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A Comparison of Functional and Preferred Reinforcers during FCT

Amie Cowl and Kristina K. Vargo
Sam Houston State University

Function-based interventions are used to decrease problem behaviors and increase appropriate behaviors in school settings. However, there may be situations under which the functional reinforcer cannot be identified or delivered. In this study, we compared the effectiveness of a functional reinforcer and a preferred reinforcer within a functional communication training (FCT) context with a third grade student with EBD. Results showed that both reinforcers were equally effective at reducing problem behaviors and increasing communicative responses in the classroom setting. The data suggest that under conditions in which a functional reinforcer cannot be delivered, a preferred reinforcer may be as effective.

Key words: behavioral interventions, challenging behavior, functional assessment

A Comparison of Functional and Preferred Reinforcers during FCT

Many students with social, cognitive, or behavioral disorders exhibit deficits in functional communication to express their wants and needs to teachers and caregivers. Functional communication training (FCT) is a function-based differential reinforcement procedure that involves teaching individuals to use an appropriate communication response (e.g., vocal request) in place of an inappropriate behavior (e.g., aggression or disruption; Carr & Durand, 1985). For example, a teacher may identify that a student engages in problem behavior in the form of talking out to get attention from peers and adults. By using FCT, the teacher would identify a more appropriate attention-seeking behavior (e.g., saying “excuse me”) to prompt and reinforce while ignoring each instance of inappropriate behavior.

Over the past 30 years, FCT has emerged in the literature as one of the most published function-based treatments for problem behavior (Tiger, Hanley, & Bruzeck, 2008). Tiger et al. identified several necessary conditions for FCT to be successful. One condition requires conducting a functional assessment (specifically, a functional analysis [FA]) to identify the environmental events that maintain the problem behavior (e.g., attention, escape, tangibles, sensory). Conducing an experimental FA is the most accurate way to identify a behavior’s function because an FA involves exposing the student to different conditions under which the problem behavior may occur (Iwata, Dorsey, Slifer, Bauman, & Richman., 1982/1994; Tiger et al., 2008). This step is arguably the most critical in the process of identifying a successful intervention because if a teacher or therapist does not

Amie Cowl and Kristina K. Vargo, College of Education, Sam Houston State University. Correspondence concerning this article should be sent to Kristina K. Vargo, Sam Houston State University, Teacher Education Center 138, Huntsville, TX 77341.
Email: kkv003@shsu.edu

identify the correct function, the remainder of the intervention may be compromised. To illustrate, if a problem behavior is maintained by escape from difficult tasks, and the teacher incorrectly identifies the behavior as attention maintained, the (incorrect) function-based intervention (i.e., withholding attention) may serve to increase the behavior instead of decreasing it. Incorrect identification of the function may then lead to a counter-therapeutic intervention, increased time and resources, and more problem behavior.

Once the function of the problem behavior has been correctly identified, a socially-acceptable communicative response is taught to replace the problem behavior. Examples of communicative responses might include signs, picture card exchanges, microswitch selections, or vocal statements. The reinforcer used to teach these responses is the same reinforcer identified as the maintaining reinforcer for the problem behavior. That is, the reinforcer is reassigned and provided contingent upon an appropriate communicative response and often withheld following the occurrences of the problem behavior (Falcomata, Ringdahl, Christensen, & Boelter, 2010). For example, an individual who engages in problem behavior to escape difficult tasks might be taught to request a break from the task by signing “finished” or saying “Can I have a break please?” (Hagopian, Fisher, Sullivan, Acquisto, & Leblanc, 1998). Each instance of signing “break” or vocally requesting a break is followed by removal of the task (i.e., escape); problem behavior results in a continuation of task demands (no break).

The effectiveness of FCT for decreasing problem behaviors while simultaneously increasing appropriate behaviors has been demonstrated across several studies (e.g., Davis, Fredrick, Alberto, & Gama, 2012; Durand & Carr, 1991; Heath, Ganz, Parker, Burke, & Ninci, 2015). However, when implementing interventions in the natural environment it is important to recognize that there may be contextual constraints (e.g., setting) that effect the efficacy and efficiency of the treatment. In clinical and residential settings, it is common to conduct an analogue FA (Iwata et al., 1982/1994) to determine what variables are responsible for maintaining problem behaviors. In contrast, FAs (including procedural variations such as trial-based FAs [Lambert & Bloom, 2012; Rispoli, Ninci, Neely, & Zaini, 2013; Sigafoos & Saggers, 1995]) are not always feasible or socially acceptable in public school districts. The systematic manipulations necessary for FAs can be more difficult, time consuming, and labor-intensive than other assessments (Lloyd et al., 2015). School administrators may also be unwilling to approve FAs because of their focus on evoking problem behaviors (Desrochers, Hile, & Williams-Moseley, 1997; Repp, 1994). As a result, school districts commonly use non-experimental assessments to identify the function of behavior, which may not always yield accurate results (Iwata, DeLeon, & Roscoe, 2013).

