The Role of the Replacement Behavior in Function-Based Intervention

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Abstract: Three students with autism spectrum disorder (ASD) who displayed off-task behavior participated in a two-phase study. In Phase 1, a functional behavioral assessment (FBA) was conducted for each student. In addition, an assessment of each student’s ability to perform the replacement behavior identified that none of the participants was able to do so. In Phase 2, two function-based interventions were designed for each student. Both interventions included identical reinforcement and extinction procedures but different antecedent conditions. One intervention prompted performance of the replacement behavior. The other directly taught the student how to perform the replacement behavior. Both interventions were tested during classroom activities. For these students, the intervention that included teaching the replacement behavior produced high levels of on-task behavior. In contrast, the intervention without direct instruction produced much lower on-task levels that were only marginally higher than baseline. Implications for intervention design are included.

In today’s increasingly inclusive classrooms, behavior problems often disrupt instruction and increase teacher stress (Algozzine, Daunic, & Smith, 2010; Friedman, 1995). Fortunately, over many years, a significant body of research has demonstrated the effectiveness of several positive behavioral methods for addressing behavior problems for a majority of students. Some of these include teacher praise (Alberto & Troutman, 2003; Conroy, Sutherland, Snyder, Al-Hendawi, & Vo, 2009), group contingencies, (Hulac & Benson, 2010; Thorne, & Kamps, 2008) self-monitoring (Levendoski & Cartledge, 2000; Mitchem & Young, 2001), and school-wide positive behavior support (Lewis & Sugai, 1999; Todd, Horner, Sugai, & Sprague, 1999).

Students who need more individualized behavioral support may benefit from function-based interventions (IDEA, 1997). In school settings, function-based interventions have been implemented successfully with a variety of challenging behaviors and individuals, including students at-risk (Liaupsin, Umbreit, Ferro, Urso, & Upreti, 2006; Wood, Umbreit, Liaupsin, & Gresham, 2007), and those with ADHD (Stahr, Cushing, Lane, & Fox, 2006; Umbreit, 1995), emotional and behavioral problems (Kern, Delaney, Clarke, Dunlap, & Childs, 2001; Turton, Umbreit, Liaupsin, & Bartley, 2007), intellectual disabilities (Frea & Hughes, 1997; Sasso et al., 1992), autism (O’Neill & Sweetland-Baker, 2001; Reeves, Umbreit, Ferro, & Liaupsin, 2013) and learning disabilities (Burke, Hagan-Burke, & Sugai, 2003; Whitford, Liaupsin, Umbreit, & Ferro, 2013). As a result, function-based support is considered best practice for behavioral intervention in school settings (Iwata et al., 2000; Renshaw, Christensen, Marchant, & Anderson, 2008).

When designing function-based interventions, it is important to define and increase a replacement behavior that serves as an alternative to the problem behavior (Horner et al., 2005). To accomplish this, function-based in-
Interventions include three types of intervention components: (a) antecedent conditions that set the occasion for a replacement behavior, (b) reinforcement procedures that support use of the replacement behavior, and (c) extinction procedures to be used when the target behavior occurs. (cf. Crone & Horner, 2003; Umbreit, Ferro, Liaupsin, & Lane, 2007).

The student’s ability to perform the replacement behavior independently (i.e., fluently enough to be reinforced naturally) plays a key role in intervention design. Interventionists need to determine whether a student’s failure to perform a replacement behavior reflects a performance deficit or an acquisition deficit. Students with a *performance* deficit fail to perform the replacement behavior at acceptable levels even though they have the knowledge and ability to perform the skill. In contrast, students with an *acquisition* deficit lack the knowledge and/or ability to perform the replacement behavior, even under optimal conditions (Gresham, Van, & Cook, 2006). When students have acquisition deficits, the intervention must include strategies to teach the student the replacement behavior (Umbreit et al., 2007).

