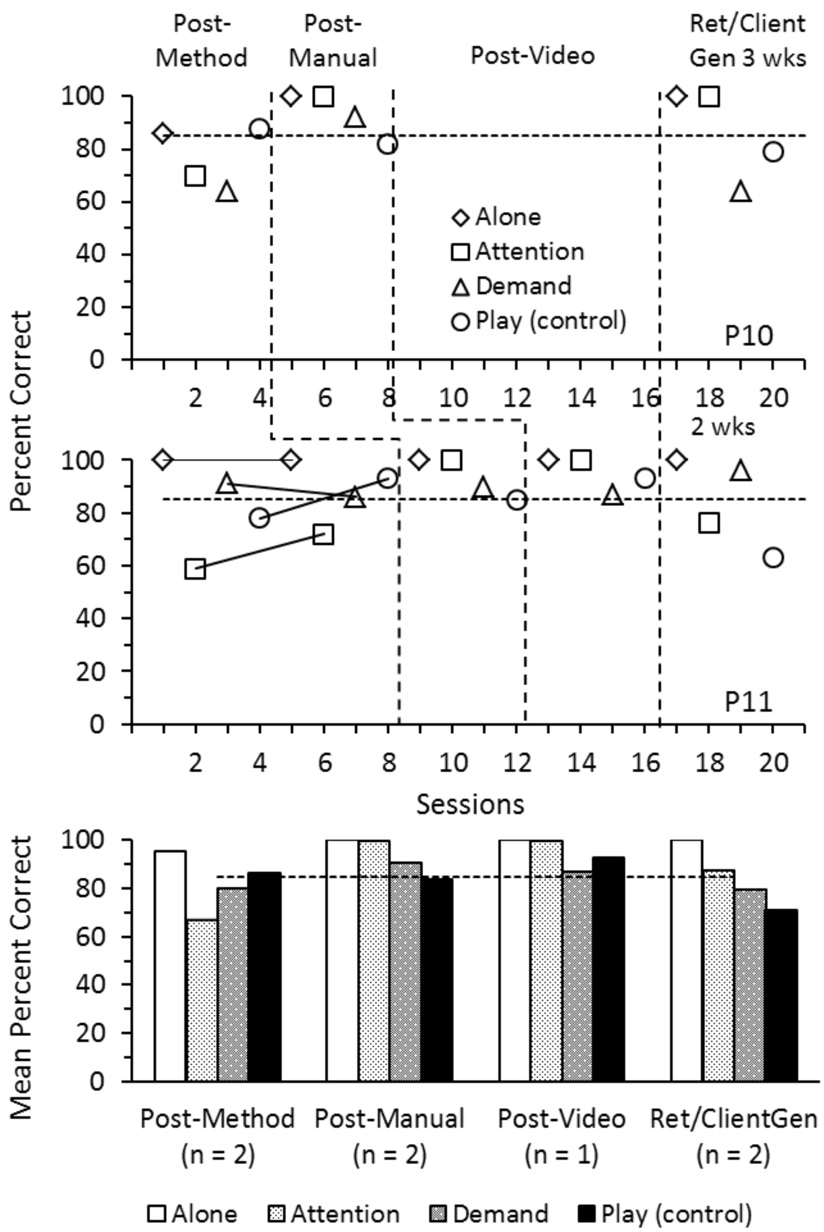

Figure 5. Performance accuracy (percent correct) of staff Participants 10 and 11 during simulated assessments at post-method, post-manual, post-video, and client assessments at retention/generalization. Horizontal line represents 85% correct. Bottom graph shows the means across participants.

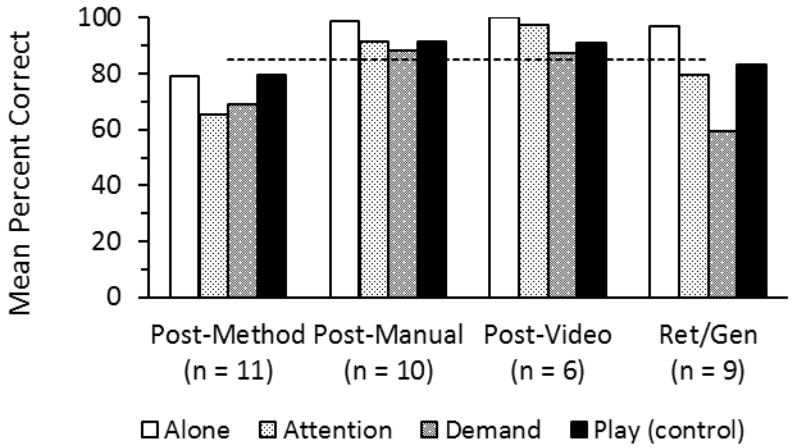

Figure 6. Mean performance accuracy (percent correct) of Participants 1 through 11 during assessments at post-method, post-manual, post-video, and retention/generalization. Horizontal line represents 85% correct.

