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Caregivers as Interventionists and Trainers: Teaching Mands to Children with Developmental Disabilities

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Abstract We evaluated the use of behavioral skills training (BST) to train caregivers to conduct procedures commonly associated with mand training. We trained two caregivers on the following procedures: (a) conducting preference assessments, (b) delivering preferred items contingent on appropriate behavior, (c) capturing and contriving motivating operations, (d) conducting probes to assess the child's current mand repertoire, (e) errorless prompting procedures using echoic prompts, (f) vocal shaping, (g) collecting data, and (h) correcting errors. We also assessed whether a trained caregiver could in turn train their spouse on these procedures. We evaluated the effects of the intervention on the frequency of child spontaneous and prompted mands. The three caregivers performed near zero percent accuracy during baseline but increased to above 80 % accuracy with training, and high performance persisted during most maintenance probes. These results were replicated for the parent who received training from their spouse. In addition, spontaneous mands were occurring more frequently than prompted mands by the end of the study. The implications of caregivers implementing mand training procedures based on Skinner's analysis of verbal behavior are discussed.

Keywords Behavioral skills training · Mands · Motivating operations · Parent training · Verbal behavior

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Children with a developmental disability such as an autism spectrum disorder (ASD) do not always access treatment services because parents often cannot afford the costs of treatment. The average annual cost for early intensive behavioral intervention (EIBI) is $40,000 (Chasson et al. 2007) which is close to the median income in the USA at $50,054 (Carmen et al. 2011). Although some insurance plans cover EIBI, at least 48.6 million individuals living in the USA were uninsured as of 2011 (Carmen et al. 2011). For those who have coverage, the problem of accessing services still exists as some private insurance companies do not include behavioral interventions in their statement of benefits (Harvey et al. 2010). Other challenges include the lack of services in rural areas and long waitlists in urban cities (Thomas et al. 2007).

It is increasingly common for parents to act as intervention agents (Sturmey and Fitzer 2007) as they play an integral role in the success of early intervention for children with developmental disabilities (U.S. Department of Education 1994). Training parents to act as interventionists has several benefits. First, the

costs of behavioral interventions may be reduced without decreasing intensity of services. Second, trained parents could train other caregivers (e.g., grandparents and siblings), facilitating generalization of treatment effects. Third, providing parents with training and education may increase parents' confidence and reduce stressors associated with deficits in the child's communication skills, which is one of the most frequent sources of parental stress (Bebko et al. 1987). Researchers have also examined parent characteristics affecting stress levels and found that parents who reported high levels of confidence in managing their child's major difficulties and perceived others in the family as similarly successful also reported lower stress (Sharpley and Bitsika 1997).

The value of teaching children with developmental disabilities a mand repertoire has been consistently demonstrated in the literature (Sundberg 1993; Shafer 1994; Charlop-Christy et al. 2002; Sundberg and Michael 2001). Mand training facilitates the development of spontaneous verbal behavior (Charlop et al. 1985; Sweeney-Kerwin et al. 2007) and enables individuals to have control over their environment by accessing reinforcers when they are most valuable. It is not surprising that problem behavior often emerges as a primary means to impact changes in the environment when no mand repertoire exists (Carr and Durand 1985).

In *Verbal Behavior*, Skinner defined the *mand* as a verbal operant which "specifies its reinforcement" and is "under the functional control of relevant conditions of deprivation or aversive stimulation" (Skinner 1957, p. 36). Laraway et al. (2003) more recently conceptualized this functional control with the term *motivating operation* (MO), to account for the establishing and abolishing effects of the MO on the value of a reinforcer as well as the bidirectional effects (i.e., evocative or abative) on behavior. Conceptually, MOs are antecedents that can be introduced as independent variables to evoke behavior.

The mand, a basic verbal operant, typically emerges early in development and benefits the speaker by allowing him or her to communicate basic needs through the mediation of another person. When the emergence of the mand does not occur, this mediation may initially require structured opportunities so that the child can learn to communicate spontaneously. More specifically, when teaching mands, it is necessary for the trainer to capture or contrive the MO to evoke the mand and to ensure that the MO is in effect when the training events occur to increase the likelihood of subsequent control by the MO (i.e., spontaneous mands when the MO is in effect).

In the past 30 years, numerous studies have demonstrated that with training, parents can teach children verbal behavior (Alpert and Kaiser 1992; Ben Chaabane et al. 2009; Charlop-Christy and Carpenter 2000; Hemmeter and Kaiser 1994; Laski et al. 1988; Mobayed et al. 2000; Peterson et al. 2005). Commonly cited teaching procedures in the literature are milieu therapy (Alpert and Kaiser 1992), incidental teaching (Charlop-Christy and Carpenter 2000), natural language paradigm (Laski et al. 1988), and the mand-model procedure (Mobayed et al. 2000). Although researchers have demonstrated that parents can be effective trainers to teach verbal behavior (e.g., mands), there are limitations in this area of research.

First, mothers often participate in the training while generalization to other caregivers (e.g., fathers) is rarely evaluated (Alpert et al. 1992; Ben Chaabane et al. 2009; Mobayed et al. 2000; Peterson et al. 2005). Second, researchers do not always provide sufficient measures of the child's gains as a result of parent training (Ben Chaabane et al. 2009) with an emphasis on measuring the structure of the child's response (i.e., mean length of utterance; Alpert et al. 1992; Peterson et al. 2005) rather than the response function. A third concern is that generalization and maintenance of parents' skills are not always adequately assessed (Ben Chaabane et al. 2009; Laski et al. 1988), and when assessed, results are often poor (Mobayed et al. 2000). Fourth, some studies have not adequately assessed child preferences for items prior to implementation of mand training (Hemmeter and Kaiser 1994; Mobayed et al. 2000). Fifth, parents may be trained to teach a single communication response such as "more" or "break" instead of teaching specific mands for items (Hemmeter and Kaiser 1994; Mobayed et al. 2000), limiting the emergence of other mands. Finally, children are often trained to respond to verbal stimuli such as caregiver questions or instructions (e.g., "what do you want?"; Alpert et al. 1992). Currently, no published study has cited the use of Skinner's functional analysis of verbal behavior to train parents to teach mands. Specifically, researchers have not always trained parents to incorporate the relevant controlling variable, motivating operations.

