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COMPONENT ANALYSIS OF BEHAVIOR SKILLS TRAINING IN FUNCTIONAL ANALYSIS

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Behavioral Skills Training (BST) is an effective training package that consists of instructions, modeling, rehearsal, and feedback. Although the efficacy of BST has been demonstrated, previous research has not clearly delineated its active components. This study used an alternating-treatment design embedded within ABC and ABCD designs to evaluate the independent effects of all components of BST for training teachers to conduct functional analyses. Prior to baseline, teachers reviewed written instructions. Following baseline, modeling, rehearsal, and feedback training occurred independently during the first training phase and in combination during subsequent training phases. Rehearsal was ineffective, whereas feedback was effective at improving the performance of all teachers. Modeling was less effective than feedback, such that improvements only occurred for some teachers and some functional analysis responses. Thus, feedback, and to a lesser extent, modeling are the effective and perhaps necessary components of BST.

COMPONENT ANALYSIS OF BEHAVIORAL SKILLS TRAINING

A component analysis is an assessment of the independent variables (components) of which a treatment package is composed (Ward-Horner & Sturmey, 2010), and the purpose of such an analysis is to identify the necessity and sufficiency of the components of the package. It is important for researchers to conduct component analyses of treatment packages to identify functional relations between treatment components and outcome measures. In addition, component analyses may enhance the social validity of treatments by making treatment packages more efficient through the identification and removal of unnecessary and perhaps aversive components.

Behavioral Skills Training (BST) is a commonly used and effective method of teaching individuals new skills, which consists of four components: instructions, modeling, rehearsal, and feedback (e.g., Gianoumis, Seiverling, & Sturmey, 2012; Sarokoff & Sturmey, 2004; Nigro-Bruzzi & Sturmey, 2010). There are only two

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single subject and one group experiment that have performed a component analysis of BST. Feldman, Case, Rincover, Towns, and Betel (1989) evaluated the effectiveness of instructions alone versus instructions, modeling, rehearsal, and feedback to teach parents with developmental disabilities to be more responsive to their children. They found that verbal instructions had a slight impact on parental responsiveness and that substantial increases in parental responsiveness only occurred after the addition of modeling rehearsal and feedback. Krumhus and Malott (1980) evaluated the components of BST to teach university students to provide social reinforcement during tutoring sessions. Again, instructions were ineffective, whereas modeling substantially improved the tutors' social reinforcement. Feedback was also effective at increasing the tutors' social reinforcement, but the high levels of responding produced by modeling made it difficult to draw definitive conclusions about the effects of feedback. Finally, using a group design, Hudson (1982) compared verbal instructions, verbal instructions with a general description of behavioral procedures, and BST for teaching parents to work with his or her child with developmental disabilities. Parent teaching skills and the number of programs mastered by the children were significantly greater for the BST group than the other treatment groups. The author concluded that modeling, feedback, and rehearsal were necessary components of the training.

Taken together, these studies indicate that instructions are not sufficient and that feedback and modeling may be the effective components; however, it is unclear as to whether modeling and feedback are necessary and/or sufficient components of BST. Therefore, this investigation consisted of a component analysis of BST in the context of teaching staff members to perform the attention, demand, and play functional analysis conditions.

METHOD

Participants, Setting, and Materials

Three direct-care staff members participated. The staff members were selected on the basis that they had no prior experience conducting functional analyses and scored less than 50% correct when implementing the attention, demand, and play functional analysis conditions during baseline. (A fourth staff member was dropped because of high performance during baseline in the attention condition). Prior to the study, all staff members received training on the basic principles of applied behavior analysis as part of their in-service training and feedback through direct observation of their performance in the classroom. All staff members were certified teacher assistants and signed informed consent forms prior to the study. As for the staff members' educational background,

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Carol had a high school degree, Sandy had a bachelor's degree and was working towards her master's degree in special education, and Debby was working on a bachelor's degree in reading education. At the start of the study, Carol, Sandy, and Debby had been employed at the school for 7 months, 1 year 4 months, and 1 week, respectively.