The purpose of this study was to examine whether different outcomes would occur when the intervention for students with acquisition deficits did or did not include direct instruction in performance of the replacement behavior. The study was conducted in two phases. In Phase 1, researchers conducted a descriptive FBA for each student and verified that each had an acquisition deficit with respect to the replacement behavior. In Phase 2, two nearly identical interventions were designed for each student. One intervention prompted performance of the replacement behavior. The other directly taught the student how to perform the replacement behavior. Both interventions were tested during classroom activities.

**General Method**

**Participants and Setting**

The study was conducted in two elementary and one middle school classrooms in an urban public school district in the southwest. To be selected, participants needed to (a) be between the ages of 4 to 13, (b) be diagnosed with ASD, (c) have an IEP, (d) display chronic challenging behavior, (e) be placed in a classroom environment that demonstrated high levels of effective practices, and (f) fail to perform the replacement behavior independently. Three participants were selected.

**Participant 1.** Calli, age 12, was a sixth grader diagnosed with ASD and Speech/Language Impairment. She was placed in a self-contained class for students with Autism, but attended resource classes for science and language arts. According to her special education teacher, Calli read at grade level and received special education services in writing, math, speech and language, and counseling. She was referred for intervention by her special education teacher because her challenging behaviors were increasing in both frequency and intensity during language arts, and the language arts resource teacher was questioning the appropriateness of her continued placement in class.

The study took place during Calli’s language arts class. The class included 17 students, the teacher, and an educational assistant who accompanied Calli to provide academic and behavioral support. Students were arranged in five rows of five seats. The class routine included entry activities, daily assignment review, usually independent writing activities, and taking turns reading a story or participating in a class discussion.

**Participant 2.** Davis was a 5-year old student diagnosed with ASD. His kindergarten class included 28 students, his teacher, and a teacher’s assistant. According to his teacher, Davis knew all the letters in the alphabet, could count to 20, and write numbers up to 10. He also could identify most high frequency words for kindergarten and write his first and last name and simple sentences. Davis received special education services in speech and language. He was referred for intervention by his kindergarten teacher. She was concerned with Davis’ struggle to adapt to the class routine and, more specifically, his failure to follow directions and complete his work during math and language arts.

At the teacher’s request, the study took place during math. Students sat in groups of four to five at long tables. The routine consisted of completing a daily math activity that
usually involved counting objects and writing numbers, and often required the students to share materials or take turns. The students rotated to different math centers each day.

Participant 3. Gabe was a 6-year old first grader diagnosed with ASD. His class included 23 students and his teacher. Gabe received special education services in reading, written expression, and speech and language. His special education teacher referred him for intervention because of behaviors that included destroying his work, leaving class without permission, and threatening to leave school. Earlier in the school year, Gabe had been moved from another first grade class due to his challenging behaviors.

The study took place during language arts because Gabe’s teacher identified that subject and period as his most difficult time of the day. Students sat in small groups of four desks facing each other. The language arts class primarily consisted of writing activities that included engaging in bell work (e.g., writing the date, correcting errors, and making simple journal entries), independently completing worksheets, or writing about a topic while the teacher rotated among small groups for reading instruction.

Classroom Environment Assessment

Each student’s classroom environment was assessed to minimize the likelihood that challenging behaviors would be the result of ineffective classroom practices. For this purpose, the Classroom Environment Checklist (Ferro, Umbreit, & Liaupsin, 2008; available on request from the first author) was used. This instrument includes 33 items that address three domains: (a) classroom structure (12 items), (b) operating procedures and routines (13 items), and (c) classroom rules (8 items). Based on direct observation, each item is rated as in place, partially in place, or not in place. For the purposes of this study, credit was given only for items describing practices that were fully in place.