Without accurate identification of the functional reinforcer, teachers may choose to implement non-function based interventions such as the delivery of preferred items. The non-function based items (preferred items) may be used if the setting (e.g., school) or other variables (e.g., time) restrict the experimental identification of the function (Fischer, Iwata, & Mazaleski, 1997), but are somewhat limited in their support when compared to function-based interventions. Fischer et al. showed that arbitrary reinforcers (reinforces that are not related to the function of the target behavior) could sometimes be substituted for the functional reinforcers using noncontintingent reinforcement when those reinforcers could not be identified or withheld during the course of treatment. Similarly, Austin and Tiger (2015) used alternative (preferred) reinforcer during an FCT procedure to decrease dependence on the functional reinforcer during delay training. Specifically, when participants were presented with the alternative reinforcer during the delays, aggression decreased and functional

communicative responses maintained at high rates. In addition Fisher, Kuhn, and Thompson (1988) found that differential reinforcement of communication using functional and arbitrary reinforcers both decreased problem behavior.

Despite the vast amount of the evidence demonstrating the effectiveness of FCT with functional reinforcers, some situations (public schools) may preclude the identification of functional reinforcers resulting in the use of non-function based interventions. Therefore, it is necessary to identify whether an alternative strategy (delivery of preferred items) results in decreased problem behavior and increased appropriate behavior when used in the context of FCT. The purpose of this study was to compare the effectiveness of a functional reinforcer and a preferred reinforcer within an FCT context in the classroom setting with a child with an emotional behavior disorder (EBD).

Method

Experimental Design

A multielement design (Ulman & Sulzer-Azaroff, 1975) embedded within a reversal design (Baer, Wolf, & Risley, 1968) was used in which the FCT style intervention alternated between the delivery of functional and preferred reinforcers. The multielement design demonstrates experimental control through rapid alternation of different levels of the independent variable with observed separation between the data paths. In this study, the reinforcer type alternated rapidly during the intervention component. The reversal design demonstrates experimental control when the observed data change as a direct result of the implementation or removal of the independent variable (intervention). Problem behaviors and requests were observed during baseline and intervention phases.

Participants, Setting, and Materials

Greg was a nine year old third grade student with EBD who was recruited for the study because of teacher reports of multiple disruptive behaviors per day throughout the school setting. He was diagnosed by a district licensed school psychologist. His behavior problems (elopement, out-of-seat behavior, talking out, noncompliance with demands, and swearing) often interfered with classroom performance resulting in poor grades; however, Greg was on track to master a majority of the 3rd grade curriculum. Greg demonstrated an inability to build or maintain satisfactory interpersonal relationships with peers and teachers, inappropriate types of behavior or feelings under normal circumstances, and a general pervasive mood of unhappiness or depression.

The educational setting goal was for Greg to be primarily educated in the general education classroom with 20 other students. However, he often spent time in the Behavior Support Classroom (BSC) as a result of problem behaviors. The BSC contained only four other students and provided one-to-one teacher attention and academic assistance. Greg's BSC teacher used a token economy to award or remove points based on emission of appropriate and problem behaviors, and he could earn points to return to the general education classroom early. While in the BSC, Greg was only able to attend social activities (special classes, recess, lunch) with peers from the BSC and not the general education setting. The BSC was structured such that it was less reinforcing than the general education classroom in an effort to promote appropriate behavior in the general education setting. Research sessions were conducted during regular school hours in the BSC at a table with two chairs arranged in the center of the classroom. We were unable to conduct initial research sessions in the general education setting due to distracting the other 20 students. Materials included data collection sheets, a timer, pencils/paper, a video camera, academic tasks, and preferred items.

Data Collection

The problem behaviors were inappropriate vocalizations (work refusal statements and swearing) and out-of-area behavior (being more than one foot from the assigned work space). We also recorded the number of trained appropriate requests emitted, which included "Can I have my iPad" for the preferred reinforcer condition and "Can you talk to me" for the functional reinforcer condition. Untrained, appropriate functionally equivalent responses (e.g., "Talk to me, please.") were also reinforced during the respective conditions. Data were collected using 10-s partial interval recording throughout the FA and the intervention phases. During the preference assessment, we recorded the percentage of selections of items. During the reinforcer assessment, data were collected on the cumulative number of responses. All sessions were videotaped for data collection purposes and scored immediately following the sessions.

Interobserver Agreement, Procedural Integrity, and Social Validity

Interobserver agreement (IOA) was assessed for at least 25% of all sessions of each phase of the study by having a second observer watch the videos and record the data. The IOA data collector was trained using behavioral skills training (Miltenberger, 2016) until she reached 90% agreement with the experimenter. IOA was scored using occurrence agreement (number of intervals with agreements of occurrences divided by the number of intervals with at least one occurrence, multiplied by 100) for the FA and intervention assessment. IOA scores were 100% for all phases except the reinforcer assessment. Due to an experimenter error with the video camera, IOA was not scored for the reinforcer assessment.