Two students with a diagnosis of autistic disorder also participated. Isaac and James were 9 and 10 years old, respectively, at the beginning of the study. They were selected on the basis that they exhibited aggressive behavior that interfered with classroom instructions, and both children were students at the day school where the study took place. Prior to the start of the study, the parents' of the students signed an informed consent allowing their children to participate in the study. Isaac's target response consisted of hitting, and James' target responses consisted of hitting and kicking. *Hitting* consisted of the student forcefully slapping or punching any part of the staff member's body with either an open or closed fist. Hitting did not include tapping or pulling the staff member's arm to get attention. *Kicking* included James forcefully kicking his foot at any part of the staff member's body. Isaac's non-target challenging response, chin tapping, consisted of Isaac tapping or pressing any part of his hand or fingers into his chin. Chin tapping did not include Isaac resting his head in his hand with his elbow on the table or scratching his chin. James' non-target challenging responses included hand tapping and spitting. The definition for hand tapping included James repeatedly banging a wall, desk, or an object with either an open or closed fist. The definition of spitting included the expulsion of saliva regardless of whether spitting was directed toward or away from the staff member.

Each staff member was paired with one student for the purpose of collecting generalization data. Carol and Debby conducted functional analyses with Isaac during the generalization-assessment sessions, and Sandy conducted functional analyses with James during the generalization-assessment sessions. The experimenter conveniently paired the staff members with the students on the basis of the staff members' and student's classroom schedules.

The study took place in a functional analysis room at the students' school, which contained a table, two chairs, a video camera, and materials necessary for the staff member to conduct the functional analysis conditions. The size of the room was approximately 3.5×2.5 m. The table was situated in a corner of the room, and the chairs were positioned next to each other at the table. The video camera was situated on a tripod stand that was located on the other side of the room. The orientation of the video camera in relation to the table and chairs allowed for a side view of the staff member and student when viewed on videotape. The materials for the functional analysis conditions included a stopwatch, leisure items, and academic materials.

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Functional Analysis Conditions

During each experimental phase, the experimenter instructed each staff member to conduct the attention, play, and demand functional analysis conditions (Iwata, Dorsey, Slifer, Bauman, & Richman, 1994; Iwata et al., 2000). All staff members performed the functional analysis conditions with simulated students and with real students.

Simulated-Assessment Sessions

During the simulated functional analysis sessions, an experimenter (the first author) simulated scripted child behavior as described by Iwata et al. (2000). The simulated responses included the target response, non-target challenging behavior, compliance with instructions, appropriate social initiations, and appropriate play. For each of the three functional analysis conditions, the experimenter created four scripts to simulate student behavior. Each script contained 20 simulations of student behavior, and block randomization was used to determine the sequence and timing of simulated-student behavior. That is, the experimenter randomly assigned half of each type of student behavior to be simulated during the first and last half of the script, with the restriction that there was a minimum of 5 s between instances of simulated-student behavior. Four scripts were used to reduce the likelihood that the staff members would simply learn a single sequence of responses for each condition, which could reduce the probability that they would generalize their skills to working with real students.

Generalization-Assessment Sessions

During each generalization-assessment session, the staff members conducted a functional analysis condition with actual students.

Dependent Measures

The dependent variable was the percentage of correct responses during the attention, play, and demand functional analysis conditions (Moore & Fisher, 2007). There were five responses scored for each functional analysis condition. The responses measured during the attention condition included (a) correctly beginning each session by prompting the student to play with the leisure items, (b) removing attention immediately after prompting the student to play with leisure items, (c) presenting attention through statements of social disapproval following each occurrence of the target response, (d) withholding attention following each occurrence of appropriate behavior, and (e) withholding attention following each occurrence of non-targeted problem behavior.

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The responses measured during the demand condition included (a) presenting an instructional trial every 30 s starting at the beginning of the session, (b) re-presenting the instruction and providing a gestural prompt when the student does not comply within 5 s of the initial instruction, (c) re-presenting the instruction and providing a physical prompt when the student does not comply within 5 s of the second instruction and gestural prompt, (d) immediately terminating the trial when the target response occurs, and (e) providing praise if the student responds correctly within 5 s to the verbal or gestural prompt. The responses measured during the play condition included (a) presenting the student with leisure items at the beginning of the session and praising the student every 30 s for appropriate play, (b) interacting with the student for approximately 5 s when he engages in appropriate bids for social interaction (e.g., giving the staff member a toy or pulling the staff member to play with a toy), (c) ignoring each occurrence of the target response by not providing attention for 5 s after the termination of the target response, (d) withholding praise if the student is engaged in the target response when praise is scheduled and allowing 5 s without the target response before delivering praise, and (e) ignoring all other non-target-problem behavior.