Each class was observed for at least 30 min by the first author and by a second independent observer. Each observer identified the number of items that were fully in place in each domain. The overall percentage of effective practices observed was calculated by dividing the total number of indicators observed by the total number of indicators in each domain, multiplying the results by 100%, and then averaging the scores in each domain to determine an overall score. IOA was calculated by dividing the number of agreements by the total number of indicators and multiplying the result by 100%.

Calli’s classroom environment was rated an overall score of 100% effective practices in place with 100% IOA. Davis’ classroom environment was rated an overall score of 100% effective practices in place with 97% IOA. Gabe’s classroom environment was rated an overall score of 93% effective practices in place with 94% IOA.

Behavioral Definitions

All three students exhibited behaviors that were considered off-task, although the topography of each student’s behavior varied. The replacement behavior for all participants was on-task behavior. For Calli, off-task behaviors included engaging in activities other than the assigned task, making rude comments or speaking rudely to teachers and peers (e.g., saying “I hate you”), complaining, raising her voice, screaming, whining or crying, banging on her desk, falling to the floor, and hitting her head. On-task behavior was defined as completing class assignments quietly, raising a hand to ask a question related to the topic or to ask for help, saying “no thank-you” when asked to participate, and “excuse me” to get someone’s attention.

For Davis, off-task behaviors included engaging in activities other than the assigned task for 10 s or more, playing with materials, taking items from peers, crying, screaming, demanding items, and interrupting the teacher. On-task behavior was defined as completing the steps necessary to engage in activities independently, requesting items from peers, and getting his teacher’s attention by approaching and waiting to be acknowledged.

For Gabe, off-task behaviors included engaging in activities other than the assigned task, off-topic talking with peers, or leaving his seat to walk around the room for more than 10 s. On-task behavior was defined as engaging in assignments independently, following
directions, and raising his hand to ask for help, if needed.

Procedure
The study was conducted in two phases. In Phase 1, a descriptive FBA was conducted for each student. Each FBA included teacher interview, direct observations, and identification of the function(s) of each student’s target behavior. In addition, each student was assessed to determine whether he or she could independently perform the replacement behavior. In Phase 2, two interventions were designed for each student. Both interventions included identical reinforcement and extinction procedures. However, one intervention prompted performance of the replacement behavior, whereas the other directly taught the student how to perform the replacement behavior. Both interventions were then tested during class activities.

Phase 1: Functional Behavioral Assessment and Assessment of Replacement Behavior

Data Collection and Analysis
A FBA was conducted for each student to identify the antecedent conditions that set the occasion for their off-task behaviors, and the consequences that maintained these behaviors. Data were collected through a structured interview and direct observations in the classroom.

Structured staff interviews were completed with each teacher. Interviews were conducted using the Preliminary Functional Assessment Survey (Dunlap et al., 1993; available on request from the first author), a 22-item survey designed to gather information about the student’s behaviors of concern and the environmental conditions that contributed to their occurrence.

Structured observations involved the collection of antecedent-behavior-consequence (ABC) data (Bijou, Peterson, & Ault, 1968). These data were collected individually for each participant. Observations were conducted in the student’s classroom during naturally occurring activities in which the target behavior was most likely to occur. A-B-C data were collected until there was a clear pattern of antecedents and consequences related to the target behavior.

The function(s) of each student’s off-task behavior was identified by analyzing the FBA data using the Function Matrix (Umbreit et al., 2007). This visual tool assists users in determining whether the student is gaining access to something or escaping/avoiding something, or both. The user then identifies more specifically whether the student is gaining or escaping attention, tangibles/activities, or sensory consequences.