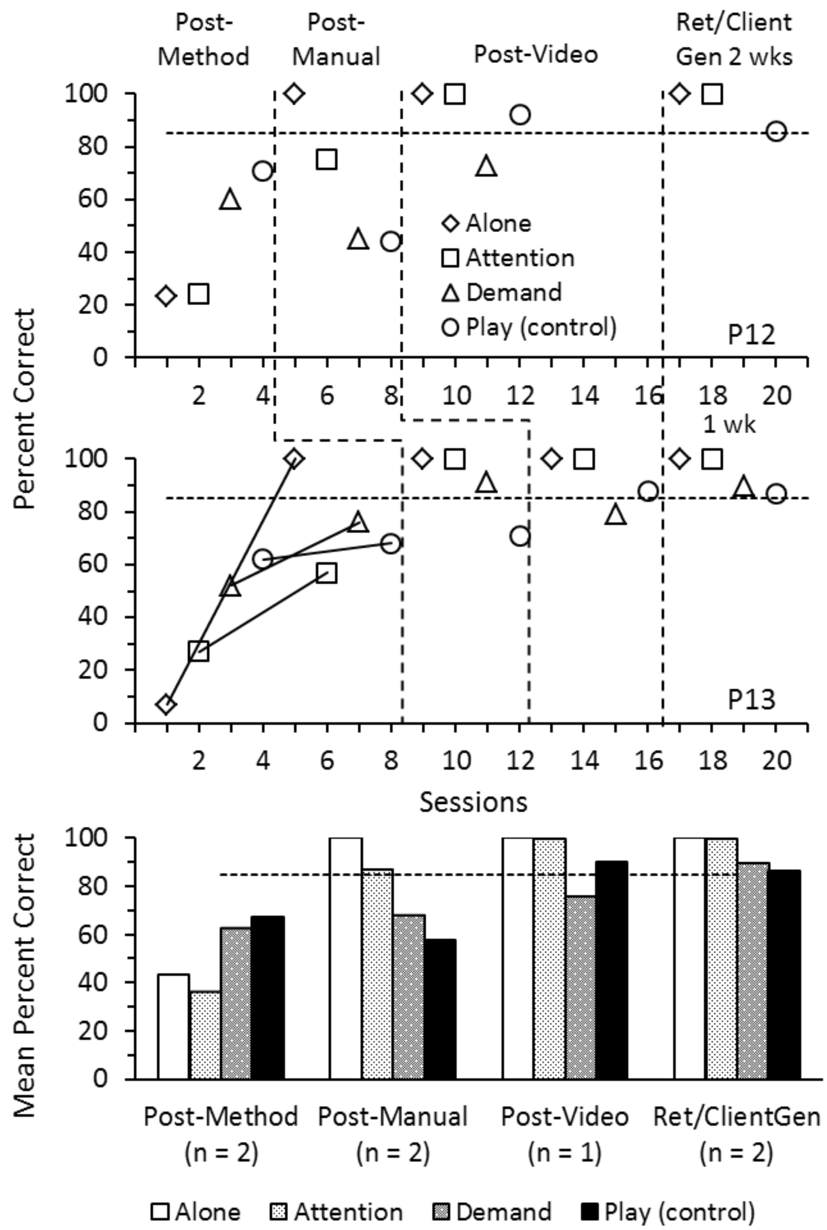

Figure 7. Performance accuracy (percent correct) of staff Participants 12 and 13 during simulated assessments at post-method, post-manual, post-video, and client assessments at retention/generalization. Horizontal line represents 85% correct. Bottom graph shows the means across participants.