Procedural integrity data were scored by having an observer record data on the experimenter's implementation of the procedures for at least 25% of all sessions throughout each phase of the experiment. A task analysis of the procedures was developed and another individual recorded the percentage of steps that were completed correctly. The mean procedural integrity scores were 96.8% (range, 75% to 100%) for the FA, 96.5% (range, 86% to 100%) for the reinforcer assessment, and 100% for the intervention.

Procedures

Pre-assessments. A paired choice preference assessment (Fisher et al., 1992) was conducted to identify preferred items for the FA and intervention. The experimenter identified five items based on teacher and staff recommendations. Prior to the assessment, Greg was given 2 min to engage with each item. The items were then removed and two objects were presented simultaneously and side-by-side on the table in front of Greg. The experimenter instructed him to "pick one," and contingent on a selection, the experimenter gave Greg 30 s access to the item. Trials continued until each item was paired with every other item. The percentage of selections was calculated and items were ranked from most preferred (highest percentage of selection) to least preferred (lowest percentage of selection). In the event that multiple items were selected for the same percentage of selections, the item that was selected when the two items were paired with each other was ranked higher.

A functional behavior assessment was then conducted to identify the function of problem behavior, which included indirect assessments (Motivation Assessment Scale [MAS] and Functional Assessment Screening Tool [FAST]) and an FA. For both indirect assessments, the experimenter sat with the BSC teacher and asked her the questions. Data were analyzed to identify consistencies across

assessments and whether there was a clear function identified. A structured observational analysis was not conducted due to teacher and administrator pressure to decrease problem behavior quickly and decreased time in the general education setting (due to problem behavior).

To clarify the findings of the indirect assessments, an FA was conducted during which Greg was exposed to control, attention, and demand conditions based on the procedures of Iwata et al. (1982/1994). Previous research has suggested that tangible item conditions should only be tested if there is sufficient evidence to warrant their inclusion because of the high likelihood of a false positive outcome (Rooker, Iwata, Harper, Fahmie, & Camp, 2011; Shirley, Iwata, & Kahng, 1999). Conversations with Greg's teacher and informal observations by the experimenter did not indicate that problem behavior was related to the removal of tangible items; therefore, a tangible item condition was not included in the FA.

All FA sessions were 5 min and were conducted up to five times per week. In the control condition, Greg and the experimenter were seated at a table with all items from the preference assessment available. No demands were given and the experimenter delivered continuous attention throughout the session. No programmed consequences were provided following problem behaviors. In the attention condition, the experimenter provided the student with a low to moderately preferred item (picture folder) and said, "I have some work to do," while directing her attention toward a reading task. All non-target behaviors were ignored and brief statements of disapproval were provided contingent on the target behaviors. In the demand condition, Greg was instructed to complete difficult tasks (spelling words on paper) identified by his teacher. His teacher stated that spelling tasks frequently evoked problem behaviors in the form of out-of-seat behavior, swearing, and task refusal. These tasks also had an extremely low rate of independent completion in the classroom. Failure to comply resulted in a three step least-to-most prompt sequence (i.e., verbal, model, physical). Contingent on a target behavior, the task was removed for 30 s, after which it was re-presented. Brief praise was provided following independent and modeled responses. All other non-target behaviors were ignored.

A concurrent schedule reinforcer assessment was conducted to identify a high preferred item that served as a reinforcer (i.e., resulted in a behavior increase) and could be used as the preferred reinforcer during intervention. Sessions lasted 5 min or until Greg ceased working for 2 min. During baseline, Greg was given a worksheet with mastered tasks (2^{nd} grade level math problems). The math problems were selected as an "easy" task because they were mastered during the previous school year, and Greg's teacher reported a high rate of independent completion of math tasks. At the beginning of the sessions, he was told he could do as much or as little work as he wanted, and no feedback or items were provided. During the reinforcer assessment, Greg was given two different colored, but identical worksheets containing the same mastered tasks as baseline. The experimenter instructed Greg that he could earn tokens to exchange for access to his high preferred items by completing problems on each worksheet. Each token was worth 10 s access to an item, and one token was delivered contingent upon each correct response. The iPad was available contingent upon completing work on the blue paper and access to a coloring sheet was contingent on completing work on the red paper (Piazza, Fisher, & Hagopian, 1996). Each potentially reinforcing item was placed behind its corresponding worksheet so that it was in sight but out of reach of the student. The experimenter then told Greg to complete as few or as many problems as he wanted. At the end of the session, tokens were exchanged for access to the item(s).

