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Efficacy of Module-Based Functional Communication Caregiver Training
for Moderate to Severe Problem Behavior

by

Lauren A. Phillips

A DISSERTATION

Presented to the Faculty of
University of Nebraska Graduate College
In Partial Fulfillment of the Requirements
For the Degree of Doctor of Philosophy

Medical Sciences Interdepartmental Area
Graduate Program

(Applied Behavior Analysis)

Under the Supervision of Professor Wayne W. Fisher

University of Nebraska Medical Center
Omaha, Nebraska

July, 2019

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Lauren Phillips

**EFFICACY OF MODULE-BASED FUNCTIONAL COMMUNICATION CAREGIVER
TRAINING FOR MODERATE TO SEVERE PROBLEM BEHAVIOR**

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University of Nebraska, 2019

Supervisor: Wayne W. Fisher, Ph.D.

Intensive behavior-analytic services typically reduce behavior problems associated with autism spectrum disorder. However, there are substantial barriers to access these services, including access to behavior analysts who can conduct the training. One way to address problem behavior and barriers to services is to train caregivers to implement function-based interventions to produce sustained improvements in child behavior. We developed a computer-based module (i.e., an e-learning module) to train caregivers to implement functional communication training, a function-based intervention, with extinction and safety procedures. Caregivers conducted a functional analysis to determine the function of their child's behavior. During baseline, caregivers responded as they typically would at home, and we determined their percentage correct caregiver responding. After completing the e-learning module, caregivers practiced implementing the training procedures in a role-play with a family member who acted like their child. Lastly, caregivers completed a posttest with their child, and we evaluated improvements in their percentage correct caregiver responding. All three caregivers demonstrated mastery of the procedures; one caregiver did not require feedback from a BCBA, and two caregivers required feedback to reach the mastery criterion. We discuss these findings and their implications for teaching caregivers to implement behavior-analytic procedures.

Keywords: autism spectrum disorder, caregiver training, e-learning modules, functional communication training, problem behavior

TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	i
ABSTRACT	ii
TABLE OF CONTENTS	iii
LIST OF FIGURES	v
LIST OF ABBREVIATIONS	vi
INTRODUCTION.....	1
Available Resources for Treating Childhood Problem Behavior	1
Caregiver Training	2
Computer-Based Caregiver Training.....	3
Purpose of the Current Study.....	3
CHAPTER 1: METHOD.....	4
Participants.....	4
Setting	5
Response Measurement and Reliability	6
CHAPTER 2: GENERAL PROCEDURE.....	10
Introduction.....	10
Functional Analysis	10
Evaluation of the Caregiver-Training E-learning Module	12
Baseline.....	13
Caregiver-Training E-learning Module.....	13
Role-play with Confederate.....	14
Posttest.....	15
Follow-up	16
CHAPTER 3: RESULTS.....	18
Functional Analysis.....	18

Baseline, Posttest, and Follow-up Sessions.....	21
Role-play with Confederate.....	25
Quantitative Effects Size.....	27
CHAPTER 4: GENERAL DISCUSSION.....	29
Summary.....	29
Implications.....	31
BIBLIOGRAPHY.....	33
APPENDIX.....	39

LIST OF FIGURES

Figure 1. Functional Analysis Data	20
Figure 2. Results of Baseline, Posttest, and Follow-up Sessions.....	24
Figure 3. Results of Role-play with Confederate Sessions.....	26

LIST OF ABBREVIATIONS

BCBA	Board Certified Behavior Analyst
BST	behavioral skills training
FCT	functional communication training

INTRODUCTION

Available Resources for Treating Childhood Problem Behavior

Most (i.e., 98%) individuals diagnosed with autism spectrum disorder engage in one or more types of problem behavior (e.g., aggression, property destruction, self-injurious behavior; Dominick, Davis Lainhart, Tager-Flusberg, & Folstein, 2007). Intensive applied-behavior-analytic services (i.e., 15-40 hr per week) are effective at decreasing problem behaviors associated with autism spectrum disorder (Lovaas, 1987); however, families encounter substantial barriers accessing these services. Applied-behavior-analytic services are costly; the national hourly cost of services implemented by a Board Certified Behavior Analyst (BCBA; Maglione, Kadiyala, Kress, Hastings, & O'Hanlon, 2017) averages \$94.72. One way to decrease the cost of applied-behavior-analytic therapy for families is to secure coverage for the cost of services through third-party payors (e.g., insurance). Forty-nine of the 50 United States have autism insurance laws that require insurance policies based in those states to fund applied-behavior-analytic services; however, the specific requirements vary from state to state which may reduce access to services when families move. For example, some states have (a) annual or lifetime caps on the allowable dollar amount of services, (b) age limits for service recipients, or (c) have weekly therapy hour limits. Additionally, one state (i.e., Tennessee) does not mandate autism insurance coverage; that is, insurance policies in that state can deny medically necessary treatments because there is no legal requirement to provide coverage (Autism Speaks, 2019). Even third-party payors pay for applied-behavior-analytic therapy costs, the dearth of and high demand for qualified providers often limit service access (Liptak et al., 2008). Other factors that limit or delay services include minority racial and ethnic status and lower socioeconomic status (Liptak et al., 2008). These barriers to service access led BCBA's to consider ways to increase

access to critical interventions more quickly after a child receives an autism diagnosis (Suess, Wacker, Schwartz, Lustig, & Detrick, 2016; Wacker et al., 2005).

Caregiver Training

Caregiver training is an effective way to address many barriers to service access. After a BCBA trains caregivers to implement a treatment program with integrity, that caregiver can continue to provide their child with access to services with minimal cost compared to if the BCBA implemented the treatment program him or herself. Caregiver training is especially effective because it converts the time that a child would have been at home without therapy into treatment time (Kuhn, Lerman, & Vorndran, 2003).

When the BCBA is teaching the caregiver to implement interventions identifying the function of, or reason for, problem behavior with a functional analysis is an important first step (Greer et al., 2019). Treatments based on functional analysis outcomes are more effective at achieving behavior-reduction goals than non-function-based interventions (Ingram, Lewis-Palmer, & Sugai, 2005). Functional Communication Training (FCT) is a function-based treatment that involves teaching a child a communicative response to access the reinforcer for problem behavior while ensuring that problem behavior no longer produces access to the reinforcer. Once the child learns the communicative response the schedule of reinforcement for the communicative response is thinned to practical levels for caregiver implementation in the home and community (Dominick et al., 2007; Greer, Fisher, Saini, Owen, & Jones, 2016). Caregiver training that includes behavioral skills training (BST; i.e., instructions, modeling procedures, role-play with caregivers until they respond to the mastery criterion, and feedback on errors and correct responding) can produce accurate caregiver implementation of treatment protocols and simultaneous reduction in the child's problem behaviors (Greer et al., 2019; Fisher, Greer, Fuhrman, & Querim, 2015;

Fisher, Luczynski, Hood, Lesser, Machado, & Piazza, 2014). However, caregiver training requires substantial time from a BCBA to implement BST to achieve these outcomes.