Behavioral skills training (BST) is a useful instructional model for training caregivers. Instructions, modeling, rehearsal, and feedback (i.e., BST) have been used to teach parents to implement procedures with their children with autism (Ben Chaabane et al. 2009; Charlop-Christy and Carpenter 2000; Gillett and LeBlanc 2007). Typically, the trainer delivers instructions followed by a model, rehearsal opportunities, and feedback until the trainee reaches a specified level of mastery (Miltenberger et al. 2004). It may be impractical for multiple caregivers (e.g., mother and father) to attend training until each have met a criterion. A train-the-trainer model allows the expert to train one individual effectively to perform the target procedure and to train others to do the same. Only two published studies have evaluated the use of peer (i.e., spousal) training for training multiple caregivers of the same child on behavioral technologies (Adubato et al. 1981; Kuhn et al. 2003) and neither focused on mand training.

The purpose of this investigation was to evaluate the effectiveness of BST for teaching caregivers to implement procedures related to mand training based on Skinner's analysis, with particular emphasis on teaching caregivers to capture and contrive MOs in the child's natural environment (Skinner 1957). By staggering the introduction of skills using a multiple-baseline-across-modules design, we evaluated the effects of caregivers implementing specific procedures on changes in the occurrence of spontaneous mands in two children with developmental disabilities. Lastly, we evaluated whether a competently trained parent could train their spouse to accurately implement mand training procedures.

Method

Participants

Two primary female caregivers (Sam and Kristy) and one secondary male caregiver (Jared) participated in the study. All caregivers had at least a high school diploma. Kristy and Jared held university degrees. Sam and Jared were married, were between 30 and 40 years old, and were the biological parents of Franklin. Kristy was a guardian of Abby, was married to Abby's biological father, and was between 60 and 65 years old. The inclusion criteria for the primary caregivers included the following: (a) agreed to attend all seminars, (b) agreed to provide an appropriate area in the home for researchers to monitor sessions and provide feedback, (c) agreed to video record sessions with the child, (d) agreed to provide preferred toys and/or edibles for the child, and (e) performed below 20 % accuracy on the skills across all four modules during baseline. The inclusion criteria for the secondary caregiver were the same with the exception that the first criterion (i.e., agree to attend all seminars) was omitted for this caregiver.

Two children were recruited to participate in the study. Franklin was a 3-year-old male diagnosed with autism. Abby was a 12-year-old female diagnosed with fragile X syndrome. During formal evaluation and observation, both participants displayed deficits in communication, which included low rates of spontaneous mands. The inclusion criteria for each child included (a) caregiver reported deficits in language and communication skills during the intake, (b) deficits in spontaneous mands confirmed by formal assessment with the *Verbal Behavior Milestones Assessment and Placement Program* (Sundberg 2006), and (c) no physical impairments impeding vocal speech production.

Setting and Materials

The instructional modules were delivered to parents at an autism treatment center on a university campus using BST. Specifically, a large seminar room equipped with multimedia equipment and two large projector screens were used to deliver module presentations and practice skills during rehearsal and feedback. Following module attendance, investigators scheduled visits in the family homes to observe sessions with the caregiver and child. At the start of the session, caregivers determined where the session would occur in the home based on the child's access to the areas and presence of preferred items. Sessions took place either in the living room, outdoor patio, kitchen, or the child's bedroom. On some occasions, caregivers brought the child to the center for sessions. Regardless of location, similar preferred items were used during each session to teach mands. These items were kept within the child's sight and out of the child's immediate reach during each session.

Experimental Design

We used a concurrent multiple-baseline-across-modules design to analyze the effects of the BST module training with each caregiver. Four to 5 weeks after module 4 training and corresponding sessions with the child, we

conducted probes to assess the maintenance of the caregivers' accuracy of treatment implementation and the child's mands. In order to advance to the next module, primary caregivers had to achieve three consecutive sessions at or above 80 % accuracy overall on all trained skills. The secondary caregiver was required to demonstrate at or above 80 % accuracy overall on all trained skills for two consecutive sessions to advance to the next module.

Procedure

Baseline Prior to the evidence-based BST module training, each caregiver was given specific instructions for the eight targeted skills and their performance with the child was directly observed (see Table 1 for a list of these instructions). Baseline sessions were conducted at the home or at the center. At the start of every session, caregivers were reminded that they could elect to pass on performing any skill with the exception of the final 10-min observation where parents were asked to complete "10 min of mand training." During this 10-min observation, investigators collected baseline data on the child's verbal behavior.

BST Modules Training modules were presented on a biweekly basis, and there were four modules in total. During these modules, investigators incorporated the components of a BST approach. Attendees were provided with written instructions (i.e., handouts) at the start of the module followed by verbal instructions using PowerPoint with embedded models, rehearsal opportunities, and verbal feedback. The handouts consisted of the presentation slides printed in a handout format (i.e., three slides per page) so that caregivers could take notes. In vivo and video modeling of the target skills were embedded in the presentations. Video models depicted graduate students performing the skill with a child or another graduate student confederate. In vivo models consisted of a graduate student performing the skill in real-time with another graduate student acting as the "target child." Following this model, caregivers rehearsed the skill and were given immediate verbal feedback on their performance. Verbal feedback consisted of praise for correct performance, and if errors occurred, corrective feedback was provided. If caregiver performance was below 100 % accuracy, graduate students provided an additional in vivo model of the specific response that was missed or incorrectly performed. This sequence of rehearsal, feedback, and modeling continued until the caregiver performed each target skill at 100 % accuracy.