Intervention. The condition identified as maintaining the problem behavior during the FA was used as the intervention context for Greg. The final three attention condition sessions from the FA were used as baseline data due to the high rates of responding and teacher and administrator preference to move to intervention quickly. Baseline sessions were conducted the same as the FA attention

condition sessions. Attention in the form of brief reprimands was provided contingent upon problem behaviors and all other behaviors were ignored.

Following baseline, a discrete trial procedure (Fisher et al., 1998) was used to teach Greg the communicative responses associated with the functional and preferred reinforcers. The experimenter conducted training sessions in blocks of 10 trials, and the mastery criterion was met when the appropriate response occurred for 100% of the trials during two consecutive sessions. The experimenter presented Greg with two colored cards and told him that when the green card was present and he engaged in the appropriate communication response ("Can you talk to me?"), the functional reinforcer (attention) would be provided. When the yellow card was present, the response of "May I have my iPad, please?" was reinforced with the preferred reinforcer (iPad). Once the student engaged in the requests in the presence of each of the cards within 5 s, we alternated between the functional and preferred reinforcer conditions to identify which reinforcer increased requests and decreased problem behaviors most effectively and efficiently.

Intervention sessions were conducted similarly to baseline sessions except for a contingency reversal. That is, during both intervention conditions, appropriate requests were immediately reinforced with either attention (functional reinforcer condition) or the iPad (preferred reinforcer condition), and problem behavior was ignored. The interventions differed only in the type of reinforcer (functional or preferred) that was provided. Following a stable pattern of responding during intervention, we returned to the baseline phase to identify whether the intervention was necessary to maintain appropriate requests and low levels of problem behavior. We then reversed back to the intervention phase to replicate the findings.

Results

The results of the preference assessment are shown in the top panel of Figure 1. Greg's highest preferred items were the coloring sheet and the iPad, which were equally selected during 80% of trials. The coloring sheet and iPad were then used in the reinforcer assessment to identify if the high preferred items served as reinforcers that could be used during the preferred reinforcer component of intervention. The bottom panel of Figure 1 depicts the results of the reinforcer assessment. During the baseline phase of the reinforcer assessment, Greg engaged in responding during the first two sessions before engaging in no responses for three sessions, suggesting that completion of the work task alone was not automatically reinforcing. During the reinforcer comparison phase, Greg initially allocated responding similarly between the worksheets associated with the each preferred item. However, during the latter sessions, Greg allocated the majority of responses to the worksheet associated with the iPad and not the worksheet associated with the coloring sheet. When we reversed back to baseline and provided no reinforcers contingent on responding, Greg emitted few responses. These data suggested that the iPad was a reinforcing stimulus and was selected as the preferred reinforcer for intervention.

Results from the MAS and FAST were mixed, and it was unclear whether the behavior was multiply maintained (attention and escape). The MAS suggested that the function of problem behavior was attention; however, Greg received equal, high scores for both the social attention and social escape reinforcement categories with the FAST. These mixed results indicated that a clear function was not identified via indirect assessments, which warranted an FA. Figure 2 shows the results of Greg's FA which revealed that his behavior was maintained by attention alone. There was a consistent increase in the percentage of intervals with target behaviors from 27% in session 8 to 83% by session 14, and 100% by session 20. Problem behaviors did not occur in the control and demand conditions, verifying that Greg's problem behaviors were maintained by attention alone and not also by escape.

Figure 3 shows the results from the intervention, which compared the effects of functional and preferred reinforcers. The results show that both reinforcer types were equally effective at decreasing problem behaviors and increasing appropriate communication responses. In the initial baseline phase, there was a high, stable level of problem behaviors. When the intervention was implemented, problem behaviors immediately dropped to zero and maintained across both reinforcer conditions. The trained appropriate response occurred during approximately 33% of intervals, which equates to almost 100% of the opportunities Greg could request items when he did not have access. These data show that Greg was maximizing reinforcement and asking for only the available reinforcer in the relevant condition when he did not have access. We then returned to baseline, during which problem behaviors increased to levels (nearly 70% of the intervals within 3 sessions) consistent with the initial baseline phase. During the second intervention phase, problem behaviors decreased to zero and requests increased to approximately 33% of the intervals, replicating the findings from the first intervention phase.

Discussion

The results of this study showed that both functional and preferred reinforcers were equally effective at reducing problem behaviors and increasing appropriate communication in a school setting for a young boy with EBD. Prior to intervention, Greg engaged in high rates of problem behavior and did not appropriately communicate his wants or needs. Following training, Greg engaged in maximally effective responding to gain access to a preferred reinforcer (iPad) and a functional reinforcer (attention). These data replicate the Fisher et al. (1998) study, which also showed that nonfunctional (preferred) reinforcers could be effective at decreasing problem behaviors. Additionally, these results extend the findings of Austin and Tiger (2015) that showed that problem behavior during FCT delay fading (with the functional reinforcer) could be decreased with the delivery of an alternative preferred reinforcer (Xbox). Our study extended those findings by showing that a preferred reinforcer could be substituted for the functional reinforcer during FCT. These data suggest that a powerful reinforcer (iPad) may be used to briefly override existing contingencies (deprivation of attention); however, it is unclear which characteristics or properties of the preferred reinforcer were necessary for this effect to occur.