Data Collection

Each functional analysis condition lasted 5 min and was videotaped. Undergraduate research assistants scored the staff members' behavior during all conditions for the simulated-assessment and generalization-assessment sessions. The research assistants scored the occurrence and non-occurrence of each staff members' behavior as correct or incorrect on the basis of simulated or actual student behavior and the timing of the staff members' instructions and attention according to protocol (Moore & Fisher, 2007). The percentage of correct responses was determined by dividing the number of correct responses by the total number of correct and incorrect behaviors, multiplied by 100%.

Independent Variables

Instructions

The experimenter provided the staff members with instructions that described the purpose and procedure of each functional analysis condition. The instructions were identical to those published in Appendix A of Iwata et al. (2000), with the exception that the descriptions of the target and non-target responses were specific to the children included in this study.

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Video Modeling

Videotapes displayed examples of the correct implementation of each response needed to perform the functional analysis condition correctly. Videotapes contained simulated examples of correct staff member performance, such that one experimenter played the role of the student while another experimenter illustrated the correct response (Iwata et al., 2000). There were three videotapes, one for each functional analysis condition. The video for each functional analysis condition was 5 min in length. The student-simulated behavior in each video was based on a script that was similar to the scripts described previously; however, the sequence and timing of student-simulated behavior was arranged so that the range of correct functional analysis responses could be modeled. For instance, during the demand video model, the experimenter simulated a target response between instructional trials and at various points during instructional trials. Therefore, the video model consisted of the experimenter modeling escape contingently on the target response, regardless of whether the target response occurred immediately after a verbal instruction or during a trial that included a physical or gestural prompt. The rationale for systematically programming student behavior during video modeling was to ensure that each video displayed the range of stimulus and response variations to which the staff would need to respond.

Rehearsal

The staff member practiced conducting an additional 5-min session with the experimenter simulating student behavior. The rehearsal sessions were exactly the same as the simulated-assessment session, such that the experimenter simulated 20 student responses. Rehearsal training immediately preceded a simulated-assessment session, which was videotaped and scored later. The staff member did not receive any instructions or feedback of any kind during the rehearsal sessions.

Feedback

The experimenter provided verbal and written feedback to the staff member for each response for a given functional analysis condition. Feedback sessions began with verbal feedback regarding the staff member's performance on the previous simulated-assessment session. The experimenter provided praise statements for the responses that were performed with 90% accuracy or greater, and the experimenter provided corrective feedback for the responses that were performed with less than 90% accuracy. Following verbal feedback, the staff member was given a typed sheet containing a summary of the verbal feedback that the experimenter provided.

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Experimental Design

The experimental design was an alternating treatments design within an ABC design for Sandy and within an ABCD design for Carol and Debby, such that each functional analysis condition was trained using a different training procedure (modeling, rehearsal, or feedback training) or a different combination of training procedures (e.g., modeling + feedback) during each training phase. The instructions (baseline) phase was followed by two to three training phases depending on the participants' performance. The first training phase assessed the independent effects of each component of BST, whereas the second training phase assessed a combination of two components. The third training phase included the combination of modeling, rehearsal, and feedback. There was a mastery criterion of 90% for two consecutive sessions during all training phases. Those functional analysis skills meeting the mastery criterion during a given training phase were not targeted for training during the subsequent training phases. For example, during the first training phase, Sandy reached the mastery criterion for the demand and play conditions; therefore, the experimenter did not collect data for these responses during the second training phase. The type of assessment session (simulated versus generalization) and the type of functional analysis condition performed during the assessment session was block randomized, with the exception that generalization probes occurred a maximum of two times for each functional analysis condition during each experimental phase.

Procedure

Baseline

Prior to the first baseline session, the experimenter gave each staff member written instructions regarding the purpose and procedure of each functional analysis condition. Each staff member also completed a quiz to ensure that they read the procedure for each condition. If a staff member did not score 90% or above on the quiz, the experimenter reviewed the incorrect answers and provided an explanation as to why the answer was incorrect. Further, the experimenter then asked the staff member to re-take another version of the quiz. This procedure continued until the staff member scored at least 90% correct for each functional analysis quiz.