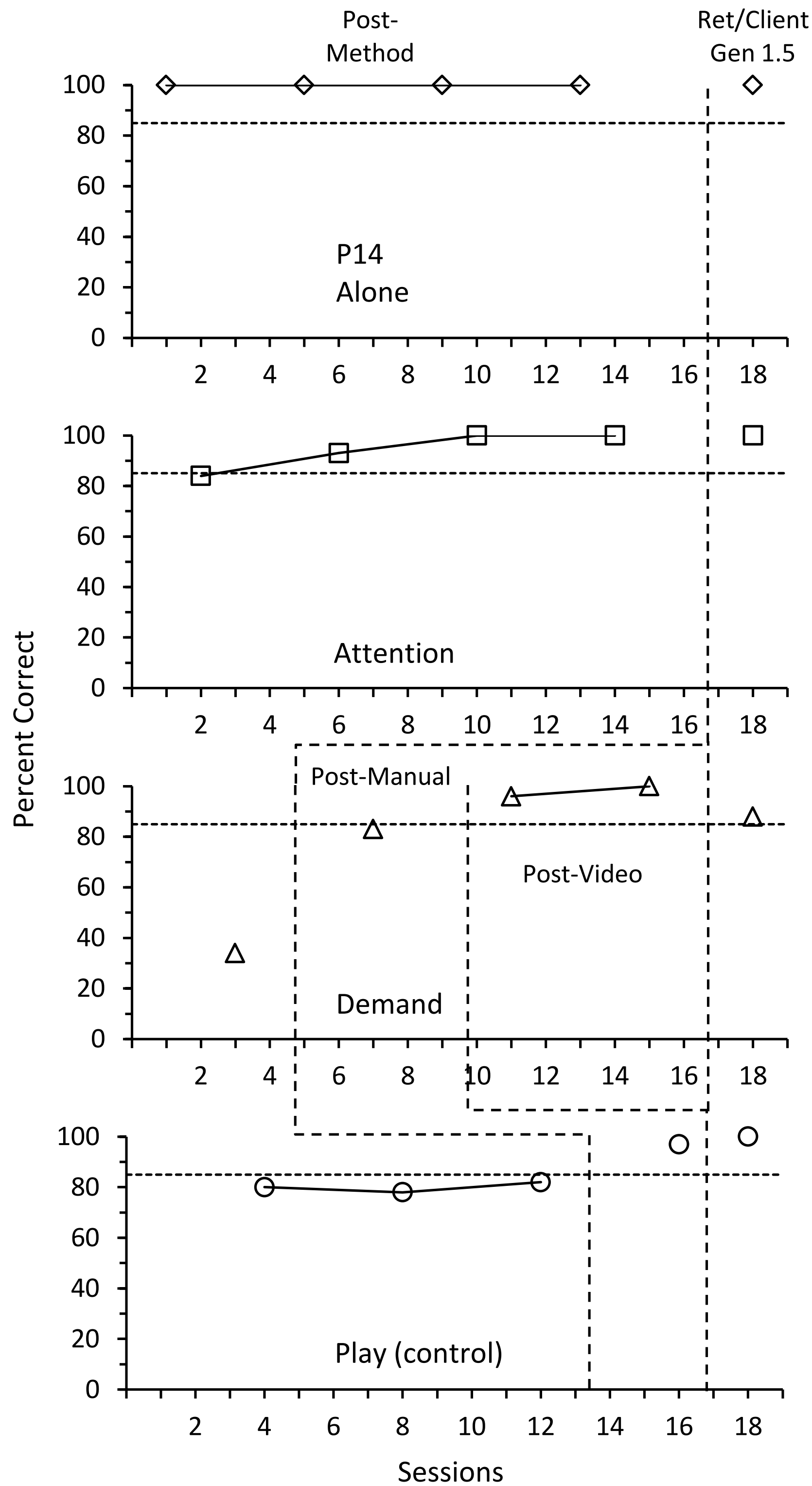

Figure 8. Performance accuracy (percent correct) of student Participant 14 during simulated assessments at post-method, post-manual, post-video, and client assessments at retention/generalization. Horizontal line represents 85% correct.