The findings from this study should be interpreted with caution for teachers when deciding to use preferred or functional reinforcers. We chose to compare the efficacy of functional and preferred reinforcers because they are both commonly used categories of reinforcers within the classroom setting. Nevertheless, we recommend that teachers strive to use functional reinforcers whenever possible due to the overwhelming evidence of their effectiveness. Research shows that two features of an effective FCT program include continuous and immediate delivery of the functional reinforcer (Tiger, Hanley, & Bruzek, 2008), but there are some situations under which functional reinforcers may not accessible (e.g., lack of resources) or feasible (e.g., large group instruction) for teacher delivery, necessitating other strategies. Our study only assessed the effects of one preferred item that was shown to have reinforcing effects through a formal concurrent reinforcer assessment, which may not always be possible in the school setting. Therefore, future research might investigate what parameters define preferred reinforcers and which of those parameters result in effects similar to functional reinforcers. Future research could also address generalization to the student's general education classroom. Due to time constraints with the end of the academic year, we were unable to assess whether the communicative responses generalized outside of the BSC classroom.

Despite the strong experimental control showing decreases in problem behavior were a function of the intervention conditions, we identified some limitations of our study that could be addressed with

future research. First, this study only includes data for one participant, so the generalizability of these findings to other individuals with EBD is limited. Nonetheless, the results showed clear, immediate changes in behavior as a result of implementing or withdrawing both conditions of the intervention. Future studies should continue to evaluate those conditions under which and the populations with whom preferred reinforcers may be substituted for functional reinforcers. Second, because our study was conducted within the public school setting, we encountered many challenges that extended the length of our study and imposed limitations on our procedures. That is, we were limited in the times we could access the student and classroom to conduct sessions, and the teachers frequently expressed concerns with reinforcing problem behaviors during the FA. Additionally, teachers expressed concerns with the amount of time needed to conduct the full study and how that might take away instructional time from other students. Therefore, future research should consider using social validity measures prior to the study to help inform the best times, locations, and procedural options for conducting research within a public school setting. Additionally, future research may benefit from including assessment procedures (e.g., trial-based FA) that are most commonly used in the school setting to develop intensive interventions for individuals who engage in problem behaviors.

Finally, our FA did not include a tangible item condition, which leaves the possibility that Greg's problem behavior may have been multiply-maintained with attention and tangible items. We chose not to include the tangible item condition in our FA because of the possibility of a false positive result (Rooker et al., 2011) and no evidence to suggest a tangible function. Rooker et al. (2011) discussed that if a tangible item condition is to be included in an FA, the items delivered contingent upon problem behavior should be the same ones that are delivered following problem behavior in the natural setting. Greg was never given access to the iPad in the natural setting following problem behavior due to its limited availability in the school setting, providing additional support that it was not an item that maintained his problem behavior. Therefore, we can be more confident that the iPad was not a functional reinforcer and only served as a preferred reinforcer. Still, future researchers may wish to first exclude the possibility of a tangible item function in the event of comparing preferred tangible items to functional reinforcers.

References

Austin, J. E., & Tiger, J. H. (2015). Providing alternative reinforcers to facilitate tolerance to delayed reinforcement following functional communication training. *Journal of Applied Behavior Analysis, 48*(3), 663-668 6p. doi:10.1002/jaba.215

Baer, D. M., Wolf, M. M., & Risley, T. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis, 1,* 91-97. doi: 10.1901/jaba.1968.1-91

Carr, E.G., & Durand, V.M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis, 18,* 111-126. doi:10.1901/jaba.1985.18-111

Davis, D.H., Fredrick, L.D., Alberto, P. A., & Gama, R. (2012). Functional communication training without extinction using concurrent schedules of differing magnitudes of reinforcement in classrooms. *Journal of Positive Behavior Interventions, 14*(3), 162-172. doi:10.1177/1098300711429597

Desrochers, M. N., Hile, M. G., & Williams-Moseley, T. L. (1997). Survey of functional assessment procedures used with individuals who display mental retardation and severe problem behaviors. *American Journal on Mental Retardation, 101*(5), 535–546. https://www.researchgate.net/publication/14130851_Survey_of_functional_assessment_procedures_with_individuals_who_display_mental_retardation_and_severe_problem_behaviors

Durand, V. M., & Carr, E. G. (1991). Functional communication training to reduce challenging behavior: Maintenance and application in new settings. *Journal of Applied Behavior Analysis, 24,* 251-264.