During each assessment session, the experimenter instructed the staff member to perform a functional analysis condition (e.g., attention, demand, or play condition) as accurately as possible on the basis of the instructions. The experimenter did not provide any feedback to the participants or answer any questions regarding the instructions.

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Training Phase 1

The experimenter randomly assigned modeling, rehearsal, or feedback to each functional analysis condition for Carol. The experimenter used random assignment and counterbalancing to assign modeling, rehearsal, and feedback to Sandy and Debby. For instance, the experimenter randomly assigned modeling to the attention condition for Carol during Training Phase 1, and the experimenter randomly assigned modeling to the demand and play conditions for Sandy and Debby, respectively. In this way, the presentation of individual components was counterbalanced across participants and functional analysis conditions. Further, each training session immediately preceded a simulated-assessment session, where the staff member's performance for the functional analysis condition that previously received training was measured. All training session were 5 min in duration, and the experimenter set a mastery criterion of 90% or better for two consecutive training sessions.

During video modeling, the staff member watched a video model of a functional analysis condition. The staff member watched the video model immediately prior to conducting a simulated-assessment session for the functional analysis condition that was modeled. Following the video, the experimenter instructed the staff member to implement the functional analysis condition on the basis of the instructions received during baseline and the responses modeled in the video.

For the functional analysis condition designated to receive feedback, the experimenter provided the staff member with verbal and written feedback on the basis of the staff member's performance from the previous assessment session. First, the experimenter read a description of the staff member's performance that included praise statements for correct responses and corrective feedback for incorrect responses. Next, the experimenter provided the staff member with a written summary of the verbal feedback. Feedback training occurred immediately prior to conducting a simulated-assessment session. Following feedback training, the experimenter instructed the staff member to conduct the functional analysis condition on the basis of the instructions from baseline and the feedback from the previous session.

For the functional analysis condition designated to receive rehearsal training, the experimenter provided the staff member with a 5-min rehearsal session immediately prior to a simulated-assessment session. The experimenter did not provide the staff member with any additional instructions, modeling, or feedback during rehearsal training. Following rehearsal training, the experimenter instructed the staff member to perform the functional analysis condition on the basis of the instructions during baseline and what he or she may have learned by practicing an extra functional analysis condition.

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Training Phase 2

This phase was similar to the first training phase with the exception that the experimenter conducted two types of training for each functional analysis condition. For instances, if the protocol called for a staff member to receive modeling and feedback, the experimenter conducted two 5-min training sessions immediately prior to the simulated-assessment session. Thus, there was a total of 10 min of training that preceded each simulated-assessment session, with 5 min devoted to each type of training. To control for the order of training, the experimenter randomly determined the training session that was conducted first. As with Training Phase 1, immediately following training, the staff member conducted the functional analysis condition that was previously trained during a simulated-assessment session.

Training Phase 3

This phase was similar to the second training phase. Any functional analysis condition that the staff member performed with less than 90% accuracy received training using the combination of modeling, rehearsal, and feedback. The experimenter randomly determined the order of training sessions.

Interobserver Agreement

Two observers who were familiar with the purpose and experimental conditions of the study scored interobserver agreement (IOA). The observers randomly selected 50, 61, and 52% of Carol, Sandy, and Debby's sessions across experimental phases to evaluate IOA. The observers selected the same proportion of each functional analysis condition to evaluate IOA and independently scored the staff members' percent correct functional analysis response for those randomly selected sessions. An agreement was recorded when both observers scored the same staff behavior at the same time. IOA was calculated by dividing the total number of agreements by the total number of agreements plus disagreements, multiplied by 100%. The overall mean IOA for each participant averaged over experimental phases was 95% (range 87–100%), 92% (range 57–100%), and 91% (range 83–100%) for Carol, Sandy, and Debby, respectively.

Procedural Integrity

The observers collected procedural integrity data on the experimenter's simulation of student responses during simulated-assessment sessions across all experimental phases. They collected procedural integrity data for 40% of Carol's sessions and for 42% of Sandy and Debby's sessions. They collected procedural integrity data by measuring

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the frequency and proportion of simulated-student behavior. They scored procedural integrity data by summing the total correct number of simulations and dividing by 20 and then multiplied by 100%. In the cases where the experimenter was not able to simulate student behavior because the staff member's behavior set the occasion for the simulation (e.g., a staff member provided only four instructions during a demand condition, yet the experimenter was required to simulate six correct responses to the staff member's instructions), the observers calculated integrity data by totaling the number of correct simulations and dividing by the total number of simulations. The mean percentage of correctly simulated-student behavior averaged across staff members and experimental phases was 99% (range 95–100% correct simulations).