Each student’s ability to perform the replacement behavior independently prior to intervention was assessed using a two-step process. First, the steps involved in completing the replacement behavior were task analyzed (see Table 1 for a sample task analysis). Data were then collected on the number of steps each student performed independently. Second, a reinforcement contingency was added to see whether students would perform more steps under highly motivating conditions. The percentage of steps each participant completed independently was determined by dividing the number of steps performed inde-

| TABLE 1 |
| Task Analysis of the Replacement Behavior for Calli |

1. **Engages in assignment:**
   a) Gets materials when necessary (book from shelf, paper, pencil)
   b) Starts assignment within 30 seconds of teacher request
   c) Engages in the assignment/task
   d) Sits quietly
   e) Puts materials away

2. **Raises hand to ask a question or ask for help:**
   a) Raises hand
   b) Waits to be called on
   c) Asks an appropriate question

3. **Says “no thank you” when called on:**
   a) Uses appropriate voice tone
   b) Says, “no thank you”

4. **Says “excuse me” to get someone’s attention:**
   a) Looks in person’s vicinity
   b) Uses appropriate voice tone
   c) Says, “excuse me”
   d) Waits for person to acknowledge
   e) Make an appropriate comment
pendently by the total number of steps, and then multiplying the result by 100%. These results were used to confirm that each student had an acquisition deficit, not a performance deficit.

Results

Results of the interviews, direct observations, function identification, and assessments of the replacement behavior are presented for each student.

Calli. A structured interview was conducted with Calli’s language arts teacher and the teaching assistant who accompanied her to class. The teacher was most concerned about Calli’s rude comments, which included Calli telling the teacher she was terrible and that she hated her. She reported that Calli acted out when work demands were placed on her. When off-task behaviors occurred, the teacher told her to stop, or offered her a break.

The assistant was most concerned about Calli’s disrespectful behavior and work avoidance. She indicated these behaviors occurred daily and had been escalating for the past month in language arts class. She believed Calli’s off-task behavior occurred when she was asked to complete an assignment she did not want to do. Disrespectful behavior occurred when she was given verbal cues to stop or the opportunity to take a break. If she continued, she eventually would be taken back to class or given an office referral.

A-B-C data were collected during five sessions for a total of 3 and 1/2 hours. Calli engaged in off-task behavior when (a) the teacher gave her instructions, (b) she was asked to share information, and (c) she was called on to participate. When these antecedents occurred, Calli engaged in other (non-directed) activities, complained, made rude comments to the teacher or assistant, screamed, banged her hand or pencil on her desk, hit herself on the head, fell to the floor, or left class without permission. In every case, Calli received attention from the teacher, assistant, or peers (e.g., additional explanations, reprimands, prompts to ask for help or a break, peers looking or laughing at her) and she also avoided her assignment or the request to contribute.

Data from the interviews and observations were organized into the Function Matrix to determine that Calli engaged in off-task behaviors when she was given an assignment and/or was called on to contribute. Off-task behavior enabled her to get attention from her teachers and peers and avoid the assignments and expectations.

Calli’s ability to perform the replacement behaviors independently was assessed over six days during her language arts class. Data were collected on whether Calli performed each step in the task analysis for the replacement behaviors: (a) task engagement, (b) raise hand to ask for help or an appropriate question, (c) say, “no thanks,” when asked to participate and, (d) “excuse me,” to get someone’s attention (see Table 1). Because task engagement included engaging in the assignment and sitting quietly, data were collected using 30 s whole intervals for at least 25 min. Data on the remaining social behaviors were collected using frequency data based on the number of opportunities during class.

For the first three days, the task analysis assessment showed Calli engaged in the replacement behavior an average of 14% (range 0–42%) of the time, and performed the steps of raising hand, saying “no thanks,” when called on, or “excuse me,” to get someone’s attention 0% of the time. For the next three days, a reinforcement contingency was added. Calli was told that, if she did her work and was respectful to her teachers and peers, she could leave class 15 min. early to either listen to her favorite music CD, or use the computer. Under the reinforcement contingency, Calli performed the steps in task engagement an average of 86% (range 67–98%) of the intervals, and said “no thanks,” 100% of the time based on one opportunity, but performed the steps to raise her hand 0% of opportunities, and got someone’s attention appropriately only 63% of opportunities. These data confirm a performance deficit with remaining engaged and saying “no thanks,” but an acquisition deficit with hand raising and getting someone’s attention.