Computer-based Caregiver Training

One way to minimize time requirements is to develop an e-learning program that allows caregivers to access training through an online program. Combining technological advances to optimize high-quality training can produce outcomes that are consistent with services administered directly by a BCBA while reducing the number of sessions that a BCBA needs to be present (Fisher et al., 2014). Although e-learning module-based trainings exist for conducting functional behavior assessments and FCT (Griffin, & AFIRM Team, 2017; Sam & AFIRM Team, 2017; Vanderbilt Center on the Social and Emotional Foundations for Early Learning, n.d.) there are currently no empirically validated e-learning modules that systematically teach caregivers to implement FCT with their children.

Purpose of the Current Study

Therefore, the purpose of this proposed study was to develop and assess the efficacy of e-learning module to teach caregivers to implement FCT with their children who engaged in moderate to severe problem behavior.

CHAPTER 1: Method

Inclusion and Exclusion Criteria

Child participants were diagnosed with an autism spectrum disorder that was verified using the Autism Diagnostic Observation Schedule-2nd Edition (ADOS-2). We recruited Maggie from our severe behavior program's outpatient waiting list; children on this waiting list need approximately 15-30 hrs of services a week. Maggie and Roberto's BCBA's in other departments (e.g., the early intervention program) referred them for the study because they engaged in moderate to severe problem behavior and could benefit from assessment and treatment for their problem behavior. We excluded child participants if they had problem behavior (a) maintained by automatic reinforcement based on the results of the functional analysis, (b) that one caregiver could not safely manage alone, or (c) that did not occur consistently during the functional analysis (we excluded five participants for this reason).

We included caregivers if they (a) spoke, read, and wrote in fluent English; (b) were willing to attend appointments for 3 hrs weekly for 6 consecutive weeks and for 1 follow-up appointment; and (c) were able to recruit one individual (e.g., friend, family member) who was at least 19 years of age to serve as a confederate throughout training. We excluded caregivers if they (a) were currently receiving formal training comprised of a combination of instructions, modeling, role-play, and feedback on their performance based on functional-analysis results to decrease their child's problem behavior through the school or another program or if they (b) later decided they were unwilling to complete weekly appointments for 6 weeks (we excluded one participant for this reason).

Participants

Three caregivers and two children participated in this study; one child participated with both her mother and her father. Both child participants engaged in problem behavior (e.g., aggression, disruption of property, self-injurious behavior) maintained by social reinforcement that we confirmed based on the results of a functional analysis. Roberto was a 7-year-old male diagnosed with autism spectrum disorder, receptive expressive language disorder, and stereotypic movement disorder with self-injurious behavior. Roberto communicated using a combination of two to three-word mands with some carrier phrases (e.g., "I want...") and an augmentative and alternative communication device. Roberto's biological mother, Ms. Hernandez, was 38 years old. Ms. Hernandez reported that she completed her Associate's degree and that she had previous caregiver training on using differential reinforcement to minimize attention for problem behaviors and to provide praise for appropriate behaviors.

Maggie was a 6-year-old female diagnosed with autism spectrum disorder, an accompanying language impairment of other symbolic dysfunctions with limited intelligible speech and some phrase speech, and other specified disruptive, impulse-control, and conduct disorder. Maggie communicated using one to two-word mands and an augmentative and alternative communication device. Maggie's biological mother, Ms. Bowser, was 31 years old. Ms. Bowser was completing her Master's degree at the time of the study and reported no previous caregiver training. Maggie's biological father, Mr. Bowser, was 37 years old. Mr. Bowser reported that he completed some college and had no previous caregiver training.

Setting

Caregivers conducted sessions in a treatment room adjacent to a room with one-way observation at a university-based clinic. Treatment rooms contained a table and

chairs. The caregivers wore an earbud connected to a walkie-talkie so that the BCBA could communicate exclusively with the caregiver without the child hearing.

Response Measurement and Reliability

Child Behavior

Observers collected frequency data on child problem behavior (aggression, disruption of property, and self-injurious behavior), independent communication, and prompted communication. We used the program BDataPro (Bullock, Fisher, & Hagopian, 2017), to convert data from the functional analysis, baseline, and treatment evaluation to responses per minute by dividing the number of behaviors by the session duration. Aggression included hitting, kicking, pushing, pulling, grabbing, throwing for both participants; biting, choking, pinching, scratching, head butting, and face grinding for Maggie. Self-injurious behavior included self-hitting for both participants; headbanging for Roberto; body-slamming, hair pulling, pinching, scratching, and biting for Maggie. Disruption included throwing, hitting, and kicking objects, swiping objects from surfaces for both participants; tearing objects for Maggie. Child independent functional communication included vocally stating the specified reinforcer (e.g., Observers scored independent communication when Maggie independently said “up”; Roberto independently said “toys please”) or handed the communication card to the caregiver that included a picture of the child’s reinforcer with the communication response written below the picture (e.g., a picture of trains and a tablet above the text “toys please”). Child prompted functional communication occurred when the child used the vocal or card communication described above after the caregiver modeled the response or used hand over hand guidance to prompt the child to pick up the communication card and hand it to the caregiver. Observers did not score child independent or prompted communication if the communicative response co-occurred or occurred within 3 s

following problem behavior. Observers collected duration data on child negative vocalizations, which included any vocalization above conversational level (i.e., screaming, crying).

Caregiver Behavior

We collected frequency data on caregiver opportunities to prompt a communicative response, caregiver prompting communicative responses, caregiver reinforcing communicative responses, caregiver reinforcing child problem behavior, and caregiver correct use of safety procedures. Caregivers had an opportunity to prompt a functional communicative response following 3 s in which their child did not have access to the functional reinforcer, which was a train set and a tablet for Roberto and attention for Maggie and during which their child did not emit an independent communicative response or engage in problem behavior or negative vocalizations. We defined caregiver prompting communicative responses as the caregiver modeling the vocal response (e.g., “say, toys please”), modeling the card exchange (e.g., “you can ask for your toys like this [placed card in their own hand]”), or using hand over hand guidance to help his or her child pick up the card and place it in the caregiver’s hand. We defined caregiver reinforcing the communicative response as providing the child the functional reinforcer within 10 s of the child’s independent or prompted communicative response. We defined caregiver reinforcing child problem behavior as the caregiver providing the functional reinforcer within 3 s of problem behavior or if problem behavior occurred within 3 s of the caregiver providing reinforcement for the functional communication response. We defined caregiver correct use of safety procedures as blocking problem behavior by inserting either the underside of his or her forearm or an open palm between the part of the body his or her child was using for problem behavior (e.g., the child’s mouth, the child’s head, the child’s hand) and area that his or her child was targeting (e.g., the

caregivers arm, the floor, the wall). Blocking disruption of property also included holding items that the child forcefully attempted to move (e.g., chairs, tables).

We used an electronic spreadsheet program to calculate correct caregiver responding by summing the frequency of the caregiver prompting communicative responses, reinforcing communicative responses, using correct safety procedures, and placing problem behavior on extinction (i.e., frequency of problem behavior less frequency of reinforcement for problem behavior). We then calculated the number of opportunities the caregiver had to respond correctly to communicative responses (i.e., the sum of opportunities to prompt communicative responses and instances of child prompted and independent communicative responses) and problem behavior (i.e., the frequency of the child's problem behavior times two representing the opportunity to use correct safety procedures and place problem behavior on extinction for each instance of problem behavior). We divided the number of correct caregiver responses by the number of opportunities to respond correctly and converted the ratio to the percentage of correct caregiver responding.