Falcomata, T. S., Ringdahl, J. E., Christensen, T. J., & Boelter, E. W. (2010). An evaluation of prompt schedules and mand reference during functional communication training. *Behavior Analyst Today*, *11*(1), 77-84. http://eds.a.ebscohost.com.ezproxy.shsu.edu/eds/pdfviewer/pdfviewer?sid=66482a8f-9c3c-436e-8ac6-542a3959230f%40sessionmgr4002&vid=9&hid=4105

Fischer, S. M., Iwata, B. A., & Mazaleski, J. L. (1997). Noncontingent delivery of arbitrary reinforcers as treatment for self-injurious behavior. *Journal of Applied Behavior Analysis*, *30*(2), 239.doi: 10.1901/jaba.1997.30-239

Fisher, W. W., Kuhn, D. E., & Thompson, R. H. (1998). Establishing discriminative control of responding using functional and alternative reinforcers during functional communication training. *Journal of Applied Behavior Analysis*, *31*(4), 543-560. doi:10.1901/jaba.1998.31-543

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25,* 491–498. doi: 10.1901/jaba.1992.25-491

Hagopian, L.P., Fisher, W.W., Sullivan, M.T., Acquisto, J., & Leblanc, L. A., (1998). Effectiveness of functional communication training with and without extinction and punishment: A summary of 21 cases. *Journal of Applied Behavior Analysis, 31,* 211-235. http://dx.doi.org/10.1901/jaba.1998.31-211

Heath, A. K., Ganz, J. B., Parker, R., Burke, M., & Ninci, J. (2015). A meta-analytic review of functional communication training across mode of communication, age, and disability. *Review Journal of Autism and Developmental Disorders, 2,* 155-166. doi: 10.1007/s40489-014-0044-3

Iwata, B.A., DeLeon, I.G., & Roscoe, E.M. (2013). Reliability and validity of the functional analysis screening tool. *Journal of Applied Behavior Analysis, 46(1),* 271-284. doi: 10.1002/jaba.31

Iwata, B. A., Dorsey, M. F., Slifer, K. J., Bauman, K. E., & Richman, G. S. (1982/1994). Toward a functional analysis of self-injury. *Journal of Applied Behavior Analysis*, *27*(2), 197-209. doi: 10.1901/jaba.1994.27-197

Lambert, J. M., & Bloom, S. E. (2012). Trial-based functional analysis and functional communication training in an early childhood setting. *Journal of Applied Behavior Analysis, 45,* 579-584. doi: 10.1901/jaba.2012.45-579

Lloyd, B., Wehby, J., Weaver, E., Goldman, S., Harvey, M., & Sherlock, D. (2015). Implementation and validation of trial-based functional analyses in public elementary school settings. *Journal of Behavioral Education, 24*(2), 167-195. doi:10.1007/s10864-014-9217-5

Miltenberger, R. (2016). *Behavior modification: Principles and procedures*. Boston: Wadsworth Publishing.

Piazza, C. C., Fisher, W. W., & Hagopian, L. P. (1996). Using a choice assessment to predict reinforcer effectiveness. *Journal of Applied Behavior Analysis, 29*1-89. doi:10.1901/jaba.1996.29-1

Rispoli, M., Ninci, J., Neely, L., & Zaini, S. (2014). A systematic review of trial-based functional analysis of challenging behavior. *Journal of Developmental and Physical Disabilities, 26,* 271-283. doi: 10.1007/s10882-013-9363-z

Rooker, G. W., Iwata, B. A., Harper, J. M., Fahmie, T. A., & Camp, E. M. (2011). False-positive tangible outcomes of functional analyses. *Journal of Applied Behavior Analysis, 44,* 737-745.

Shirley, M. J., Iwata, B. A., & Kahng, S. (1999). False-positive maintenance of self-injurious behavior by access to tangible reinforcers. *Journal of Applied Behavior Analysis, 32,* 201-204.

Sigafoos, J., & Saggers, E. (1995). A discrete-trial approach to the functional analysis of aggressive behavior in two boys with autism. *Australia and New Zealand Journal of Developmental Disabilities, 20,* 287-297. doi: 10.1080/07263869500035621

Tiger, J. H., Hanley, G. P., & Bruzek, J. (2008). Functional communication training: A review and practical guide. *Behavior Analysis in Practice, 1*(1), 16-23. http://www.ncbi.nlm.nih.gov.ezproxy.shsu.edu/pmc/articles/PMC2846575/

Ulman, J. D., & Sulzer-Azaroff, B. (1975). Multi-element baseline design in educational research. In E. Ramp & G. Semb (Eds.), *Behavior analysis: Areas of research and application* pp. 371-391). Englewood Cliffs, NJ: Prentice-Hall.