Davis. Davis’ teacher reported that his academic abilities were at or above grade level, yet he often failed to complete nonpreferred activities. Sometimes he escalated to screaming, crying, and disrupting the class. She re-
ported these behaviors occurred 5–10 times per day and were most likely to occur during centers. When Davis became disruptive, the teacher either sent him to the resource teacher’s class or to the principal’s office. The practice was unsuccessful. When he was sent to the resource teacher or principal, he would read a story or access the computer (preferred activities) and/or return to class with a picture of a solar system or map (a preferred item).

A-B-C data were collected during language arts and math centers for a total of three hours over four days. Off-task behavior occurred when Davis was asked to complete an activity during centers, and when he had to share materials or take turns with his peers. When these antecedents occurred, Davis interrupted the teacher or assistant to ask what he needed to do or to ask for a picture of a map or solar system. He interrupted the teachers by approaching them and saying “excuse me” repeatedly and progressively louder each time. Adults always gave him attention, reminded him that he needed to wait, and told him what to do. When another student had something Davis wanted, he either screamed that he needed the object, grabbed it from the student without asking, or interrupted the teacher to tell on the other student. The other students at his table either told him he needed to share, or argued with him until the teacher or assistant came over to get the students back on-task. Using the Function Matrix, the interview and observational data indicated Davis’ off-task behaviors during center activities enabled him to get teacher attention, assistance, and information on what he was supposed to do.

Davis’ ability to perform the replacement behaviors independently was assessed for four days during center activities. Data were collected on whether he completed each step in the task analysis of his replacement behavior (the full task analysis is available on request from the first author): (a) task engagement, (b) requesting items from peers appropriately, and (c) getting his teacher’s attention appropriately. For the first three days, data indicated that Davis independently performed the steps for engagement an average of 12% (range 0–20%) and the steps for both requesting items from peers and getting teacher’s attention 0% of the time under typical classroom conditions. On day four, a reinforcement contingency was arranged. Davis was told he could earn his choice of a picture of a solar system or a map. He continued to independently perform only 20% on the steps for engagement and 0% for requesting items from peers and getting teacher’s attention, clearly indicating an acquisition deficit across all three areas of the replacement behavior.

Gabe. Gabe’s teacher was most concerned about his failure to follow directions, complete his class work, and remain in class. She stated he was very capable of completing his assignments, but generally did not. She explained how on two occasions he had left class without permission and walked out of school.

A-B-C data were collected for 4 hours over four days. Off-task behavior occurred when Gabe was given an assignment to complete independently. Of the seven assignments he was expected to complete, Gabe completed three with additional teacher prompting and assistance, but did not even attempt the remaining assignments. Gabe’s teacher verbally prompted him 53 times by telling him or showing him where to write his name, reminding him to work or keep working, reading the question to him, or telling him where to write the answer. Gabe responded to 14 of those prompts (26%). Otherwise, he sat at his desk, played with small objects, interacted with peers inappropriately, or walked around the classroom. Using the Function Matrix, Gabe’s off-task behaviors occurred when he was asked to work independently and enabled him to either get additional prompting and assistance or to escape the assignment.

Ability to independently perform the steps in the replacement behavior was assessed four times during language arts. Data were collected on whether Gabe completed each step in his task analysis for on-task behavior (the full task analysis is available on request from the first author). For the first three days, Gabe performed an average of 14% of the steps (range 0–29%) under typically occurring classroom conditions. On day four, a reinforcement contingency was added. Gabe was told he could go to the library to read a book about volcanoes for the remainder of the period if he completed the class assignment. Under the reinforcement contingency, Gabe performed only 43% of the steps indepen-
dentiy, clearly indicating an acquisition deficit.