Reliability

A second observer scored 33% of randomly selected sessions independently to assess data accuracy (reliability). The reliability of direct-observation measures was established through measurement of interobserver agreement. We used the program BDataPro (Bullock et al., 2017) to calculate exact interobserver agreement for each behavior by dividing the number of 10-s intervals in which both observers scored the same number of occurrences of behavior by the total number of intervals (e.g., 30 intervals) and converting the ratio to a percentage. Mean agreement coefficients across participants were 99% (range, 85% to 100%) for problem behavior, 88% (range, 37% to 100% with 12% of sessions below 70%) for negative vocalizations, 96% (range, 85%

to 100%) for child independent communicative responses, 99% (range, 85% to 100%) for child prompted communicative responses, 95% (range, 96% to 100%) for caregiver opportunities to prompt communicative responses, 99% (range, 89% to 100%) for caregiver prompting communicative responses, 98% (range, 89% to 100%) for caregiver reinforcing communicative responses, 98% (range, 83% to 100%) for caregiver reinforcing problem behavior, and 98% (range, 83% to 100%) for caregiver correct use of safety procedure.

CHAPTER 2: General Procedure

Introduction

Participants and their caregivers attended the clinic either twice weekly for 1.5-hr appointments or weekly for 3-hr appointments. We conducted all sessions with Roberto in a session room with padding on the walls and floor due to his headbanging.

Functional Analysis

The BCBA taught the caregiver to conduct a functional analysis to assess if the participants' problem behavior was maintained by social reinforcement (Hammond, Iwata, Rooker, Fritz, & Bloom, 2013; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994). The BCBA provided the caregiver with vocal instructions on how to implement the condition procedure and on how to block unsafe problem behavior before the caregiver conducted each condition. The BCBA then role-played as the child and provided feedback on correct and incorrect implementation until the caregiver demonstrated three-consecutive trials with 100% correct responding to problem behavior and nontarget behavior (i.e., behaviors other than the child's problem behaviors). Functional-analysis sessions were 5 min.

Monitored ignore screener (Ms. Hernandez and Ms. Bowser only)

Ms. Hernandez and Ms. Bowser conducted a monitored ignore screener to rule out that problem behavior was maintained by automatic reinforcement (Querim, Iwata, Roscoe, Schlichenmeyer, Ortega, & Hurl, 2013). The caregiver and child entered the session room, and the caregiver did not respond to any problematic or nontarget behaviors for their child.

Multielement functional analysis

Ms. Hernandez and Ms. Bowser conducted a fixed-sequence multielement functional analysis, which included attention, toy play, escape, and tangible conditions. The caregiver provided no differential consequence for nontarget behaviors.

Attention

The caregiver and child played for 1 min before the start of the session. The caregiver then pretended to be busy. The caregiver provided 20 s of verbal and physical attention following each instance of problem behavior. This condition served as the test for problem behavior maintained by social positive reinforcement in the form of access to attention.

Toy Play (control)

The caregiver provided the child with preferred toys throughout the session and access to attention at least every 20 s. This condition served as the control.

Escape (Ms. Hernandez and Ms. Bowser only)

The caregiver presented demands that they reported evoked problem behavior (e.g., matching tasks and activities of daily living [Maggie], cleaning up clothing and paper [Roberto]). The caregiver delivered the instruction, modeled how to complete the task, and used hand over hand guidance as needed (i.e., three-step prompting.) The caregiver stopped delivering instructions, stepped away from his or her child, and provided a 20-s break from instructions following problem behavior. This condition served as the test for problem behavior maintained by social negative reinforcement in the form of escape from demands.

Tangible (Ms. Hernandez and Ms. Bowser only)

The caregiver provided the child with access to highly preferred item(s) for 1 min (train set [Roberto], tablet [Robert and Maggie]). At the start of the session, the caregiver

removed the preferred items. The caregiver returned the item(s) to the child for 20 s following problem behavior. This condition served as the test for problem behavior maintained by social positive reinforcement in the form of access to tangible items.

Reversal Analysis for Roberto.

Roberto engaged in only one instance of problem behavior during the multielement functional analysis. Ms. Hernandez reported that Roberto's problem behavior was more likely to occur when Roberto had to wait longer to receive his toys than we had programmed in the tangible condition. Therefore, we switched to a BAB reversal design and conducted consecutive tangible sessions in the B phases (i.e., Sessions 15 to 18 and 22 to 24) and consecutive toy-play sessions in the A phase (i.e., Sessions 19 to 21).

Reversal analysis for Maggie

Mr. Bowser conducted an ABAB reversal design to confirm that Maggie had problem behavior to access his attention as it did with Ms. Bowser.

Evaluation of the Caregiver-Training E-learning Module

Baseline

The caregiver conducted baseline sessions by establishing the antecedent from the test condition of the functional analysis that evoked the most problem behavior. As Maggie's problem behavior was multiply maintained (attention and tangible), her caregivers choose to focus on her attention-maintained problem behavior because attention restriction reportedly caused more problem behavior at home. We treated Maggie's tangible-maintained problem behavior after completion of this study.

Before the session, the BCBA asked the caregiver to describe how she or he typically responded when his or her child had problem behavior. The BCBA then told the caregiver that they could respond; however, they typically would. For Ms. Hernandez, the BCBA started the session by telling Ms. Hernandez to restrict Roberto's preferred

items and respond however she typically would. For Ms. Bowser or Mr. Bowser, the BCBA started the session by telling Ms. Bowser or Mr. Bowser that she or he could restrict her or his attention and respond as she or he typically would. If the caregiver provided continuous access to preferred items (Ms. Hernandez) or attention (Mr. or Ms. Bowser) for 60 s, the BCBA instructed the caregiver to remove the preferred items (Ms. Hernandez) or restrict their attention (Mr. or Ms. Bowser). Caregivers had a communication card in the session room. Ms. Hernandez had a bucket of toys that contained a train set and a tablet. Baseline sessions were 5 min.

Caregiver-training E-learning Module.

Caregivers completed the e-learning module in a single, 25- to 40-min appointment in a quiet room without their child present. During training, participants had a laptop computer with the Articulate 360 program (Articulate Global, Inc., 2018). The training was a computer-based e-learning module that included instructional slides, video demonstrations, quizzes, and a BCBA voiceover that read and explained the slides. The training content explained (a) how to identify antecedents that precede and consequences that follow behavior; (b) reinforcement and how it contributes to the development of problem behavior; (c) applications of reinforcement to increase appropriate behaviors; (d) description of the purpose of the functional analysis and what the outcomes meant for the caregiver's child; (e) basic safety procedures describing body positioning (e.g., be at or above your child's level), environmental modification (e.g., remove breakable items), and blocking strategies, (f) functional communication responses; (g) how to select a form of communication (e.g., vocal, picture card) that is appropriate for the child; (h) how to prompt communication; (i) how to create motivation for child communication, (j) how to implement FCT when the child did not engage in

problem behavior; and (k) how to respond to problem behavior and implement extinction (i.e., withhold reinforcement) until the child communicated.