Treatment Integrity

The observers also collected treatment integrity data for a minimum of 30% of the training sessions when the experimenter provided modeling, rehearsal, and feedback training. For rehearsal training, the observers collected data on the experimenter's correct simulation of student behavior and the presence and absence of the feedback and modeling. For the feedback training, research assistants collect data on the accuracy of the experimenter's comments regarding each staff member's response (e.g., the correct delivery of praise and corrective feedback in the absence of modeling and extra practice), the order in which the experimenter provided feedback (verbal followed by written), and the duration of training. For modeling training, the observers collected data on the presentation of the correct video model. The overall mean percentage of correctly implemented modeling, rehearsal, and feedback training was 100, 99 (range 95–100%), and 96% (range 89–100%), respectively. In addition, each video model was scored to ensure 100% accurate functional analysis responses and that the experimenter simulated the correct number and proportion of student behavior.

Social Validity Measure

Following the completion of the study, each staff member was asked to rate how much they liked each type of training and the effectiveness of each training (Table 2 displays the questions and the staff members' responses to each question). The first series of questions required the staff members to rate the effectiveness and their liking of each training separately by circling one of the following: poor, fair, good, very good, or excellent. The last two questions required the staff members to select the training that they liked the most and the one that they believed to be most effective.

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RESULTS

Figure 1 displays the percent correct functional analysis responses as a function of the baseline and the three training phases for the Carol, Sandy, and Debby, respectively. During the written instructions phase, the three staff members' percent correct responses for the simulated assessment sessions were generally stable across staff members with an average of 21, 20, and 22% for Carol, Sandy, and Debby, respectively. In addition, the staff members' performance during the generalization sessions was similar to the simulated-assessment sessions, with the exception that Carol's and Debby's performance during the demand and attention generalization-assessment sessions, respectively, was greater than 50%.

During the first training phase, feedback training was highly effective at improving staff members' performance, whereas rehearsal was not effective. Each staff member reached the mastery criterion for the functional analysis responses trained with feedback, and the average percent correct responding with feedback training was 82, 85, and 95% for Carol, Sandy, and Debby, respectively. In contrast, rehearsal training did not have any appreciable effect on the staff members' performance. Carol's, Sandy's, and Debby's average percent correct responding with rehearsal training was 38, 19, and 32%, respectively. Finally, with the exception of Sandy's generalization session for the attention condition, which was substantially greater than the simulation sessions, the generalization sessions for the conditions receiving feedback and rehearsal training closely resembled the staff members' performance during simulation sessions.

The effects of modeling during the first training phase were less consistent than feedback. Modeling training produced substantial increases in performance for Carol and Sandy during the attention and play conditions, respectively, and both staff members reached the mastery criterion with modeling training. With modeling training, Carol's and Sandy's average percent correct responding was 95 and 81%, respectively. Modeling training for Debby during the demand condition only had a marginal effect on her performance, and her average percent correct was 44%. Finally, with the exception of Sandy's performance during the attention generalization session, the generalization sessions for the conditions receiving modeling were consistent with the staff members' performance during simulation sessions.

During the second training phase, the combination of modeling and rehearsal training occurred for the demand, attention, and play conditions for Carol, Sandy, and Debby, respectively. For each participant, modeling training was added to the condition that received rehearsal training during the first training phase. The combination of modeling and rehearsal training produced an immediate increase in performance to an average percent correct of 95% during the attention condition