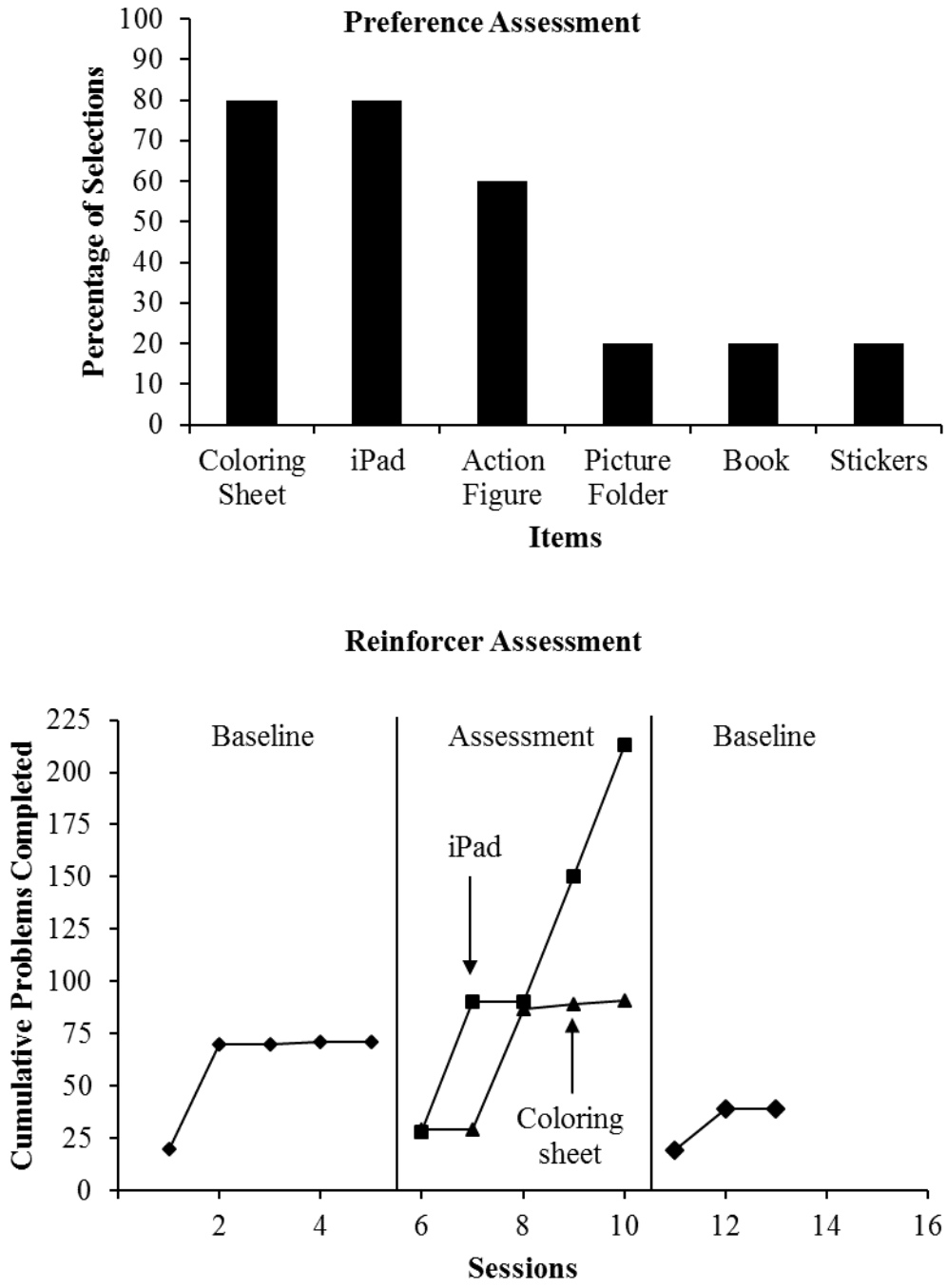

Figure 1. The top panel shows the results from the paired-choice preference assessment with items organized from most preferred (left) to least preferred (right). The bottom panel shows the results from the reinforcer assessment with the top two preferred items, iPad and coloring sheets.