Caregivers had a quick reminders sheet available during training (see appendix for the quick reminders sheet for tangibly maintained problem behavior), a pencil, and scratch paper to take notes. The quick reminders sheet consisted of one single-sided sheet of paper that described (a) the reason for the child's problem behavior, (b) how to prompt communication, (c) how to respond to problem behavior, and (d) safety recommendations. Caregivers completed three quizzes on (a) identifying antecedents, behaviors, and consequences that contribute to problem and appropriate behaviors; (b) Identifying the probable functions of problem behavior from scenarios; (c) identifying the function of their child's problem behavior. Quizzes were embedded into the training, and we programmed the quizzes so that caregivers did not move on to the next section until they scored 100% on the quiz.

Role-play with Confederate.

Caregiver plus confederate sessions occurred following the completion of the caregiver-training e-learning module. Each session included 10 trials, lasting between 4 and 9 min. The caregiver designated a family member, which we call the confederate, who was willing to role-play as the caregiver's child with the caregiver role-playing as him or herself. We programmed the role-plays so the caregiver had multiple opportunities to practice the skills taught in the e-learning module in each session. The opportunities to prompt and reinforce communicative responses and to place problem behavior on extinction and use safety strategies were equivalent across sessions. The confederate had a script with instructions on how to respond (i.e., when to engage in problem behavior, types of problem behavior, independent communication, prompted communication). The caregiver had his or her quick reminders sheet and a functional

communication card in the room. The BCBA instructed the caregiver to remove the preferred items (Ms. Hernandez) or to restrict his or her attention (Mr. and Ms. Bowser) and to respond to the confederate based on what they learned in the caregiver-training e-learning module. If the caregiver provided continuous access to preferred items (Ms. Hernandez) or attention (Mr. and Ms. Bowser) for 60 s, the BCBA instructed the caregiver to remove the preferred items (Ms. Hernandez) or restrict his or her attention (Mr. and Ms. Bowser). The BCBA reminded the caregiver to refer to his or her quick reminders sheet if he or she had any questions.

Pre-session Feedback for Mr. Bowser

Mr. Bowser's responding during role-play sessions with the confederate did not reach the mastery criterion of 80% correct responding across three consecutive sessions, and his percentage of correct responding was not increasing toward the mastery criterion, the BCBA provided feedback before the next session until the caregiver's responding reached the mastery criterion.

Before session 7, the BCBA completed a feedback session with Mr. Bowser. The BCBA provided verbal feedback that he should prompt a communicative response following 3 s in which the confederate did not have Ms. Bowser's attention and during which the confederate did not emit an independent communicative response, engage in problem behavior, or engage in negative vocalizations. The BCBA also provided Mr. Bowser feedback that he should not comment on or tell the confederate not to have problem behavior. Lastly, the BCBA provided Mr. Bowser feedback that he should block each instance of problem behavior, specifically by setting the confederate's hands down when she pinched him and by holding onto furniture that the confederate tried to throw and push.

Posttest

The caregiver conducted posttest sessions with his or her child after demonstrating mastery with the confederate. The BCBA instructed Ms. Hernandez to remove the preferred items from the confederate and Mr. and Ms. Bowser to restrict attention from the confederate and to respond to the confederate based on what they learned in the caregiver-training e-learning module. If the caregiver provided continuous access to preferred items (Ms. Hernandez) or attention (Mr. and Ms. Bowser) for 60 s, the BCBA instructed the caregiver to remove the preferred items (Ms. Hernandez) or restrict their attention (Mr. and Ms. Bowser). The BCBA reminded the caregiver before the start of the session to refer to their quick reminders sheet if they had any questions. Posttest sessions were 5 min.

Pre-session feedback for Ms. Bowser

Ms. Bowser's responding during posttest session with Maggie did not reach the mastery criterion of 80% correct responding across three consecutive sessions, and her percentage of correct responding was not increasing toward the mastery criterion. Therefore, the BCBA completed a feedback session before Session 12. The BCBA provided Ms. Bowser verbal feedback that she should prompt a communicative response following 3 s in which Maggie did not have Ms. Bowser's attention and during which Maggie did not emit an independent communicative response or engage in problem behavior or negative vocalizations. The BCBA also provided feedback that Ms. Bowser should provide attention for verbal requests (e.g., "up") in addition to card exchanges. Lastly, the BCBA provided feedback that Ms. Bowser should block each instance of self-injurious behavior, including self-pinching, as this often produced redness on Maggie's skin.

Follow-up

The follow-up appointments occurred 2 weeks after the last posttest session for Ms. Hernandez and Mr. Boswer or after the last posttest with pre-session feedback for Ms. Bowser. These appointments were identical to the posttest sessions.

Pre-session feedback for Mr. Bowser

Mr. Bowser's responding during the follow-up posttest sessions with Maggie did not maintain the mastery criterion of 80% correct responding across three consecutive sessions, and his percentage of correct responding was not increasing toward the mastery criterion. Therefore, the BCBA completed a feedback session before session 23. The BCBA provided Mr. Bowser verbal feedback that he should prompt a communicative response following 3 s in which Maggie did not have Ms. Bowser's attention and during which Maggie did not emit an independent communicative response or engage in problem behavior or negative vocalizations. The BCBA also provided feedback that Mr. Bowser should provide attention for Maggie's independent communicative responses that immediately followed Mr. Bowser removing his attention. Lastly, the BCBA provided feedback that Mr. Bowser should block each instance of problem behavior, specifically by setting Maggie's hands down when she pinched him and by holding onto furniture that Maggie tried to throw and push. Before Session 26, the BCBA provided Mr. Bowser additional verbal feedback that he should provide attention for Maggie's independent communicative responses that immediately followed Mr. Bowser removing his attention. The BCBA also provided feedback that Maggie needed to emit a communicative response before Mr. Bowser provided attention and that Mr. Bowser could either help her say what she wanted (e.g., "up) or help her use the communication card.

In session feedback for Mr. Bowser

Mr. Bowser's responding with Maggie during the follow-up posttest sessions with pre-session feedback did not meet the mastery criterion of 80% correct responding across three consecutive sessions. Therefore, the BCBA provided in-session feedback throughout each session until his responding reached the mastery criterion. During Sessions 28 to 31, the BCBA alerted Mr. Bowser when he had an opportunity to prompt a communicative response (i.e., following 3 s in which Maggie did not have Ms. Bowser's attention and during which Maggie did not emit an independent communicative response or engage in problem behavior or negative vocalizations). The BCBA also provided Mr. Bowser feedback that Maggie needed to emit a communicative response before Mr. Bowser provided her attention and that Mr. Bowser could either help her say what she wanted (e.g., "up) or help her use the communication card.