Table 1 Instructions presented for the yes/no checklist for all four modules and eight core skills

Module	Skill(s) #	Instruction
1	1	"Show me how you conduct a MSWO to identify preferred edibles, activities, or toys. If you can, use the data sheet to record your results."
1	2	"Show me how you pair with your child."
2	3a	"Show me how you capture your child's motivation."
2	3b	"Show me how you contrive your child's motivation."
2	4	"Show me how you would determine if your child can request a preferred item independently. If you can, use the data sheet to record your results."
3	5	"Show me how you would determine what word or word shell to use during the mand training. If you can, use the data sheet to record your results."
3	6	"Show me how you would teach your child to mand for items. If you can, use the data sheet to record your results."
4	7, 8	"Now we are going to do 10 min of mand training. During the training, show me how you would use the clickers and clicker data sheet."

Module Skills Target skills covered in the first module included conducting preference assessments using the multiple stimulus without replacement method (MSWO) described by DeLeon and Iwata (1996) and delivering preferred items contingent on appropriate behavior (i.e., differential reinforcement). Target skills covered in the second module included capturing and contriving motivating operations using an incidental teaching approach and conducting probes to assess the child's current mand repertoire. Target skills covered in the third module included errorless learning using echoic and/or tact prompts and vocal shaping using word shells during incidental teaching. Word shells were developed by the investigators for three to five preferred items. Target mands were broken down into three to five shaping steps that were a series of successive word approximations based on least to most response effort. Word shells for target preferred items were printed on cards and provided

to the caregiver at the start of the module 3 training. Investigators based the word shell progression on the Kaufman Speech Praxis Treatment Kits©, a tool for a systematic word shell approach. Target skills covered in the fourth module included collecting data on the occurrences of prompted and spontaneous mands and correcting errors. Therefore, a total of eight core skills were trained sequentially. Tables 2, 3, 4, and 5 provide a more detailed description of the components of these procedures for each module.

Sessions with Child One to 3 days following completion of module training, implementation sessions were initiated with the child and were conducted on a daily-to-weekly basis. Sessions typically lasted between 20 and 60 min depending upon the accuracy of skill performance. During these sessions, the investigator presented skill-specific instructions associated with each module (see Table 1). By observing caregiver performance during sessions with the child, the investigator assessed generalization of skill performance from the module training with graduate students to sessions with the child. Also, investigators continued to measure baseline performance on any untrained skills (prior to module 4 training). At the start of every session, caregivers were reminded that they could elect to pass on performing any skill. During direct observation, investigators did not provide any prompts. Verbal feedback was delivered immediately after each trained skill was performed, passed, or the allotted time for each skill had elapsed. If the caregiver performed a trained skill incorrectly, did not perform the trained skill, or elected to pass, the investigator modeled the skill with the child and provided one additional opportunity for the caregiver to perform the skill. Performance was not scored during these additional response opportunities. The last 10 min of sessions was designated to observe incidental caregiver and child interactions to score the occurrence of mands.

Table 2 Operational definitions of the items measured on the yes/no checklist for skills in module 1

Skill #	Item #	Operational definition
1	1	3–6 items presented in a linear array.
1	2	Does not mix food items with toys in array
1	3	Allows only one item to be chosen at a time
1	4	Allows child to consume edible or allows access to item for 10 to 30 s
1	5	Removes each item from the array after it is chosen
1	6	Rotates item(s) after each choice
1	7	Ranks according to order that the child chooses (selects and consumes) item
2	8	Delivers preferred item(s) chosen in previous MSWO contingent upon appropriate play/vocalizations, eye contact with caregiver, or approaches to caregiver at least once. Withholds item if problem behavior occurs
2	9	Caregiver does not place any demands on the child during the pairing session
2	10	Names each item that is presented at least once

Table 3 Operational definitions of the items measured on the Yes/No checklist for skills in module 2

Skill #	Item #	Operational definition
3a	11	Places at least one preferred item within the child's reach
3a	12	Identifies when MO is present. Waits for child to look at item, approach, or reach for item before delivering item
3b	13	Engages with preferred item(s)
3b	14	Identifies when MO is present. Waits for child to look at, approach, or reach for item before delivering item
4	15	Holds preferred item in view of child and does not provide any verbal prompts
4	16	Waits approximately 5 s for a response. Delivers item following appropriate response or after the 5-s elapses (non-contingent)
4	17	Records the first probe data correctly

Peer Training Sam (biological mother of Franklin) trained Jared (biological father of Franklin) to implement the mand training procedures. Once Sam demonstrated the skills for the current module at or above 80 % accuracy for three consecutive sessions and baseline data were collected on Jared's performance for that module, Sam was instructed to train Jared in their home. Specifically, Sam was instructed to use a BST approach that included written instructions (i.e., handouts), in vivo modeling, rehearsal, and verbal feedback until Jared performed the target skills to 100 % accuracy. The investigators provided Sam with a handout to give to Jared, which was an identical copy to the handout provided to caregivers during module trainings. The

Table 4 Operational definitions of the items measured on the yes/no checklist for skills in module 3