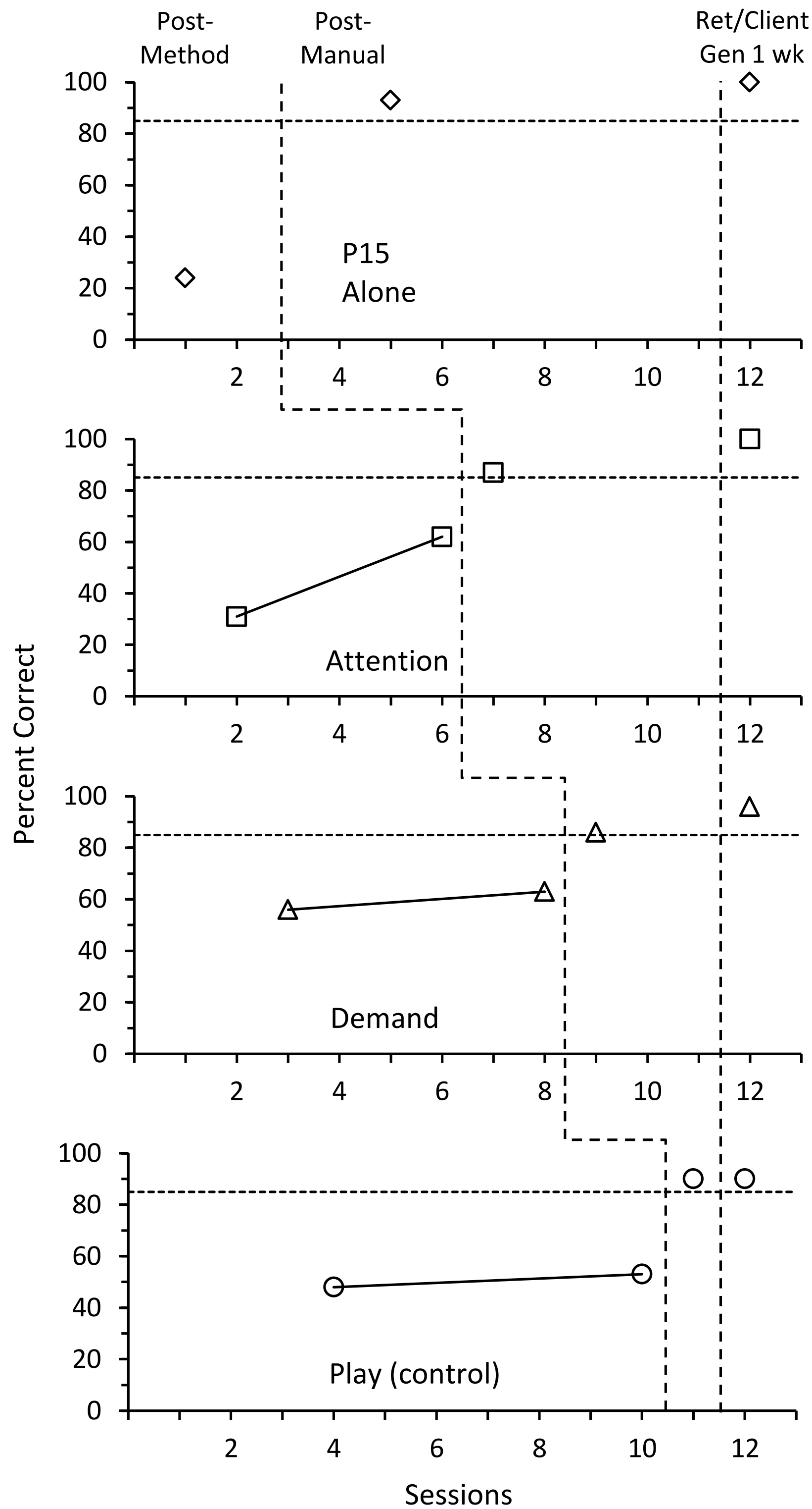

Figure 9. Performance accuracy (percent correct) of student Participant 15 during simulated assessments at post-method, post-manual, post-video, and client assessments at retention/generalization. Horizontal line represents 85% correct.