CHAPTER 3: Results

Functional Analysis

Figure 1 depicted the rate of child problem behavior during caregiver-conducted functional analyses for Roberto with Ms. Hernandez (top), Maggie with Ms. Bowser (middle), and Maggie with Mr. Bowser (bottom). Roberto engaged in one instance of problem behavior during the monitored ignore screener; therefore, we ruled out problem behavior maintained by automatic reinforcement. Roberto engaged in only one instance of problem behavior during the multielement functional analysis. The BAB reversal showed that social positive reinforcement in the form of access to preferred tangible items maintained Roberto's problem behavior. Maggie engaged in two instances of problem behavior during the monitored ignore screener; therefore, we ruled out problem behavior maintained by automatic reinforcement. The results of Maggie's multielement functional analysis with Ms. Bowser demonstrated that social positive reinforcement in the form of access to attention and access to preferred tangible items maintained

Maggie's problem behavior. The results of Maggie's reversal-design functional analysis with Mr. Bowser confirmed that Mr. Bowser's attention functioned as reinforcement for Maggie's problem behavior.

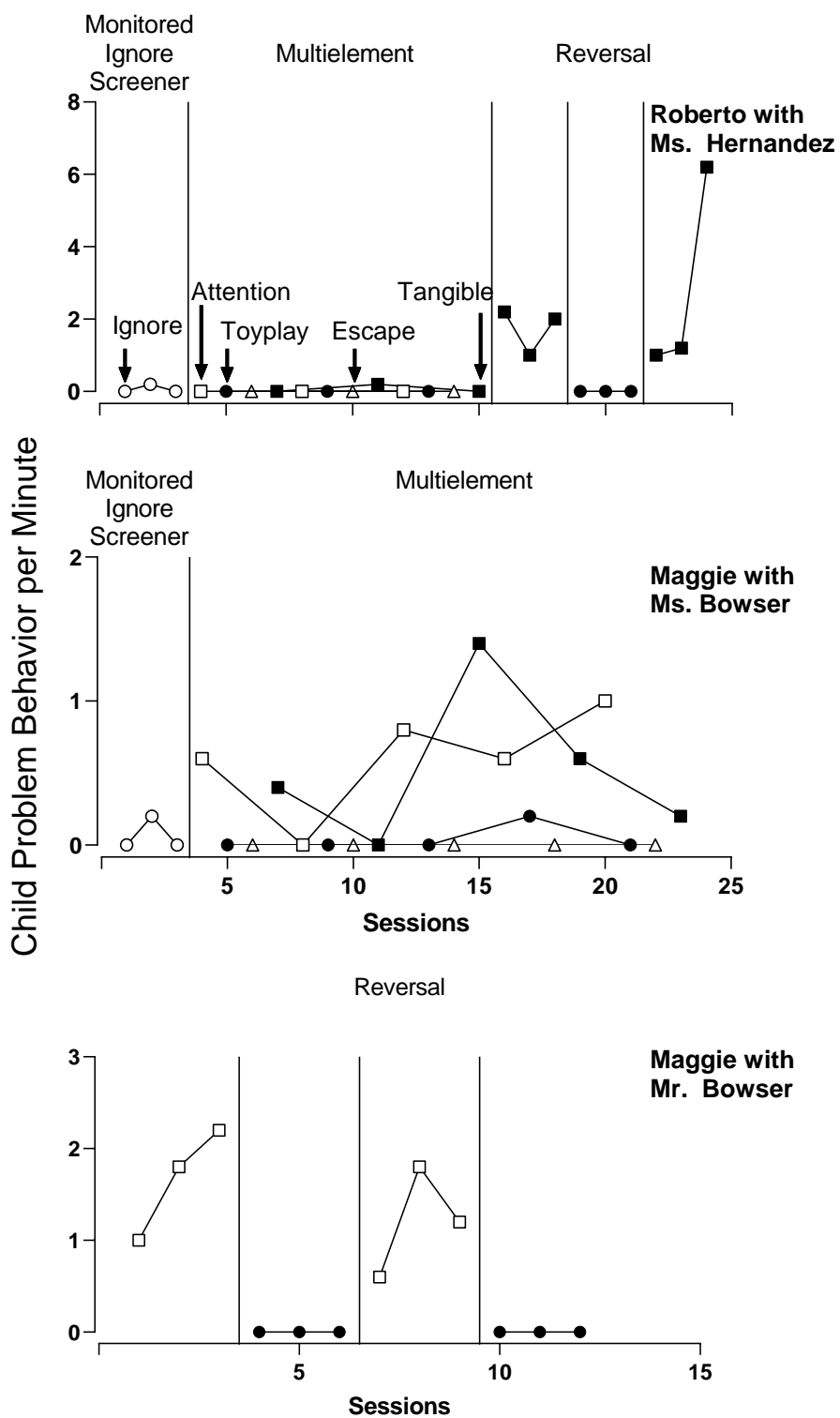


Figure 1. Child problem behavior per minute for Roberto with Ms. Hernandez (top), Maggie with Ms. Bowser (middle), and Maggie with Mr. Bowser (bottom) during caregiver-implemented functional analyses.

Baseline, Posttest, and Follow-up Sessions

Figure 2 depicts the percentage of correct caregiver responding during baseline and posttest sessions (left) and the rate of child problem behavior (right) for Ms. Hernandez and Roberto (top), Ms. Bowser and Maggie (middle), and Mr. Bowser and Maggie (bottom).

During baseline, mean correct responding for Ms. Hernandez was 51% (range, 47% to 54%). During posttest sessions, mean correct responding increased to 100%. During the 2-week follow-up appointment, correct responding maintained at a high level ($M = 97%$; range 0% to 29%). During baseline, Roberto's mean responses per minute of problem behavior was 1.7 (range, 1.2 to 2). During posttest sessions, mean responses per minute of problem behavior decreased to 0 and maintained at the 2-week follow-up appointment. Ms. Hernandez reported that she practiced the strategies she learned in the caregiver-training e-learning module at home before the posttest sessions and between the posttest and 2-week follow-up appointment and that Roberto showed great improvement at home.

During baseline, mean correct responding for Ms. Bowser was 10% (range, 0% to 12%). During posttest sessions, mean correct responding increased to 70% (range, 58% to 79%); however, Ms. Bowser did not meet mastery during posttest sessions following completion of the caregiver-training e-learning module and role-play with the confederate. Therefore, the BCBA provided pre-session feedback before Session 12. After pre-session feedback, Ms. Bowser's mean correct responding was 92% (range, 84% to 100%). During the 2-week follow-up appointment, Ms. Bowser maintained a high percentage of correct responding ($M = 96%$; range, 89% to 100%). During baseline, Maggie's mean rate of problem behavior per minute was 0.7 (range, 0 to 1.6). During posttest sessions, Maggie's mean problem behavior per minute initially increased

relative to baseline and started to decrease ($M = 0.9$; range, 0.6 to 1.2); however, when the BCBA introduced feedback to Ms. Bowser, Maggie's mean problem behavior per minute initially increased to 1.0 (range, 1.0 to 1.4). During the 2-week follow-up appointment, Maggie's mean problem behavior per minute decreased ($M = 0.1$; range, 0 to 0.2). Ms. Bowser reported that she practiced the strategies she learned in the caregiver-training e-learning module at home between the posttest and 2-week follow-up appointment and the strategies helped Maggie use her words to communicate instead of having problem behavior at home.