Skill #	Item #	Operational definition
5	18	Holds up the item, says the whole word and waits approximately 3 s to test whether the child can repeat the whole word. Note: Parent can repeat this step up to 3 times before moving to step 19
5	19	1. If child says the whole word, parent stops probing and delivers item. 2. If child cannot say the whole word, probes a lower word shell. Delivers item when child makes a sound that is part of the shell. 3. If child *fails* to repeat any sound associated with item, presents a different preferred item and repeats steps 18–19 once more
5	20	Records probe data correctly. Circles correct number corresponding to word shell
6	21	Presents a preferred item to the child
6	22	Waits for child to indicate motivation (i.e., reaches/looks at/approaches item)
6	23	Starts with same prompt level recorded from previous teaching session
6	24	1. Fades level of prompt (e.g., removes item out of sight) after 3 successful trials (i.e., child repeats prompt or spontaneously requests) at current prompt level, or 2. Stays at current prompt if child is not successful (i.e., does not repeats or spontaneously request), or 3. Moves back to a lower prompt level or word shell if child does not respond to prompt
6	25	1. Delivers item when child makes an approximation (i.e., a previous word shell) or says the whole word, or 2. If child does not make an approximation (i.e., a previous word shell) after repeated prompts, parent selects another preferred item and repeats steps 21–25
6	26	Accurately records prompt level used during last trial of the session in the T column

handout listed the target caregiver responses for each skill. Investigators were not directly involved in this part of the training. Once Sam or Jared indicated that training for the current module was completed, the investigators scheduled a direct observation session with Jared and Franklin. During direct observation, the investigators did not provide any prompts. Feedback and modeling occurred after each skill was performed. Similar to sessions with the primary caregiver, the investigators only modeled skills performed incorrectly or skills that were not performed (i.e., passed) by the secondary caregiver.

Table 5 Operational definitions of the items measured on the yes/no checklist for skills in module 4

Skill #	Item #	Operational definition
7	27	Records prompted mands with the counter at least 80 % agreement with primary observer
7	28	Records spontaneous mands with the counter at least 80 % agreement with primary observer
7	29	Enters data correctly into mand datasheet
8	30	If child emits an incorrect request or engages in problem behavior, parent puts the item out of sight for at least 3 s
8	31	Re-presents item with a 0-s prompt when the child is no longer engaging in problem behavior or after 3 s following an incorrect response
8	32	Delivers item contingent upon child emitting approximations or correct responses

Dependent Variables and Data Collection

Caregivers During sessions with the child, caregivers' accuracy of treatment implementation was directly observed and measured using a pen and paper 32-item yes/no checklist during all sessions across modules. The checklist included multiple items that corresponded with each of the eight target skills. Each item was associated with a target caregiver response which was operationally defined. See Tables 2, 3, 4, and 5 for a list of the skills, items, and operational definitions. A "yes" was scored for an item if the caregiver engaged in the target response the first time the relevant antecedent occurred. A "no" was scored if, following the presentation of the skill-specific instruction, the caregivers' performance did not match the operational definition for the relevant item. Based on the complexity of the skill, caregivers were given 1 to 10 min to perform each skill. Performance was reported as a percent correct for each module by dividing the total number of items performed correctly (i.e., total number of yeses) within the module by the total number of items within the module.

Child During all phases of the study, data were collected on the occurrence of spontaneous and prompted mands using 10-s partial interval recording during 10-

min mand sessions with the caregiver. Data were scored using ABC Data Pro© software on iPads. Spontaneous mands were defined as articulate vocal responses (i.e., word shells or the whole word) under the control of the motivating operation (i.e., following the removal of the item, child approaching the item or person, or reaching for the item) without vocal prompts from the caregiver presented within 10 s prior to the child's vocal response. Spontaneous mands were scored when the item was both present and absent from the child's sight. Prompted mands were defined as articulate vocal responses (i.e., word shells or the whole word) under the control of the motivating operation produced within 10 s of a vocal (i.e., echoic) prompt provided by the caregiver.

Interobserver Agreement

Interobserver agreement (IOA) between independent observers was measured for 67 % of the sessions on caregiver performance on the checklist through videotaped recordings of the sessions. Agreement was calculated by dividing the total number of items on the checklist with agreement by the total number of items with agreements plus disagreements multiplied by 100. The caregiver checklist measures averaged 97 % (range, 90 to 100 %) agreement. Child behavior was scored for IOA for 59 % of the sessions. Agreement on the occurrence of prompted and spontaneous mands was calculated by the number of intervals with agreement divided by the number of intervals with agreement plus disagreements multiplied by 100. Agreement for spontaneous and prompted mands was on average 86 % (range, 70 to 97 %) and 86 % (range, 73 to 97 %), respectively.

Procedural Integrity

The investigators assessed the fidelity of the training delivered by graduate students for 100 % of the module presentations and 55 % of direct observation sessions with a yes/no checklist. Specifically, the investigators measured whether the graduate student trainer provided the correct antecedents (e.g., correct instructions without prompts) and the correct consequences (e.g., verbal feedback) for the caregiver behavior across the different phases of the study. During the module presentations, procedural integrity was 100 %. During direct sessions with the child, procedural integrity averaged 96 % (range, 78 to 100 %).

Social Validity

At the end of the study, parents were given a six-item questionnaire in a resealable envelope to take home and complete in the privacy of their own home. Surveys were returned anonymously in a sealed envelope to the administrative staff at the center, who were not affiliated with the study. We used a five-point Likert scale to assess whether parents found the procedures were helpful, effective, and easy to implement with their children. Other questions included likelihood of training other family members, continuing to use the training, and recommending the training to others. Both caregivers indicated that the training was extremely helpful and that they were extremely likely to continue using the teaching procedures with their children. Both caregivers also indicated that they were extremely likely to recommend the training to other caregivers and likely to train other family members. Both caregivers rated the teaching procedures as easy to implement. Sam scored the teaching procedures as extremely effective in producing language gains, whereas Kristy scored the training package as moderately effective.