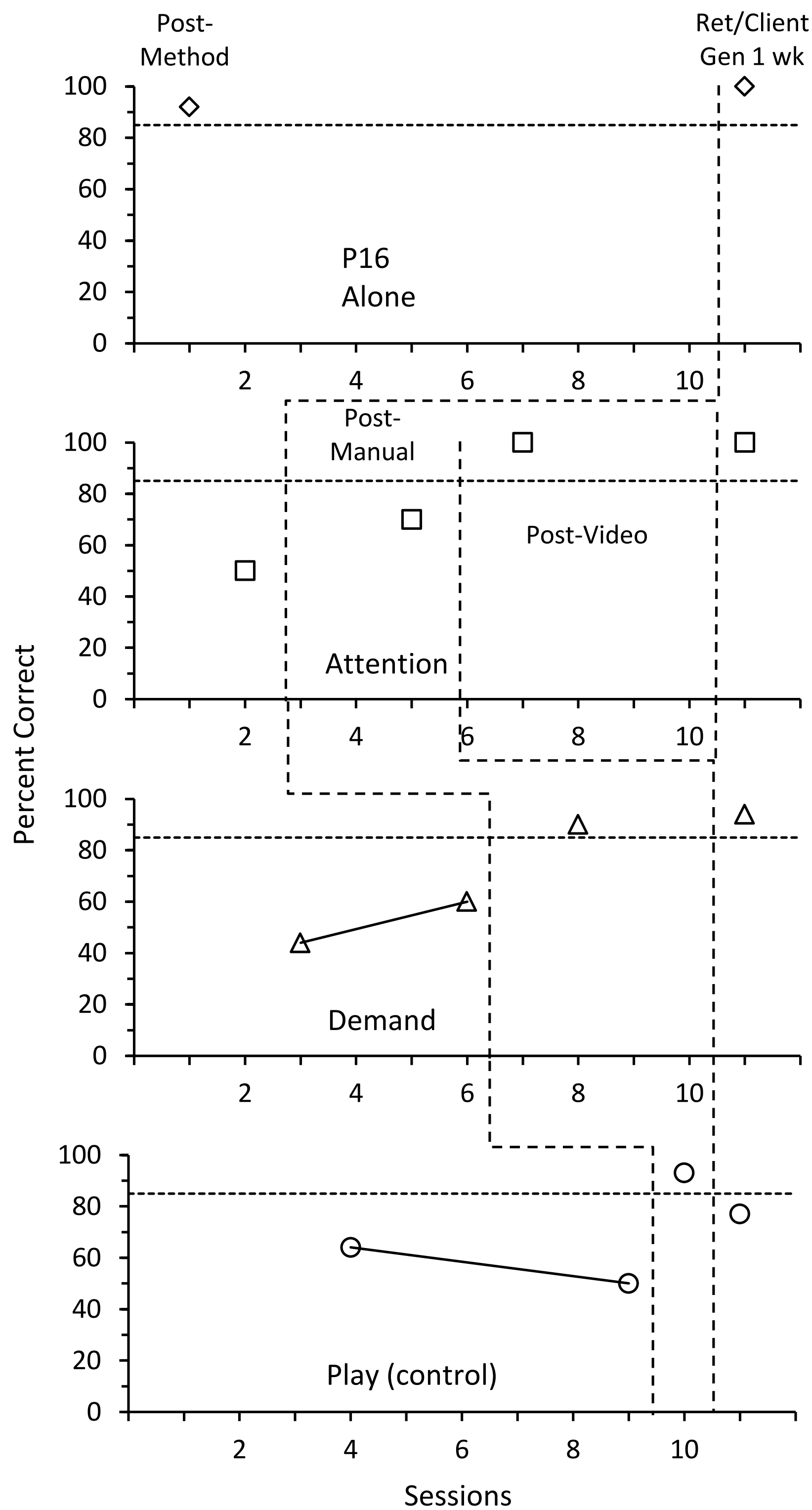

Figure 10. Performance accuracy (percent correct) of student Participant 16 during simulated assessments at post-method, post-manual, post-video, and client assessments at retention/generalization. Horizontal line represents 85% correct.