During baseline, Mr. Bowser's mean correct responding was 11% (range, 0% to 38%). During posttest sessions, mean correct responding was 52% (range, 0% to 83%) and met the mastery criterion during his last three posttest sessions ($M = 82\%$; range, 80% to 83%). During 2 two-week follow-up appointment, mean correct responding decreased to 27% (range, 0% to 67%). Therefore, the BCBA provided pre-session feedback before Sessions 23 and 26. After pre-session feedback, Ms. Bowser's mean correct responding increased to 81% in Session 23 and to 88% in Session 26 but decreased in subsequent sessions when the BCBA did not provide pre-session feedback. Therefore, the BCBA introduced in-session feedback, and Mr. Bowser's mean correct responding increased to 100%. During baseline, Maggie's mean problem behavior per minute was 0.6 (range, 0 to 1.2). During posttest sessions, Maggie's mean problem behavior per minute decreased to 0.3 (range, 0 to 0.8). During the 2-week follow-up appointment, Maggie's mean problem behavior per minute decreased to 0.2 (range, 0 to 0.4) when the BCBA did not provide feedback. Maggie's mean problem behavior per minute increased to 0.8 (range, 0.2 to 1.6) when the BCBA provided pre-session feedback. Maggie's mean problem behavior per minute initially increased ($M = 0.4$; range, 0 to 1) when the BCBA provided in-session feedback; however, her mean

problem behavior per minute decreased to 0 across the last two sessions. Mr. Bowser reported that he did not practice the strategies he learned in the caregiver-training e-learning module at home. The BCBA encouraged him to start using the strategies at home.

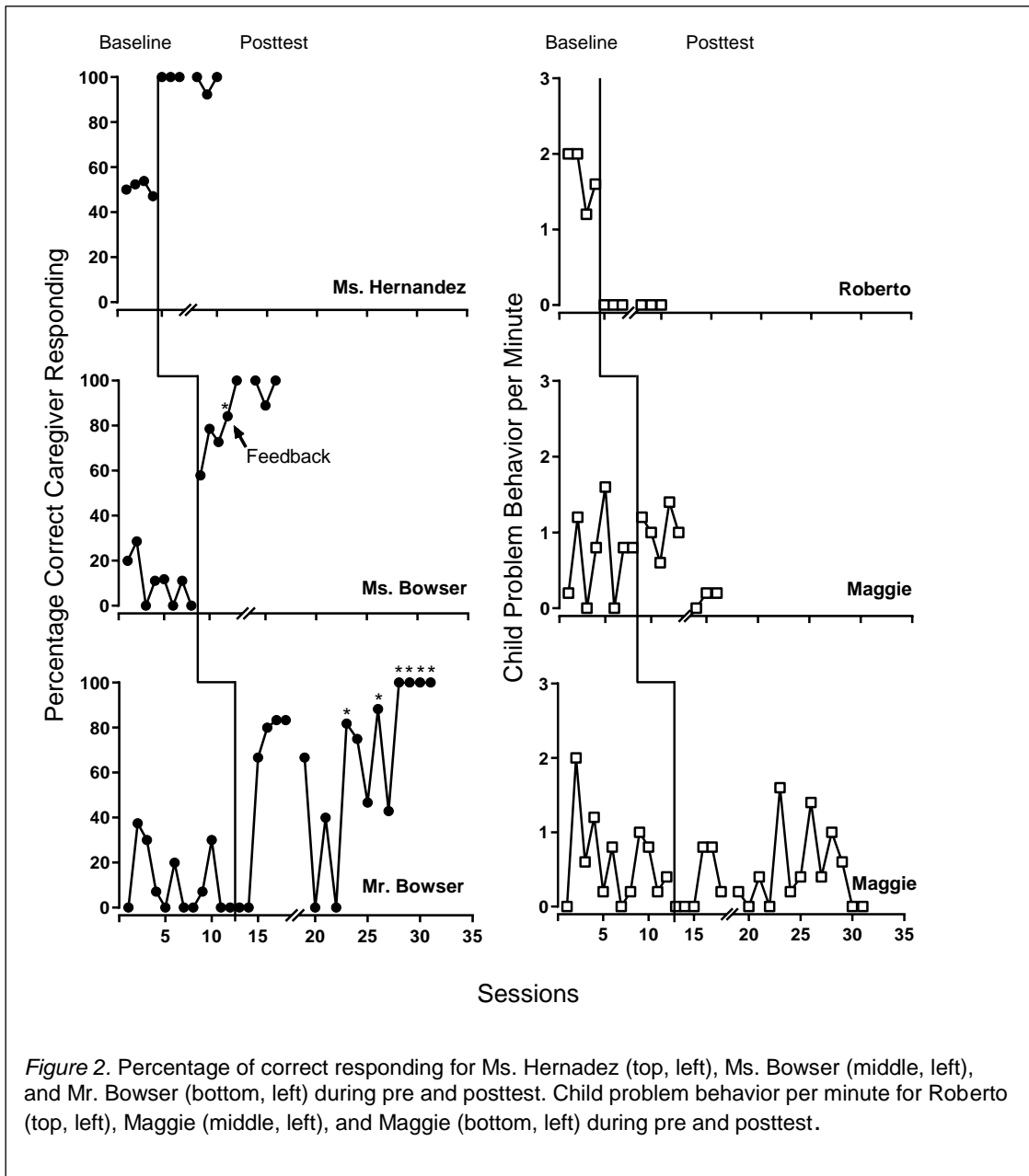
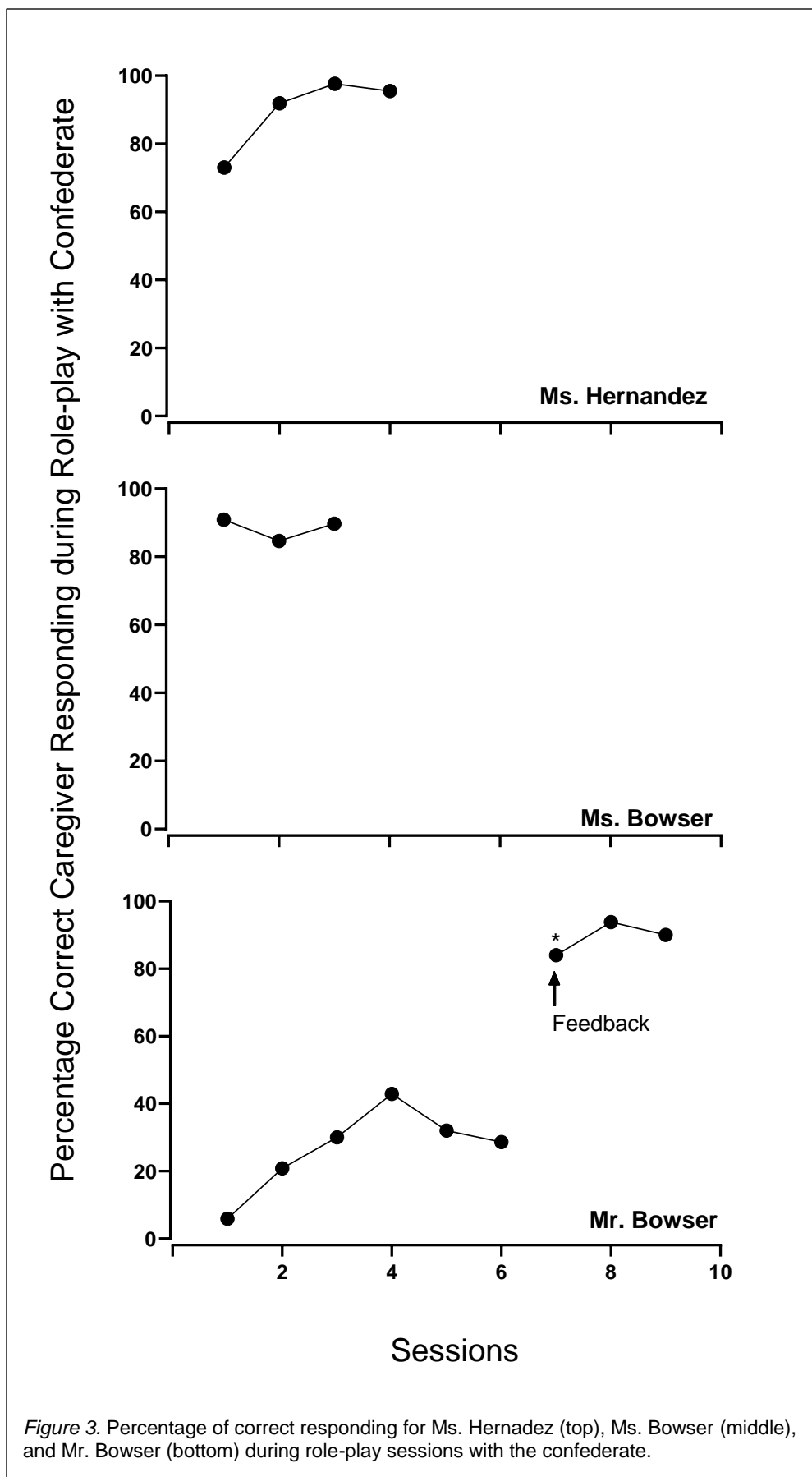