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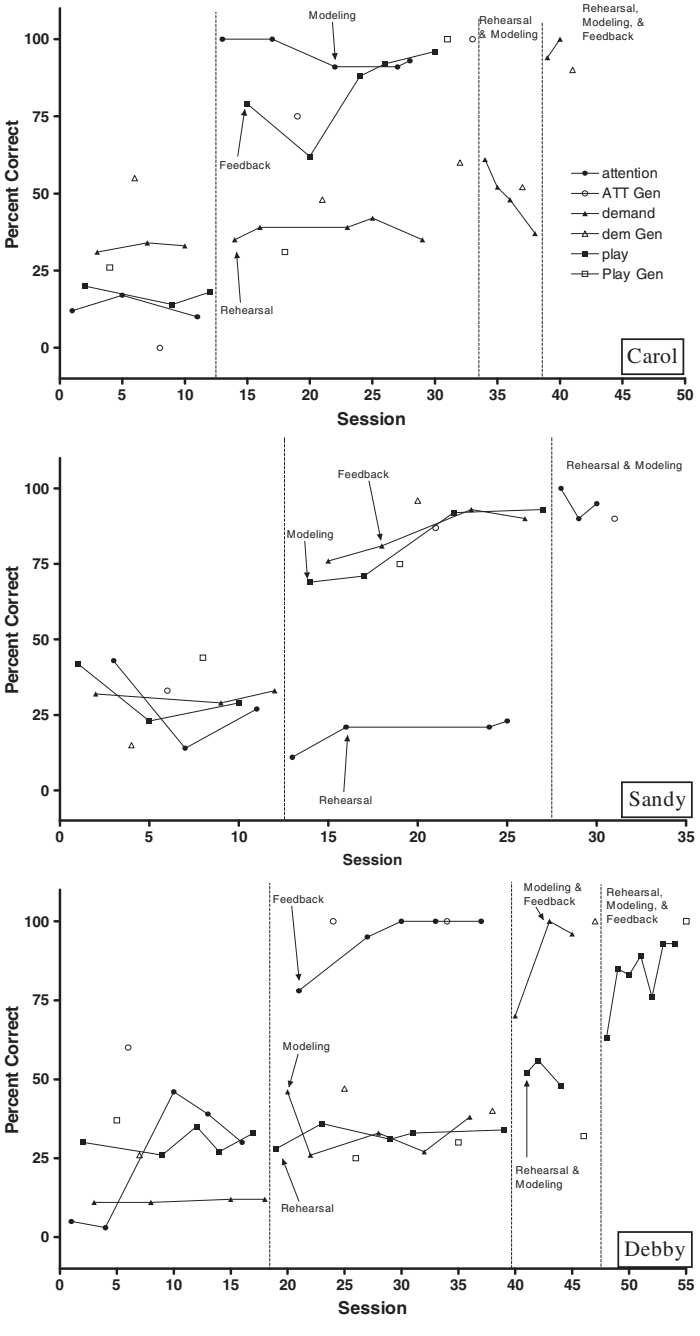

Figure 1. The percentage of correct functional analysis responses for each staff during the written instructions phase and the three training phases.

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for Sandy. For Carol and Debby, the combination of modeling and rehearsal had marginal effects on performance and their average percent correct was 50 and 52%, respectively. Further, because modeling did not improve Debby's performance for the demand condition during the first training phase, the experimenter added feedback to modeling during the second training phase. The combination of modeling and feedback training for Debby was effective at improving performance to criterion with an average percent correct of 89%. Finally, the staff members' performance during all generalization probes was similar to all simulated sessions.

Because the combination of rehearsal and modeling training was ineffective at improving Carol and Debby's performance during the demand and play conditions, respectively, the experimenter used a combination of modeling, rehearsal, and feedback training to teach these responses during the third training phase. With this combination of training, Carol's performance during the demand condition increased after the first training session to criterion, and she reached mastery criterion within two training sessions. Carol's average percent correct was 97%. Improvements in Debby's performance were much more gradual, as it took six training sessions before she reached mastery criterion. Debby's average percent correct was 82%. Finally, the generalization sessions for both staff members were similar to their performance during simulated sessions.

Table 1 provides a summary of the overall effectiveness of each type of training averaged over the participants and experimental phases. The two measures of effectiveness presented in the table include (a) the number of times a particular training was effective out of the total number of times the training was used and (b) the percentage of change from the previous experimental phase to the phase when the training was first introduced. Feedback training was effective at improving the staff members' performance to mastery criterion every time it was implemented, and modeling training was effective only 50% of the time. Rehearsal training was never effective at improving performance.