**Phase 2: Intervention Development and Testing**

In Phase 2, two interventions were developed for each student. The two interventions included identical reinforcement and extinction procedures. However, one intervention prompted performance of the replacement behavior, whereas the other directly taught the student how to perform the replacement behavior. These interventions were then tested within the context of naturally occurring classroom activities and routines. For each student, the study took place over five weeks. It included 21 sessions for Calli, 25 sessions for Davis, and 22 sessions for Gabe.

**Procedure**

Each intervention included antecedent adjustments, reinforcement procedures, and extinction procedures. For each student, Intervention 1 involved prompting of the replacement behavior, but no direct instruction in how to perform it. Intervention 2 was identical but included direct instruction.

**Calli.** In Intervention 1, Calli was reminded of the behavioral expectations at the start of class. When the replacement behavior occurred, she was verbally praised. She also received a plus on her point sheet for every 5 min she was on-task. If Calli earned 80% of her points by a designated time, she got to leave class 10 min early for free time in her resource class, listening to music or playing on the computer. When the target behavior occurred, the teacher and assistant avoided responding. Intervention 2 was identical except that Calli was taught to raise her hand to get the teacher’s attention, and to get her assistant’s attention by looking in her vicinity and saying “excuse me.” To teach Calli the replacement behavior, the first author met with her for four 30-min sessions to provide instruction on examples and non-examples of how to ask for help, get someone’s attention, and greet others. She also developed (with Calli) a list of appropriate and inappropriate comments, and then taught Calli to keep the inappropriate comments to herself. A visual reminder of appropriate attention getting was also reviewed and placed in Calli’s vicinity.

**Davis.** For Intervention 1, Davis was reminded of the behavioral expectations at the start of the activity. When he was on-task, Davis was verbally praised and also earned a sticker for every 5 min he remained on task. When Davis earned five stickers during centers, he exchanged them for a daily token. When he had earned five daily tokens, he exchanged those for a picture of a solar system or map. If off-task behavior occurred, Davis was ignored and no preferred activities or items were offered as incentives to calm down. Intervention 2 was identical but included teaching Davis how to get his teacher’s attention appropriately and how to request items from peers. In addition, Davis was taught how to use visual reminders of the steps needed to complete his class activities. First, a folder containing pictures of the steps was created (e.g., write name, count, write, clean up). Before each activity, the picture sequences were arranged in the order needed to complete the activity and then reviewed with Davis. As he completed each step in the activity, he was taught to move the picture from one column to another. In addition, visual representations of the steps involved in requesting items from peers and getting his teacher’s attention were developed and reviewed before the math centers. Each day that Intervention 2 was implemented, Davis also practiced examples and non-examples of getting his teacher’s attention and requesting items from peers. Finally, Davis’ teachers were taught to use a hand signal to let him know how long he needed to wait before getting their attention. When he approached the teacher, she raised her hand and showed Davis five fingers. Then, she gradually lowered one finger at a time. When all five fingers were down, the teacher gave Davis her attention.

**Gabe.** In Intervention 1, Gabe was reminded of the behavioral expectations at the start of the activity. He was verbally praised when he was on-task. He also earned two class dollars for completing his work independently, or one class dollar for completing an assignment with assistance. When the target behavior occurred, Gabe was reminded he could raise his hand and to ask for help. If he did not complete the assignment during class, he was given the same assignment the next day. Inter-
vention 2 was identical but included teaching Gabe to use written instructions to complete his assignment independently. The teacher listed the steps Gabe needed to complete. He was then taught to cross off each step as he completed it.

**Design**

For each student, an A-B-A-C-A-[B-or-C] design was used to evaluate the effects of the different interventions. In Condition A (baseline), the teachers used the same procedures they had been using prior to the study. During Condition B, Intervention 1 was implemented. During Condition C, Intervention 2 was implemented. Sequentially, the initial baseline was followed by Intervention 1, a return to baseline, Intervention 2, another return to baseline, and then replication of the more effective intervention. Follow-up data were collected weekly for 3 weeks for Davis and Gabe, but could not be collected for Calli because the school year ended.