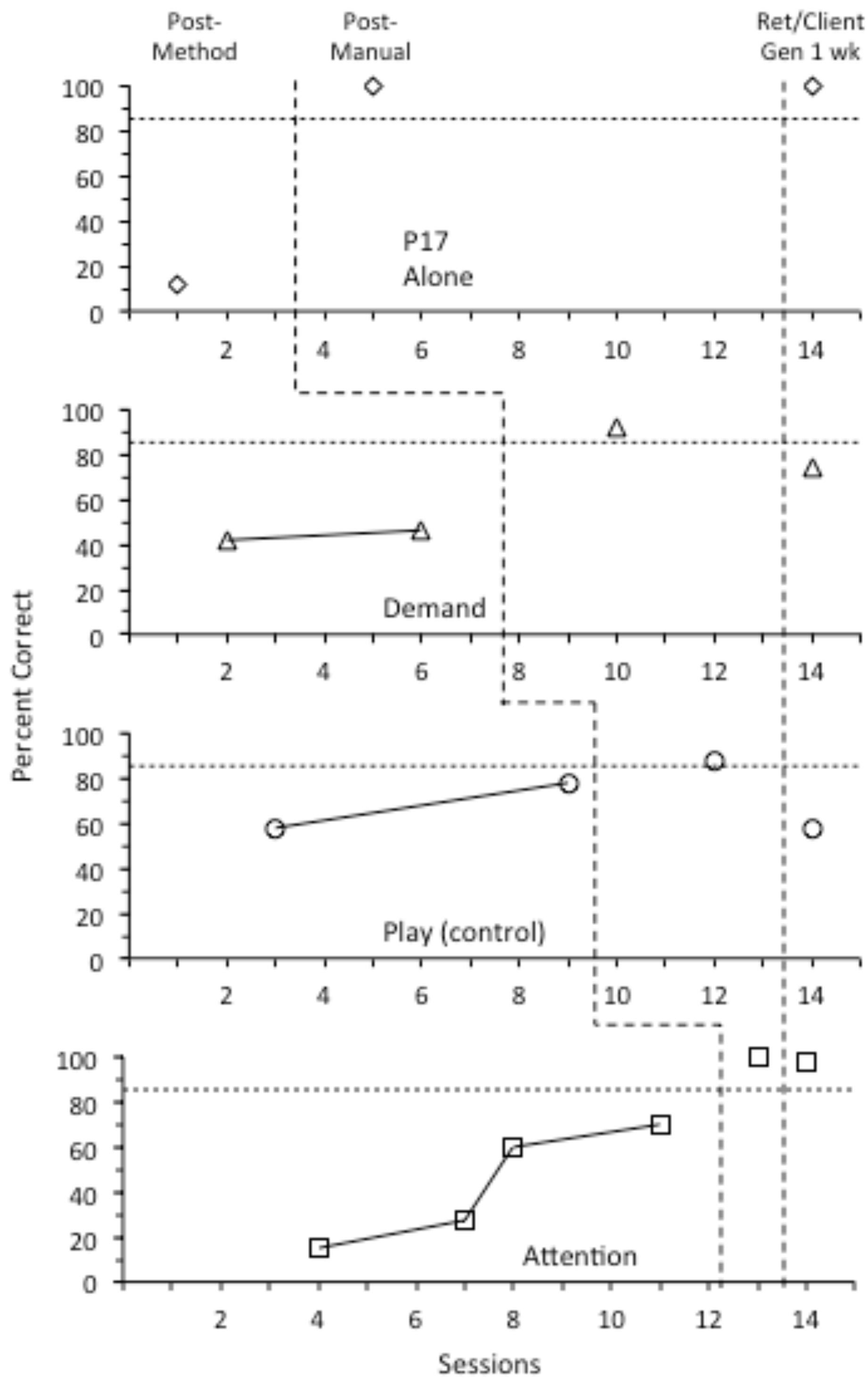

Figure 11. Performance accuracy (percent correct) of student Participant 17 during simulated assessments at post-method, post-manual, post-video, and client assessments at retention/generalization. Horizontal line represents 85% correct.