Table 2 displays the staff members' ratings of the effectiveness and liking of each type of training. Carol reported that she liked written instructions and feedback more than rehearsal and modeling. When asked to choose the component she liked the most, Carol indicated that she liked feedback more than the other types of training. Sandy reported that she liked modeling and feedback training more than written instructions and rehearsal training. When asked to choose the training she liked the most, Sandy indicated that she liked modeling more than the other types of training. Both Carol and Sandy's ratings of effectiveness and liking of specific trainings showed a high degree of correspondence, such that they tended to rate the components that they believed to most effective as the ones they liked the most. Further, both Carol and Sandy's ratings of the most effective components were consistent with the trainings that were most effective at teaching them to conduct a

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Table 1. The effectiveness of type of training for each functional analysis condition averaged over staff and experimental phases.

FA condition	Modeling		Rehearsal		Feedback	
	Effective?	% Change	Effective?	% Change	Effective?	% Change
Attention	2/2	79	0/1	5	1/1	70
Demand	0/2	16	0/1	−9	3/3	53
Play	1/2	37	0/1	2	2/2	53
Total	3/6	50	0/3	0	6/6	55

The first column for each training displays the total number of times the training was effective by the total number of times it was presented. The second column for each training indicates the average percent change from the previous phase to the phase in which the training was first introduced.

Table 2. Outcome of social validity questionnaire completed by staff.

Questions	Participants' response[a]		
	Carol	Sandy	Debby
1. Rate how much you liked			
a. Modeling training?	2	4	4
b. Rehearsal training?	1	2	4
c. Feedback training?	3	4	5
d. Written instructions training?	3	2	[b]
2. Rate the effectiveness of			
a. Modeling training?	2	4	4
b. Rehearsal training?	1	1	4
c. Feedback training?	4	4	5
d. Written instructions training?	5	2	3
3. Which training was most effective to learn how to conduct a functional analysis (Circle one: Instructions, modeling, rehearsal, feedback)?	Feedback	Modeling	Feedback
4. Which training did you like the most (Circle one: Instructions, modeling, rehearsal, feedback)?	Feedback	Modeling	Feedback

[a]1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.
[b]Debby did not provide a response to this question.

functional analysis. Finally, Debby rated her liking and the effectiveness of all the components as very good or excellent, with the exception of rating the effectiveness of written instructions as good. When asked to select the most effective training and the one she liked the most, Debby selected feedback for both questions. Although Debby tended to like all trainings and to rate all trainings as effective, when forced to choose the most effective training and the training she liked the most, Debby selected feedback for both questions. Debby's selection of feedback as the most effective training is consistent with the training that was most effective at teaching Debby to conduct a functional analysis.

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DISCUSSION

Feedback, and to a lesser extent, modeling were the most effective components of BST. With the implementation of feedback training during the first training phase, there was a systematic increase in the staff members' performance to mastery criterion, regardless of the functional analysis skill targeted for feedback training. The inclusion of feedback for those responses not meeting criterion in the first and second training phases also always improved performance to mastery criterion. With the implementation of video modeling training during the first training phase, there was a systematic increase in performance for two of three staff members; however, the addition of modeling during subsequent training phases further improved performance for only one of the three times. Finally, the staff members' low performance during baseline and lack of improvement following rehearsal indicate that written instructions and rehearsal training were ineffective. Given the consistent effects of feedback, the less consistent effects of modeling, and that written instructions and rehearsal training were consistently ineffective, one may conclude that written instructions and rehearsal training are not sufficient and that feedback and modeling are the active components of BST.

The conclusions about the components of BST are specific to this study. For instance, although instructions and rehearsal were ineffective at improving staff members' performance, it is possible that these components might be effective if implemented in a different manner or for different behavior. For example, rehearsal might be effective if staff members practiced for longer periods and instructions might be effective if presented in a different format. Similarly, it is possible that alternative methods for conducting modeling and feedback training may produce very different outcomes than what has been reported in this study. Therefore, researchers should be careful not to draw broad conclusions about the active components of BST on the basis of this study alone. Future research can address this by conducting parametric analyses of the components of BST. For example, future studies might evaluate parametric analyses modeling by evaluating the functional relationship between independent variables such as the number of times a video is presented, the time before actual training and the presentation of the video model, and the proportion of relevant discriminative stimuli and responses that a video model presents and subsequent staff behavior.