**Data Collection and Analysis**

The behavioral definitions used in Phase 1 were used again in Phase 2. Data on the replacement behavior (on-task) were collected daily. Treatment integrity (TI) data were collected during 33% of Calli’s sessions, 32% of Davis’ sessions, and 35% of Gabe’s sessions.

On-task behavior was measured using a 30-s whole-interval recording method. At the end of each interval, a plus was scored if the replacement behavior occurred throughout the entire interval. A minus was scored if the target behavior occurred at any time during the interval. Observations lasted 12 min for Calli and 15 min for Davis and Gabe.

Treatment integrity was assessed by using a checklist of the intervention procedures and recording whether each was implemented correctly. The level of treatment integrity was obtained by dividing the number of observed intervention procedures that were completed at the appropriate time by the total number of applicable intervention procedures, and multiplying the result by 100%.

**Inter-Observer Agreement (IOA)**

IOA data on student responding were collected by having a second observer independently record data on the replacement behavior. IOA data were collected in each condition and during 38% of Calli’s sessions, 32% of Davis’ sessions, and 30% of Gabe’s sessions. IOA was assessed using the exact interval-by-interval method (Kazdin, 1982). For on-task behavior, IOA averaged 93% (range = 88–100%) for Calli, 93% (range = 87–97%) for Davis, and 97% (range = 93–100%) for Gabe.

IOA for treatment integrity was established by having a second observer independently and simultaneously record whether each procedure was implemented correctly. IOA was calculated by dividing the number of agreements by the total number of applicable components and multiplying the result by 100%. IOA for treatment integrity averaged 100% for Calli and Davis, and 98% (range = 83–100%) for Gabe.

**Social Validity**

Social validity was assessed by using the Treatment Acceptability Rating Form-Revised TARF-R; (Reimers & Wacker, 1988). This instrument includes 17 items, with multiple items addressing each of the following areas: reasonableness, effectiveness, side effects, disruptive-ness/time required, cost, and willingness. Each item is rated on a 7-point Likert-type scale. Scores can range from 17 to 119, with higher scores representing greater acceptability (Reimers & Wacker, 1988). The TARF-R was completed by each student’s teacher before implementing Intervention 1 and again before implementing Intervention 2.

**Results**

Figure 1 shows on-task levels in each condition for Calli (top panel), Davis (middle panel), and Gabe (bottom panel). Calli’s on-task behavior averaged 14% (range = 6–31%) during baseline, increased to 29% (range = 0–56%) with Intervention 1, and remained at an average of 29% (range = 20–44%) when Intervention 1 was withdrawn. Calli’s on-task levels increased to an average of 92% (range = 80–100%) when Intervention 2 was
implemented, decreased to an average of 51% (range = 0–92%) when Intervention 2 was withdrawn, and increased again to an average of 82% (range = 64–100%) when Intervention 2 was reinstated.

For Davis (middle panel), on-task levels averaged 47% (range = 43–50%) during baseline, increased to 62% when Intervention 1 was introduced, and decreased to an average of 31% (range = 20–50%) when the intervention was withdrawn. Davis’ on-task levels increased to an average of 89% (range = 83–93%) when Intervention 2 was introduced, decreased to a mean of 53% (range = 47–60%) when the intervention was withdrawn, and increased to an average of 89% (range = 77–100%) when Intervention 2 was reinstated. On-task levels remained high during follow-up.

Gabe’s on-task behavior averaged 11% (range = 0–20%) during baseline (bottom panel), increased to 18% (range = 0–37%)...
with Intervention 1, and decreased to 3% (range = 0–10%) when Intervention 1 was withdrawn. Gabe’s on-task levels increased to an average of 83% (range = 73–93%) when Intervention 2 was introduced, decreased to an average of 10% when Intervention 2 was withdrawn, and increased again to 79% (range = 77–83%) when Intervention 2 was reinstated. During follow up, Gabe’s on-task behaviors maintained at an average of 94%.