Results

Kristy and Abby (Child) During baseline, Kristy performed all skills across modules 1 through 4 at an average of 9 % accuracy (range, 0 to 40 %). See Fig. 1 for a graphic depiction. Following presentation of the first module training, there was a moderate increase to 50 % accuracy on module 1 skills with additional modeling and verbal feedback resulting in a subsequent increase to 90 % accuracy (range, 50 to 100 %). Instruction in module 2 produced a moderate increase to 60 % accuracy following training with additional modeling and feedback producing an increase in performance accuracy to 100 %. Performance accuracy during module 3 was marked by immediate increases to 100 % accuracy following training with little variability in performance during subsequent sessions (M=94 %; range, 83 to 100 %). Following training of module 4, Kristy's performance accuracy increased to 67 % (M= 56 %; range, 33 to 67 %) with an overall decreasing trend. During the 5-week maintenance probe, Kristy performed at 90 % accuracy for module 1, 60 % for module 2, and 83 % for module 3. There was no maintenance probe conducted for module 4 due to participant illness.

During baseline, there were more intervals scored with Abby's prompted mands (M= 57 %; range, 33 to 70 %) than spontaneous mands (M=13 %; range, 3 to 30 %) (see Fig. 1). Following module 1 training with Kristy, the percentage of intervals with prompted mands decreased to M=37 % (range, 25 to 43 %) and the percentage of intervals with spontaneous mands increased (M=15 %; range, 8 to 23 %). Following Kristy's participation in module 2 training, there was a decrease in the level of prompted (M=32 %; range, 17 to 50 %) and spontaneous (M=10 %; range, 3 to 25 %) mands. Following module 3 training, there was an overall decreasing trend for prompted mands (M=27 %; range, 8 to 53 %). The percentage of intervals with spontaneous mands increased in level during this module to M=23 % (range, 8 to 33 %). Following module 4 training, the percentage of intervals with prompted mands continued to decrease (M=7 %,;range, 3 to 10 %). The average percentage of intervals with spontaneous mands was 28 % (range, 12 to 38 %). During modules 2 through 4 and during the maintenance probe, spontaneous mands occurred more frequently than prompted mands with clear separation in the data paths.

Sam and Franklin (Child) During baseline, Sam performed all skills in modules 1 through 4 at an average of 4 % accuracy (range, 0 to 40 %) with a decreasing trend across the baseline sessions. See Fig. 2 for a graphic depiction. Following the presentation of modules 1 and 2, Sam's performance accuracy immediately increased to 80 %. During subsequent sessions with the child, performance accuracy increased to an average of 92 % (range, 80 to100%) for module 1 and 96 % (range, 80 to 100 %) for module 2. Following module 3 training, Sam showed a more moderate increase in performance accuracy to 50 % during the first session with the child that increased to 100 % following modeling and feedback. Following training of module 4, accuracy increased to 100 %, averaging 89 % (range, 67 to100 %) for skills in that module. During the 5-week maintenance probe, Sam performed at 90 % accuracy for module 1, 100 % for module 2, 66 % for module 3, and 66 % for module 4 remaining well above baseline levels for all skills.

Franklin (child) had more intervals with prompted mands (M=28 %; range, 12 to 38 %) compared to spontaneous mands (M=19 %; range, 17 to 22 %) in baseline with both types of mands on an increasing trend. See Fig. 2 for a graphic depiction. Following module 1 training with Franklin's mother (Sam), the percentage of intervals with prompted mands decreased slightly to M=22 % (range, 18 to 30 %) whereas the percentage of intervals with spontaneous mands did not change in level (M=20; range, 15 to 27 %). Following Sam's participation in module 2 training, there was a marked increase in the level of spontaneous (M=38 %; range, 33 to 43 %) and prompted (M= 30 %; range, 25 to 37 %) mands with spontaneous mands consistently higher than prompted mands. Following module 3 training, there was a decrease in both spontaneous (M=17 %; range, 12 to 25 %) and prompted (M=12 %; range, 8 to 18 %) mands. Following module 4 training, mands increased to an average of 23 % of intervals with spontaneous mands (range, 17 to 27 %) and 16 % of intervals with prompted mands (range, 7 to 18 %). During the 5-week maintenance probe, spontaneous mands occurred during 48 % of intervals while prompted mands remained relatively low at 8 % of intervals.

Jared and Franklin (Child) During baseline, Jared performed all skills across modules 1 through 4 at an average of 5 % accuracy (range, 0 to 40 %) with consistent zero levels during modules 1, 3, and 4 (see Fig. 3). During baseline sessions in module 2, there was a decreasing trend from 40 % accuracy during session 1 to 0 % accuracy during sessions 3 through 5. Following training on the first module by his wife, Sam, Jared's accuracy increased from 0 to 90 % accuracy. Modules 2 and 3 were also marked by substantial changes in level to 100 % accuracy following peer training. Subsequent probes during module 3 averaged 98 % overall (range, 90 to 100 %). Following training on module 4 by his wife, Sam, Jared performed skills at an average of 83 % accuracy across all skills (range, 67 to 100 %) with a clear increasing trend across sessions following ongoing sessions which included some modeling and feedback by the investigators. Performance accuracy across all modules was marked by stable increases in level with little variability in the performance. During the 4-week maintenance probe, Jared's performance accuracy was 90 % for module 1, 66 % for module 2, 100 % for module 3, and 100 % for module 4. Overall, Sam's training of her spouse Jared produced immediate increases in correct performance over baseline levels across all modules which maintained with ongoing feedback and modeling by the investigators.