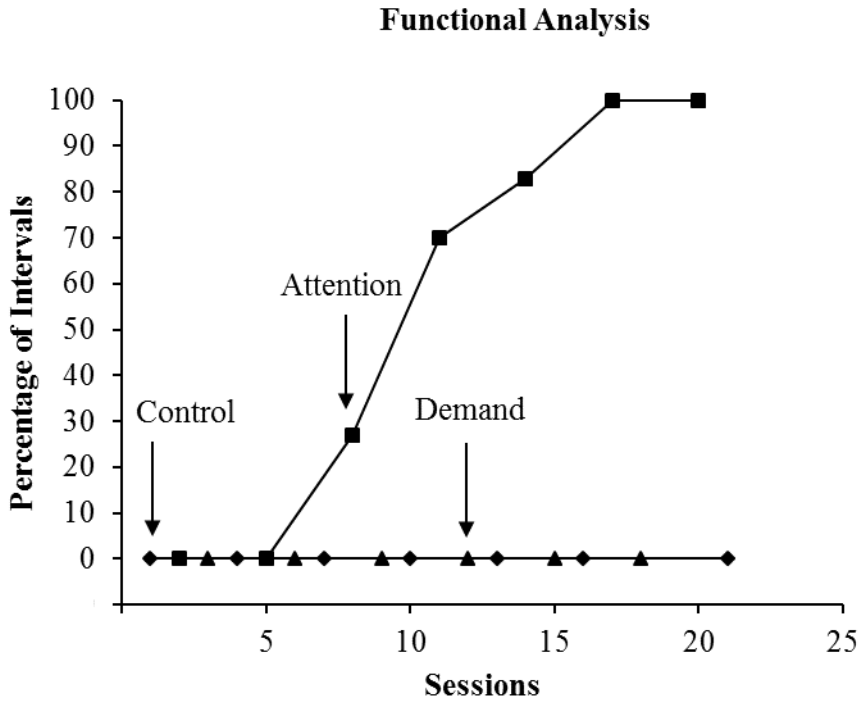

Figure 2. Percentage of intervals with target behaviors in the control, attention, and demand conditions of the experimental functional analysis.

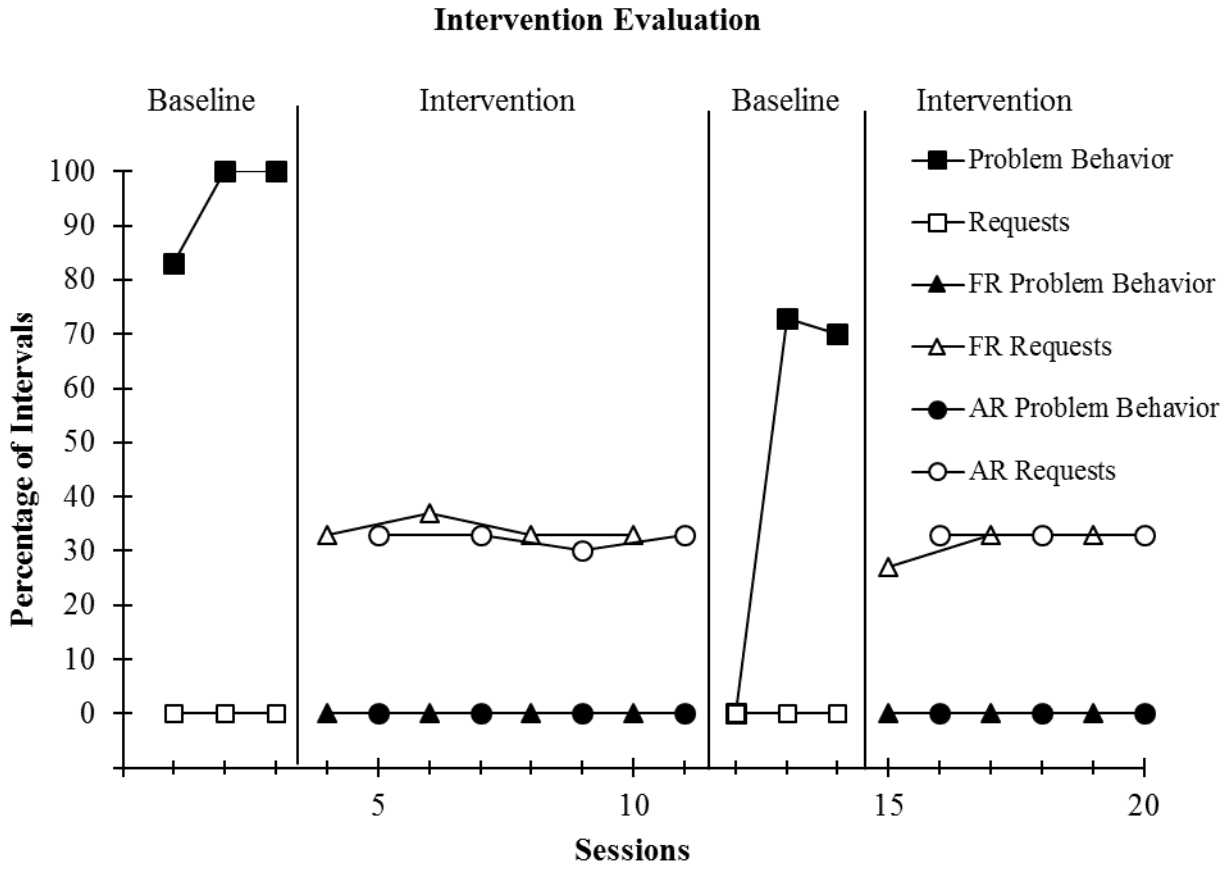

Figure 3. Percentage of intervals with both appropriate communication (requests) and problem behaviors during the baseline and intervention sessions. FR=functional reinforcer condition and PR=preferred reinforcer condition.