Treatment integrity for Calli averaged 100% during intervention conditions and 0% (indicating no intervention implementation) during baseline conditions. For Davis, TI was 86% during intervention and 0% for baseline conditions. For Gabe, TI was 100% during intervention conditions, and 0% during baseline. Using the TARF-R, Calli’s teacher rated Intervention 1 with a score of 115 (out of 117) and Intervention 2 with a score of 117. Davis’ teacher rated Intervention 1 and Intervention 2 each with a score of 114. Gabe’s teacher rated Intervention 1 with a score of 111 and Intervention 2 with a score of 105.

Discussion

Some authors (e.g., Umbreit et al., 2007) have suggested that the design of function-based interventions must include consideration of whether an individual can independently perform the replacement behavior. Data from the present study support this contention. Individuals with established acquisition deficits were supported by two nearly identical interventions. When performance of the replacement behavior was taught directly, high levels of on-task behavior were produced. In contrast, when performance of the replacement behavior was prompted but not directly taught, on-task levels were barely higher than baseline. Task analysis was used to determine whether each student could independently perform all components of the replacement behavior. The technique also made it possible to identify which particular steps in the task analysis of the replacement behavior required direct instruction. Although this procedure was used once before (Reeves et al., 2013), a reinforcement contingency was added in this study. The goal was to determine whether students could perform the replacement behavior, but would do so only under highly motivating conditions. Students who failed to perform the replacement behavior, even with contingent reinforcement, were deemed to have a clear acquisition deficit. A similar approach was used by Daly, Witt, Martens, and Dool (1997) to assess skill or performance deficits with academic tasks.

Each student’s level of on-task behavior dropped during the third reversal condition despite having received some instruction in how to perform the replacement behavior. This evidence suggests that, when initially establishing a new skill, it is necessary to maintain the environmental conditions that support that skill until the student performs it independently (i.e., fluently enough to be reinforced naturally). Depending on the complexity of the replacement behavior and the student’s ability to perform it, the amount of time required for instruction will vary and need to be monitored. Replacement behaviors will not maintain if intervention components are discontinued too quickly.

Social validity results indicated that the teachers did not differentiate between the two interventions. They found each to be helpful and acceptable, even though one was very effective and the other was not. Social validity data were collected before each intervention was implemented. As such, the rating of each intervention was not influenced by its effectiveness. In future work, staff should re-rate each intervention after using it.

Certain limitations should be noted. First, the function-based interventions were designed using the methods proposed by Umbreit et al. (2007). Different results may have obtained if a different intervention model or set of procedures had been used. Second, even though the task analyses were conducted by an experienced person following accepted procedures, the steps in each task analysis varied for each student. The data collection method used also varied. For Calli, a 30-s whole-interval method was used. For Davis and Gabe, data were collected on the number of steps each student performed independently. Task analysis and data collection procedures could vary from student to student, from practitioner to practitioner, and from replacement behavior to replacement behavior.

Third, because the study’s design required
frequently changing conditions, the interventions were primarily implemented by the first author. Although the teachers were informed about which condition was currently in effect for each student and the accompanying intervention components, they were not primarily responsible for implementing the intervention until the more effective intervention method was determined. This may have impacted the results. Finally, the instrument used to assess each student’s classroom environment (Ferro et al., 2008) has not been validated. The checklist did, however, provide data for systematically evaluating the classroom environment. Furthermore, when a second observer independently evaluated the same environment, high levels of IOA obtained.

The design of function-based interventions must include consideration of whether an individual can independently perform the replacement behavior. Failure to do so can result in interventions that are technically and procedurally accurate, yet quite ineffective. More attention to this important area is needed both in research and practice.

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