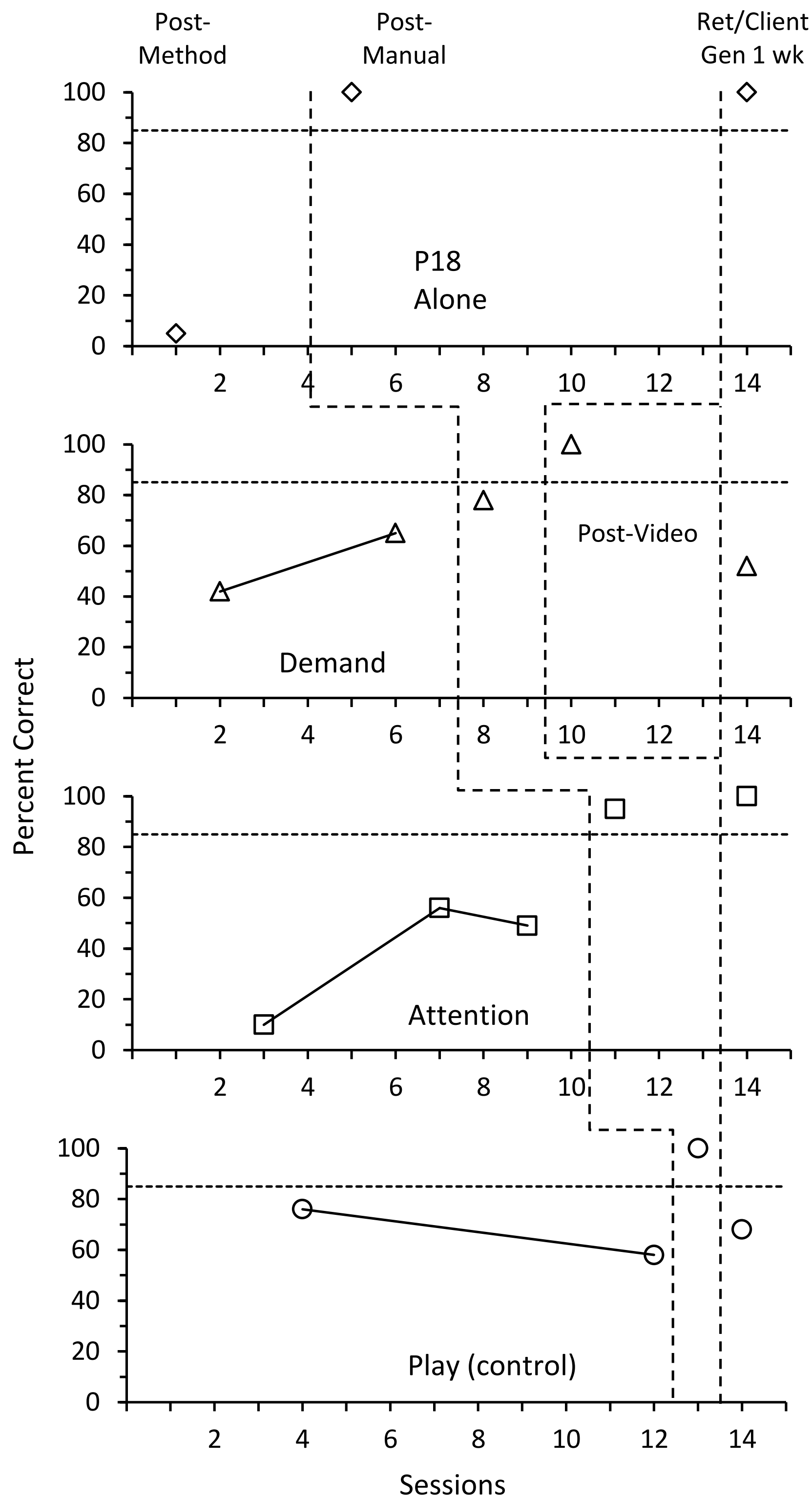

Figure 12. Performance accuracy (percent correct) of student Participant 18 during simulated assessments at post-method, post-manual, post-video, and client assessments at retention/generalization. Horizontal line represents 85% correct.

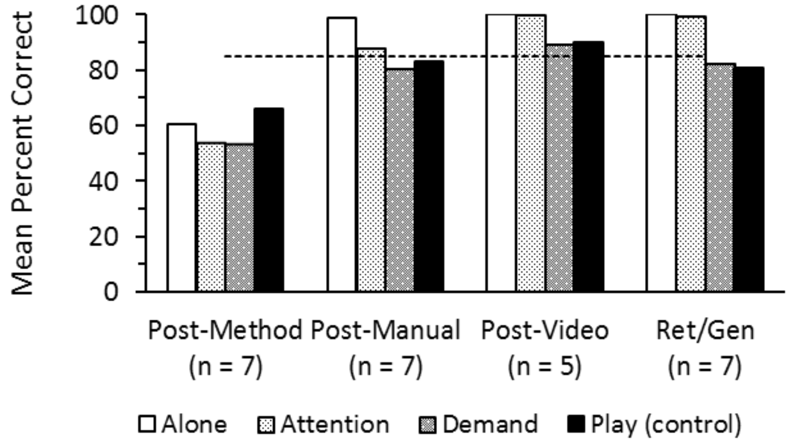

Figure 13. Mean performance accuracy (percent correct) of Participants 12 through 18 during assessments at post-method, post-manual, post-video, and retention/generalization. Horizontal line represents 85% correct.