Using the term necessity to describe the effects of feedback and modeling in this study is challenging (cf. Ward-Horner & Sturmey, 2010). Indeed, it is tempting to label feedback as the necessary component of BST because it was the most effective, but because modeling was sometimes effective independent of feedback, the statement that feedback is the necessary component is inaccurate. It is also tempting to reconcile this issue by classifying the necessity and sufficiency of each component for each participant separately, and Debby's data suggest that feedback was necessary because

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modeling and rehearsal training were ineffective, whereas Sandy's data suggest that both feedback and modeling were sufficient and that rehearsal training was not sufficient. A different challenge, however, arises when evaluating individual data to draw conclusions about the necessity of components. For instance, the use of the term necessary with regard to Debby's data may be inappropriate given the experimental design because we used counterbalancing to control for different responses receiving different treatments across participants; one could argue that the use of such an intersubject control procedure would require replication of an effect across participants to warrant the use of the term necessity. On the other hand, one could argue that the replication of the effectiveness of feedback across responses and experimental phases (e.g., Debby's data) sufficiently mitigates confounding of component and response interactions; although sequence effects remain a concern (Ward-Horner & Sturmey, 2010). Because of the absolute nature of the terms necessity and sufficiency, it is perhaps best to be conservative in their use. Therefore, given the type of experimental control procedures used in this study, it is most appropriate to describe the components as effective or ineffective when evaluating individual data. For instance, modeling and feedback were both effective for teaching Sandy; modeling and feedback were both effective for teaching Carol, but the effectiveness of modeling was dependent on the response; feedback was the only effective component for teaching Debby. In characterizing the study as a whole, the active components are feedback and modeling, and it is accurate to characterize written instructions and rehearsal as not sufficient because the effects (or lack thereof) were replicated across participants.

Although definitive conclusions regarding the necessity of components are unwarranted, this study extends previous studies by providing a direct comparison of the independent and combined effects of modeling, rehearsal, and feedback. Previous attempts at a component analysis of BST did not adequately separate components (Feldman et al., 1989) or adequately evaluate individual components due to sequence effects (Krumus & Malott, 1980). Therefore, the present study extends these previous component analyses by independently evaluating all components prior to the evaluation of component combination and is consistent with other studies demonstrating that feedback and modeling are independently effective training procedures (LeBlanc, Ricciardi, & Luiselli, 2005; Moore & Fisher, 2007; Roscoe, Fisher, Glover, &Volkert, 2006). Beyond the analysis of treatment components, this study has important clinical implication. As Krumus and Malott (1980) discussed, video modeling is effective, inexpensive, and does not require expensive one-on-one training. Thus, one approach to training new staff members might be to (a) train all staff members using video modeling and (b) to use feedback to improve the performance of those staff members that were unable to learn from the video models. Even if video modeling training is effective for only 50% of new staff members, such a training model might cut in half the time required to train a group of new employees. Further, given the high degree

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of correspondence between the most effective training and the staff members' rating of the component they liked the most, the elimination of the written instructions and rehearsal may not influence the social acceptability of the training while reducing training time. These proposals are consonant with recent tiered models of caregiver training or stepped care approaches (Phaneuf & McIntyre, 2011). Future evaluations of such a tiered model of caregiver training should be evaluated not only from the perspective of behavior change but also from the economics of cost of training.

This study has two important limitations. First, because the experimenter provided instructions prior to the training phases, it is unknown as to whether feedback and modeling would have been as effective without prior instructions. Second, the generalization probes might not have accurately reflected the staff members' performance because neither Isaac nor James emitted aggressive responses, thus, staff members only needed to respond to a subset of potential student responses. Although the lack of aggressive responses during the generalization probes threatens the validity of the probes, it is important to note that the students engaged in the range of other possible responses that could occur during a functional analysis (e.g., appropriate play, non-target challenging behavior, correct and incorrect responses, etc.). Furthermore, the generalization probes mostly corresponded well to the simulation-assessment session, which suggests that the staff members generalized a large portion of their skills.

In summary, this study provides the most complete analysis of the components of BST to date. Future researchers should continue to evaluate the effectiveness of modeling and feedback for teaching other skills to evaluate the robustness of the present findings. Future research in this area should also attempt to evaluate the necessity of instructions to assess the sufficiency of modeling and feedback training by independently evaluating the effects of each BST component and combinations of components.

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