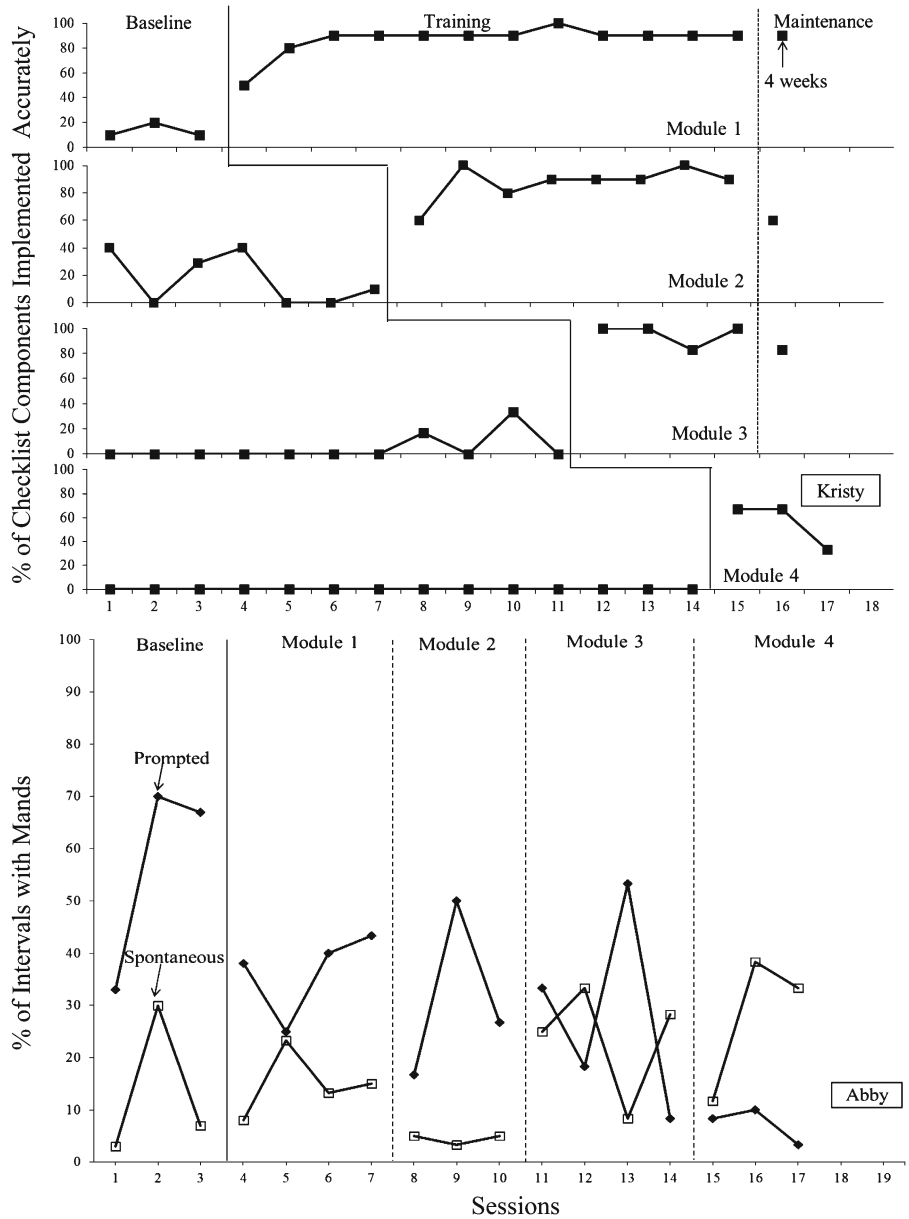

Fig. 1 Percentage correct during baseline, training, and maintenance phases on the 32-item checklist across modules 1 through 4 for Kristy (*top panel*). Percentage of intervals with spontaneous and prompted mands during 10-min sessions with Kristy conducting mand training with Abby during baseline, training, and maintenance phases across modules 1 through 4 (*bottom panel*)

During Jared's baseline sessions with Franklin, there were more intervals with prompted (M=23 %; range, 12 to 28 %) than spontaneous mands (M=21 %; range, 20 to 26 %) (see Fig. 3). Following implementation of the components trained in module 1, Franklin's prompted mands decreased in level (M=14 %; range, 10 to 17 %), whereas spontaneous mands did not change over baseline levels (M=19 %; range, 18 to 20 %). Following module 2 training, prompted and spontaneous mands decreased from baseline levels to 18 % (range, 13 to 23 %) of intervals and 13 % (range, 3 to 23 %) of intervals, respectively. Following module 3 training, there were increases in both prompted (M= 20 %; range, 12 to 28 %) and spontaneous (M=24 %; range, 7 to 40 %) mands over module 2 levels. Following module 4 training, Franklin's percentage of