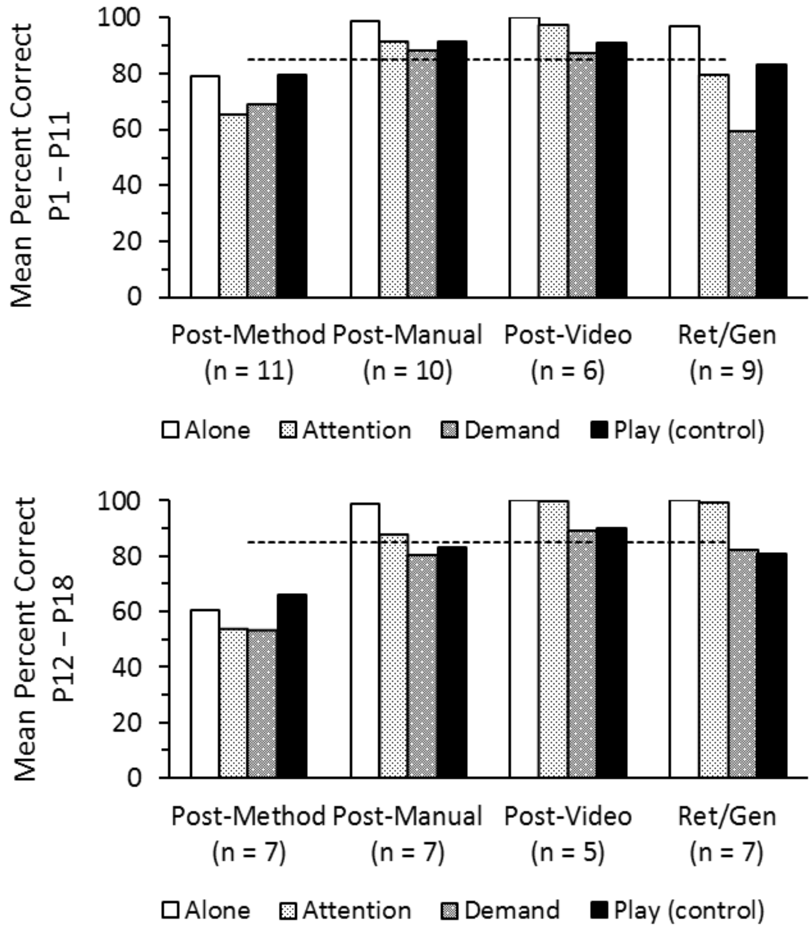

Figure 14. Mean performance accuracy (percent correct) of participants in Experiments 1 (top graph) and 2 (bottom graph) during assessments at post-method, post-manual, post-video, and retention/generalization. Horizontal line represents 85% correct.

Appendix A: Functional Analysis Target Behaviours and Sample Scoring Sheet

Alone/Ignore Condition

Correct Target Behaviour:

1. Not initiating any interaction with the client.
2. Not interacting with the client upon occurrence of target or non-target behaviours.

Incorrect Target Behaviour:

1. Initiating interaction with the client.
2. Interacting with the client upon occurrence of target or non-target behaviours.

Attention Condition

Correct Target Behaviour:

1. Not initiating any interaction with the client.
2. Not interacting with the client upon occurrence of non-target behaviours.
3. Interacting with the client upon occurrence of target problem behaviour in the same interval the behaviour occurred of in the following one.

Incorrect Target Behaviour:

1. Initiating interaction with the client.
2. Interacting with the client upon occurrence of non-target behaviours.
3. Not interacting with the client upon occurrence on target problem behaviour.

Demand Condition

Correct Target Behaviour:

1. Presenting a demand within 30 seconds from the beginning of sessions or from previous demand.
2. Not removing demand upon occurrence of error, no response, or occurrence of non-target behaviours. The trainee could either keep presenting the same demand or prompt the correct response.
3. Removing material upon occurrence of the target problem behaviour.
4. Removing demand upon occurrence of the target problem behaviour.

Incorrect Target Behaviour:

1. Not presenting a demand within 30 seconds from the beginning of sessions or from previous demand.
2. Removing demand upon occurrence of error, no response, or occurrence of non-target behaviours.
3. Not removing material upon occurrence of the target problem behaviour.
4. Not removing demand upon occurrence of the target problem behaviour.

Play (Control) Condition

Correct Target Behaviour:

1. Initiating interaction with the client within 30 seconds from the beginning of the sessions or from previous interaction.
2. Not interacting with the client for 5 seconds upon occurrence of non-target inappropriate behaviours.
3. Not interacting with the client for 5 seconds upon occurrence of target problem behaviour.

Incorrect Target Behaviour:

1. Not initiating interaction with the client within 30 seconds from the beginning of the sessions of from previous interaction.
2. Interacting with the client within 5 seconds upon occurrence of non-target inappropriate behaviours.
3. Interacting with the client within 5 seconds upon occurrence of the target problem behaviour.