Figure 2. Percentage of correct responding for Ms. Hernandez (top, left), Ms. Bowser (middle, left), and Mr. Bowser (bottom, left) during pre and posttest. Child problem behavior per minute for Roberto (top, left), Maggie (middle, left), and Maggie (bottom, left) during pre and posttest.

Role-play with Confederate

Figure 3 depicts the percentage of correct responding during confederate role-play sessions for Ms. Hernandez (top), Ms. Bowser' (middle), and Mr. Bowser (bottom). Ms. Hernandez's mean correct responding with the confederate was 90% (range, 73% to 98%), and she met the mastery criterion to progress to posttest sessions with Roberto after four sessions without BCBA feedback. Ms. Bowser's mean correct responding with the confederate was 88% (range, 85% to 901%), and she met the mastery criterion to progress to posttest sessions with Maggie after three sessions without BCBA feedback. Mr. Bowser's mean correct responding with the confederate was 27% (range, 6% to 43%). Mr. Bowser did not meet the mastery criterion; therefore, the BCBA introduced pre-session feedback before Session 7. After pre-session feedback, Mr. Bowser's mean correct responding with the confederate was 89% (range, 84% to 94%), and he met the mastery criterion to progress to posttest sessions with Maggie after three sessions after one session of pre-session feedback.



Quantitative Effects Size

Single-case research studies seldom report effect sizes and the studies that do rarely report equivalent measures to those used in group-comparison studies. This hinders inclusion of single-case research outcomes in meta-analytic studies (Parker, Vannest, & Davis, 2011). However, researchers have developed methodologies for calculating effect-size statistics single-case research that produce equivalent measures to those for group-comparison research (cf. Fisher & Lerman, 2014; Shadish, 2014). We included effect-size statistics (i.e., between-case, effect-size measures) to increase to the probability that single-case research results are included in meta-analyses. We used a single-case, hierarchical-linear-model program to calculate the between-case effect size that produces equivalent outcomes to Cohen's d (Pustejovsky, 2016). We analyzed data from the baseline and the initial posttest sessions and excluded posttest sessions that we conducted after BCBA feedback. Caregiver correct responding during the posttest was significantly higher as compared to baseline and produced an effect size indicative of a large treatment effect ($d = 1.36$; 95% confidence intervals = 0.45 to 2.66; Cohen, 1997).

In summary, caregivers met the mastery criterion after the caregiver-training e-learning module. Ms. Hernandez demonstrated an immediate increase in her percentage of correct responding with the confederate and met the mastery criterion after four sessions with the confederate. When Ms. Hernandez completed posttest sessions with Roberto, she immediately met the mastery criterion and maintained high levels of correct responding during follow-up sessions. Ms. Bowser immediately met the mastery criterion in her first three sessions with the confederate. When Ms. Bowser completed posttest sessions with Maggie, she demonstrated an immediate increase in her percentage of correct responding; however, she only met the mastery criterion after one session of

presession feedback with the BCBA. Ms. Bowser maintained high levels of correct responding during follow-up sessions. Mr. Bowser demonstrated a slight increase in his percentage of correct responding with the confederate; however, he only met the mastery criterion after one session of presession feedback with the BCBA. When Mr. Bowser completed posttest sessions with Maggie, he initially demonstrated zero levels of correct responding that increased to the mastery criterion after six sessions. During follow-up sessions, Mr. Bowser demonstrated a decrease in his percentage of correct responding. Although presession feedback was temporarily effective at increasing Mr. Bowser's percentage of correct responding, in session feedback was necessary to increase Mr. Bowser's responding to the mastery criterion.

CHAPTER 4: GENERAL Discussion

Summary

One of three caregivers (Ms. Hernandez) who completed the caregiver-training e-learning module demonstrated mastery of the procedures without feedback from a BCBA. A second caregiver, Ms. Bowser, required only one pre-session feedback session during posttest sessions with her child before meeting the mastery criterion. The final caregiver, Mr. Bowser, required one pre-session feedback session during role-play sessions with the confederate. Although this caregiver initially demonstrated an increase in correct caregiver responding across posttest sessions that met the mastery criterion, his increased percentage of correct responding did not maintain during follow-up sessions and required the addition of pre-session and in-session feedback to reach the mastery criterion. These findings suggest that some caregivers can learn to implement FCT, extinction, and safety procedures following an e-learning caregiver-training module without direct training from a BCBA. Others will require feedback to reach the mastery criterion.