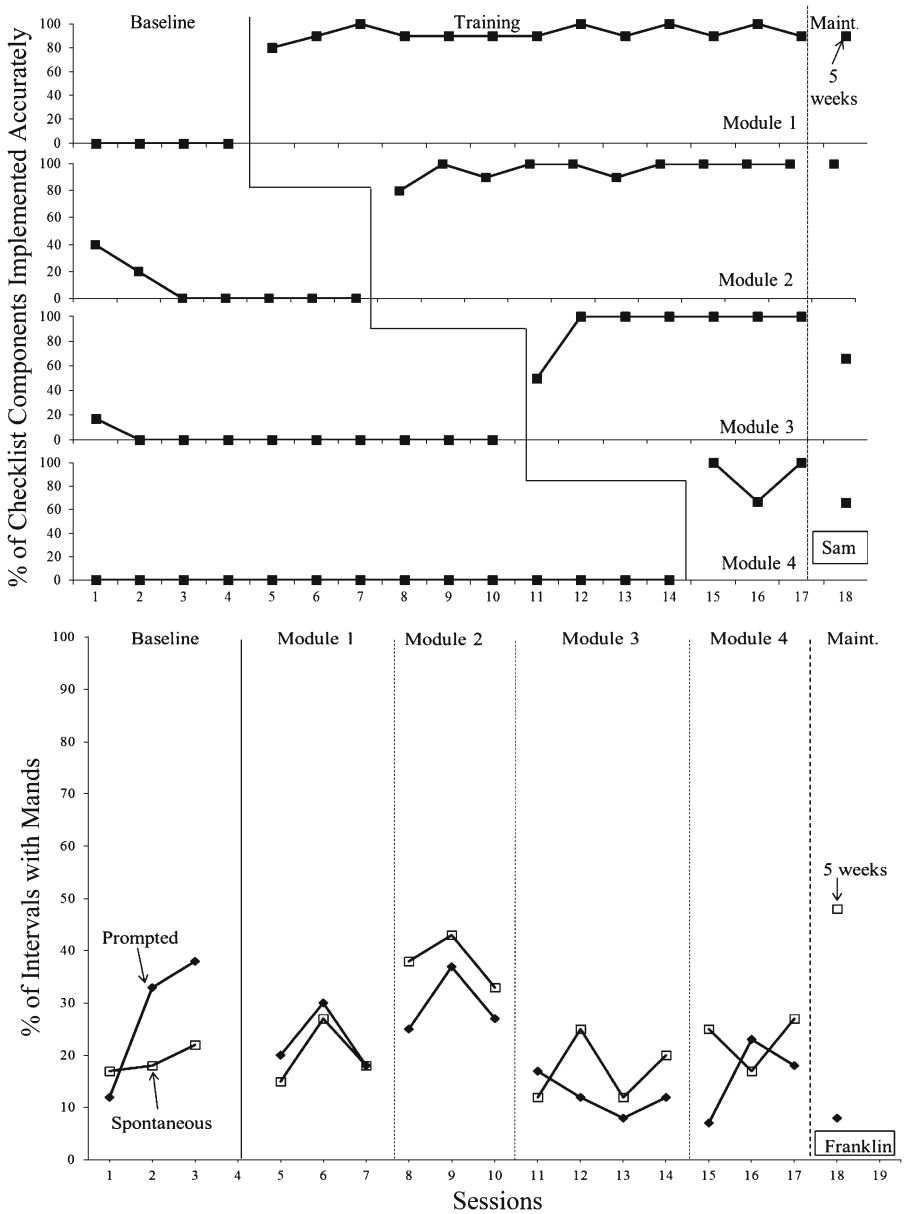

Fig. 2 Percentage correct during baseline, training, and maintenance phases on the 32-item checklist across modules 1 through 4 for Sam (*top panel*). Percentage of intervals with spontaneous (*open squares*) and prompted mands (*closed diamonds*) during 10-min sessions with Sam conducting mand training with Franklin during baseline, training, and maintenance phases across modules 1 through 4 (*bottom panel*)

spontaneous mands increased over baseline levels to an average of 30 % of intervals scored (range, 23 to 35 %) whereas prompted mands were occurring less frequently in comparison to baseline levels (M= 19 %; range, 13 to 30 %). Across all phases of the intervention, the percentage of intervals with spontaneous and prompted mands was variable.

Discussion

The results of the study demonstrate the effects of a BST model for training caregivers to implement procedures involved in mand training. The module presentations were frequently sufficient to produce immediate increases in accurate implementation of the

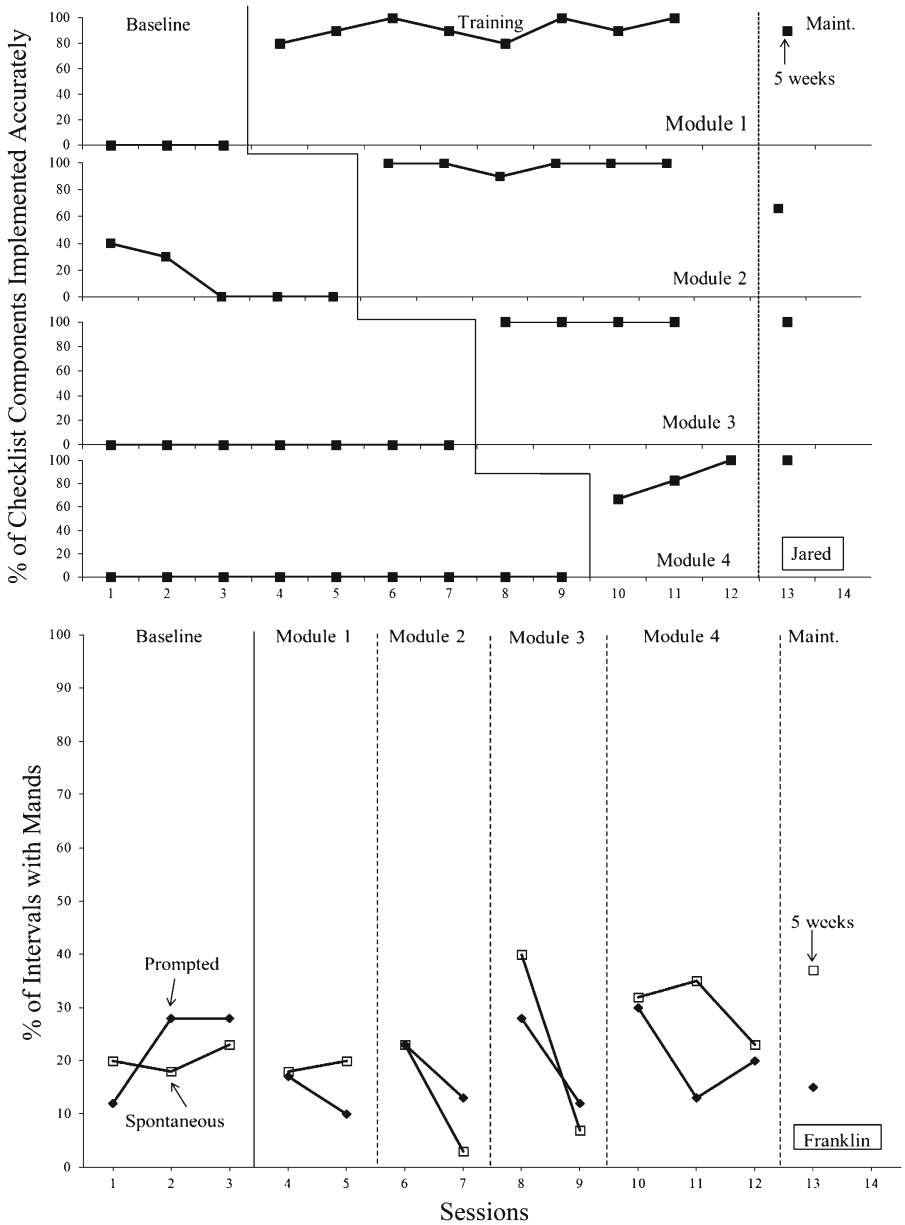

Fig. 3 Percentage correct during baseline, training, and maintenance phases on the 32-item checklist across modules 1 through 4 for Jared (*top panel*). Percentage of intervals with spontaneous and prompted mands during 10-min sessions with Jared conducting mand training with Franklin during baseline, training, and maintenance phases across modules 1 through 4 (*bottom p*anel)

skills during sessions with the child. Primary caregivers did not demonstrate many difficulties generalizing the skills trained with investigators to the target stimulus conditions (i.e., with the child). When caregiver performance did not initially increase to the 80 % accuracy criterion, additional feedback and modeling during sessions with the child were successful in producing criterion performance.

Furthermore, training skills sequentially using a multiple-baseline-across-modules design was beneficial since it allowed trainers to teach skills gradually and gave trainees repeated rehearsal opportunities on previously trained skills. The trainer could also monitor ongoing caregiver performance and make decisions to advance caregivers through the training based on the consistency and accuracy of their performance on

trained skills. Weekend seminars for training caregivers are typically lauded for the efficiency of their delivery, while the use of brief (i.e., single session) seminars to disseminate applied behavior analysis has been criticized due to the potential misapplication of procedures if mastery is not attained (Stein 1975). The current model represents a hybrid approach by presenting a series of single-training sessions. Future researchers should compare the efficacy of staggering training sequences, such as the module-by-module approach used in this study, to single-event weekend seminars in terms of caregivers' rate of skill mastery, integrity, generalization, and maintenance of skill performance.

One advantage when sequential skills are trained in a staggered fashion is that it is possible to compare components of the procedures to changes in the child's behavior (e.g., spontaneous mands from module to module). For all caregivers, implementing the brief MSWO and delivering preferred items for appropriate behavior did not produce gains in spontaneous mands. Therefore, the sight of preferred items was insufficient to produce spontaneous mands for both children. Following Sam's training in module 2 on capturing and contriving the motivation operation, there were increases in Franklin's spontaneous mands. For the other two caregivers (Jared and Kristy), increases in spontaneous mands were most evident following training on module 3 skills, which included training on prompting procedures and vocal shaping. Future researchers evaluating preparing caregivers as interventionists to teach mands might focus more intensely on selective skills to produce greater gains in spontaneous mands.

The peer training results are encouraging but preliminary, because we only had one participant (Jared). However, the results are promising in that the data showed immediate increases to over 80 % accuracy from zero levels observed during baseline following the peer training. One limitation is that we did not collect procedural integrity data on Sam's training approach with Jared. Therefore, we cannot confirm that the peer training included all BST components (i.e., instructions, modeling, rehearsal, and feedback). Another limitation regarding the peer training evaluation was that following the first session after peer training, investigators provided additional feedback and modeling of skills performed incorrectly, rather than having Sam provide this intervention for her spouse. Outside of the context of a research study, the spouse would be the only available source of feedback, so the current procedure is not directly applicable to this real-world context. Despite this limitation, the data show that following peer training, we saw immediate increases in his performance to above criterion across all modules without investigator involvement. However, maintenance of his accurate performance cannot be attributed to peer training only.

Other limitations in this study relate to the measurement of child behavior as a secondary dependent measure of the training efficacy. First, there is no demonstration of experimental control of the training on spontaneous manding, as this was a secondary measure. That is, the primary measure, and the one intended to directly change based on manipulation of the independent variable, was parent accuracy of implementation of the procedures. The resulting impact on manding was indirect and somewhat more delayed. Also, the use of discontinuous data collection to capture changes in the child's behavior may not have been as sensitive as a continuous measure, such as rate. In addition to using a continuous measure, future researchers could measure changes in the topography of mands to evaluate whether variations in topographies occur. In addition, future researchers could differentiate mands exclusively under the control of MOs from those that could be multiply controlled when the item is visible (i.e., part mand, part tact).

The study demonstrates the beneficial effects of a BST approach for training caregivers to accurately implement procedures aimed to teach mands to children with developmental disabilities. General instructions were provided prior to baseline, but parents were only able to implement the procedures effectively when full instructions, modeling, rehearsal and feedback were used to train to mastery. Also, the study demonstrates the practicality of peer training for indirectly training an additional parent to teach verbal behavior, a novel application of this approach. Lastly, by training caregivers on procedures consistent with Skinner's analysis of the mand, which emphasizes the importance of motivation, it is possible to produce increases in spontaneous mands in children with developmental disabilities (Skinner (1957)). In particular, by staggering the training across modules, we found when caregivers learned to capture and contrive motivating operations as well as incorporate vocal shaping and errorless learning procedures, spontaneous mands emerged.

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