There are several factors that may contribute to effective e-learning modules. Behavioral skills training is the standard of care for training caregivers to implement procedures with their child (Austin, Doering, & Davies, 2018; Booth, Keenan, & Gallagher, 2018; Dogan et al., 2017; Drifke, Tiger, & Wierzba, 2017; Subramaniam, 2017). Previous BST research demonstrates that instructions, modeling how to implement procedures, role-play to practice procedures, and feedback on errors and correct implementation are critical components of BST that allow caregivers to achieve mastery criterion. Our caregiver-training e-learning module incorporated aspects of BST, including instructions and modeling how to implement the procedure; however, the caregiver-training e-learning module did not incorporate role-play or feedback. In our

study, we incorporated role-play with the confederate after caregivers' completed the caregiver-training e-learning module. Caregivers received feedback on errors and correct implementation if their responding did not increase to the mastery criterion during role-play sessions with the confederate or during posttest sessions. Caregivers' demonstrated improvements in their percentage of correct responding after the caregiver-training e-learning module with two caregivers requiring one session of pre-session feedback during role-play sessions (Mr. Bowser) or during posttest sessions (Ms. Bowser) to reach the mastery criterion. Including the role-play and feedback incorporated the remaining BST components that were not addressed in the caregiver-training e-learning modules and allowed all caregivers to reach the mastery criterion. Future research should evaluate ways to incorporate role-play procedures and feedback on errors and correct implementation into e-learning modules.

Another factor that affects the outcomes of e-learning modules is the amount of active responding required from the learner (Armendariz & Umbreit, 1999; Bernard et al., 2009; Gardner, Heward, & Grossi, 1994). Bernard et al. (2009) demonstrated that more interactive components in training content improved learning outcomes for people who could access the content on their own schedule (e.g., e-learning modules) compared to people who could access the training content at a scheduled time (e.g., televideo courses). Therefore, e-learning modules, like the current caregiver-training module, may benefit from components that require active learner responding (e.g., quizzes that require caregivers to reach a mastery criterion before progressing through the module).

Another factor that can contribute to the effectiveness of e-learning modules is the complexity of the skills the learner needs to acquire (Sitzmann, Kraiger, Stewart & Wisher, 2006; Tallent-Runnels et al., 2006). Functional Communication Training and extinction may be difficult concepts for caregivers to understand given the complexity of

behavioral terminology (Freedman, 2016). E-learning modules may be advantageous because they allow a BCBA to develop training content that is built on a foundation of clear rules to help caregivers learn relevant terminology and target skills from training modules. Our caregiver-training e-learning module and quick reminders sheet provided rules on how to respond to problem behavior, how to respond to and prompt communicative responses, and how to follow safety recommendations. These rules probably helped caregivers learn a relatively complex set of skills and made these skills more appropriate to learn via e-learning module.

Implications

All three caregivers met mastery criterion in posttest sessions either without feedback or following one pre-session feedback session. Incorporating BST, active responding, and breaking complex content into clear rules all may have increased the likelihood that our caregivers learned how to implement FCT, extinction, and safety procedures. Although acquisition of these requisite skills is critical for treatment success, it is also important that caregivers maintain those skills over time. Two out of three caregivers maintained mastery of all procedures at a two-week follow-up session; however, one caregiver demonstrated a notable decrease in his percentage of correct responding at the start of the follow-up appointment. Mr. Bowser reported that he did not practice the caregiver training strategies at home, which may have contributed to his decreased correct responding. Future research should consider ways to incorporate more frequent practice sessions at the clinic or at home to help caregivers maintain acquired skills across time. Some potential directions could include training caregivers to take data, complete daily practice sessions, and report those data back to the BCBA through the e-learning platform.

There are many barriers that prevent caregivers from accessing caregiver training. Waitlists for applied-behavior-analytic services are often long due to the limited number of BCBA's who are available to provide those services (Liptak et al., 2008). Additionally, caregiver training is time intensive and often takes several hours to train caregivers on introductory concepts such as those we targeted in our caregiver-training e-learning module. Mr. Bowser and Ms. Bowser did not receive caregiver training before this study but both caregivers' demonstrated improvements in correct responding following the caregiver-training e-learning module and one pre-session feedback session with a BCBA. By developing a clear and efficient e-learning module, the BCBA was able to use the same content across families with only minor modifications to adjust for different functions of behavior. Additionally, caregivers were able to quickly complete the training (all caregivers completed the training in 25 to 40 min). Transferring caregiver training time from the BCBA's schedule to an e-learning module that caregivers can access independently reduces the demand on BCBA's time, allows BCBA's to support more clients, and produces high-quality producing improvements in the percentage of correct caregiver responding.

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APPENDIX: QUICK REMINDERS SHEET

Quick Reminders

Reason for Problem Behavior

My child has problem behavior to get his/her preferred items and activities.

- If I do the following things when my child has problem behavior, my child will have problem behavior more often:
 - Give toys back, give other toys, start playing fun games, distract my child with other activities

Communication

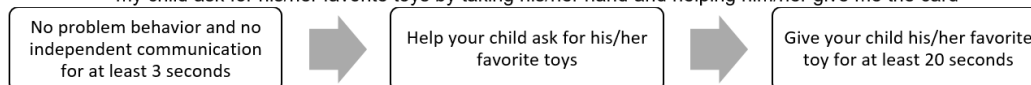
• **Independent communication**

- If my child asks for his/her favorite toy(s) **without problem behavior**, I should give my child his/her favorite toy(s) for at least 20 seconds



• **Help communicating**

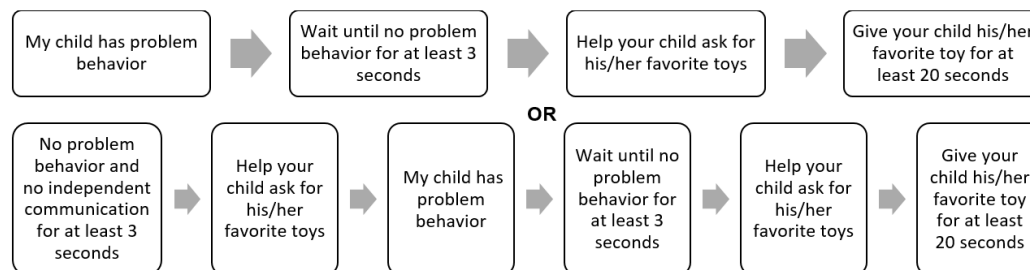
- If my child is **not** having problem behavior and is not communicating for his/her favorite toys, I can help my child ask for his/her favorite toys by taking his/her hand and helping him/her give me the card



Problem Behavior

• **Responding to Problem Behavior**

- Do not provide toys or fun activities when your child is having problem behavior
 - Do not give your child a different toy than the one you said they could not have
 - Do not talk to your child
 - Do not pick your child up
 - Do not try to teach your child to communicate while he/she is having problem behavior
- Do use safety recommendations
- Do wait until problem behavior stops for 3 seconds and then help your child ask for his/her favorite toys



• **Safety recommendations**

- Block problem behavior
 - Gently remove your child's hands off of your body if your child is hurting you
 - Use your forearm to stop your child from hurting him- or herself
 - Block your child from hitting, biting, grabbing, and scratching him or herself.
 - Remove items from your child's area if he/she is throwing items or using items unsafely
 - You can hold the items or put them away (e.g., outside of the room)
- Stand up
 - Make sure your head is at the same level or higher than your child's head