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Evaluating the Treatment Fidelity of Parents Who Conduct In-Home Functional Communication Training with Coaching via Telehealth

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Abstract We conducted a retrospective, descriptive evaluation of the fidelity with which parents of three children with autism spectrum disorders conducted functional communication training (FCT) in their homes. All training was provided to the parents via telehealth by a behavior consultant in a tertiary-level hospital setting. FCT trials coached by the behavior consultant were conducted during weekly 1-h visits. Parents made video recordings of treatment trials in which they conducted the procedures independent of coaching. We evaluated the levels of fidelity during coached and independent trials within a multielement design and recorded parents' omission and commission errors during different components of the treatment over time. The results showed no consistent differentiation between the coached and the independent trials. Some errors (e.g., omission errors associated with reinforcing manding) occurred more frequently overall, but none of the errors appeared to have a strong relationship with treatment outcomes. All children showed substantial reductions in problem behavior during the final treatment trials and especially during the coached trials. These results suggest that behavior analysts can use telehealth to implement FCT with acceptable fidelity and to achieve substantial reductions in children's problem behavior.

Keywords Treatment fidelity · Functional communication training · Telehealth

A. N. Suess (✉) · P. W. Romani · S. M. Dyson · J. L. Kuhle · J. F. Lee · K. E. Pelzel
Center for Disabilities and Development, University of Iowa Children's Hospital, 100 Hawkins Dr. Room 251, Iowa City, IA 52242, USA
e-mail: alyssa-suess@uiowa.edu

D. P. Wacker · S. D. Lindgren · T. G. Kopelman · D. B. Waldron
Department of Pediatrics, University of Iowa Carver College of Medicine, University of Iowa Children's Hospital, Iowa City, IA 52242, USA

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Introduction

Functional communication training (FCT; Carr and Durand 1985) is one of the most common differential reinforcement procedures used to treat severe problem behavior (Tiger et al. 2008). The purpose of FCT is to teach an individual an appropriate communicative response (mand) to access the same reinforcement that maintained problem behavior and to place problem behavior on extinction. To identify the maintaining reinforcer, a functional analysis (FA) typically precedes the implementation of FCT (Durand and Carr 1985; Tiger et al. 2008). The combination of FA plus FCT and other differential reinforcement procedures has been demonstrated to be an effective treatment package for reducing problem behavior displayed by individuals diagnosed with developmental disabilities (Pelios et al. 1999; Tiger et al. 2008). FA plus FCT treatment packages have been effective in inpatient clinics, outpatient clinics, and home settings (Asmus et al. 2004; Kurtz et al. 2003; Wacker et al. 1998).

Since 1998, Wacker et al. (1998, 2005, 2011) have shown that parents can implement FA plus FCT treatment packages effectively within their homes with on-site coaching from behavior consultants (i.e., applied behavior analysts). Participants in these studies were young children with developmental disabilities who displayed problem behavior. Behavior consultants provided on-site coaching to parents by describing and demonstrating procedures, giving parents prompts and corrective feedback when they implemented the procedures, and praising parents for conducting procedures with good fidelity (Harding et al. 2009). Overall, the results from these studies demonstrated that the FA plus FCT treatment package implemented by parents with on-site coaching reduced their children's problem behavior by approximately 90 % and increased adaptive behaviors such as manding and task completion.

Recently, these investigators developed FA plus FCT treatment interventions for parents to implement with their children while parents received all consultation via telehealth. In the first of these studies, Wacker et al. (2013b) showed that FAs could be conducted by parents in regional clinics across the state of Iowa with coaching provided by behavior consultants via telehealth. The investigators reported that parents were receptive to the coaching and feedback provided by the behavior consultants and that social functions were identified for 90 % of the children.

In a follow-up study, Wacker et al. (2013a) reported the effects of FCT interventions conducted via telehealth that were matched to the results of the FAs. FCT procedures were conducted by parents with 17 children at regional clinics during 1-h telehealth visits for an average of 13 weeks. The mean reduction in problem behavior was 94 %, which compared favorably with reductions achieved with on-site coaching in the participants' homes (e.g., 96 % for Wacker et al. 2011).

The results achieved via telehealth in clinic settings suggested that FA plus FCT treatment packages could be conducted effectively with remote consultation from behavior consultants. This led to a federally funded project (Lindgren and Wacker 2011) to implement the FA plus FCT treatment package in the homes of participating families. Parents continued to receive 1 h of coaching each week via telehealth (i.e., coached trials) and were asked to record "practice trials" (i.e.,

independent trials) of the treatment procedures. Parents submitted their video-recorded practice trials each week to the behavior consultant who reviewed them to identify fidelity errors made by the parents. The question of fidelity is of particular relevance to this project because the parents were not in physical contact with a behavior consultant or health service provider. Thus, the need for parents to practice the treatment procedures on their own intensified with the provision of in-home telehealth services.

Evaluating the fidelity with which parents practiced the treatment procedures also was important given previous results that demonstrated that poor fidelity with treatment procedures can affect treatment outcomes and lead to the re-occurrence of problem behavior (Carroll et al. 2013; Fryling et al. 2012). Arkoosh et al. (2007) trained parents to conduct function-based treatments and evaluated the relation between treatment fidelity and treatment effectiveness. The results suggested that higher procedural fidelity by parents was correlated with better treatment outcomes. Similar results were reported by DiGennaro et al. (2007). Volkert et al. (2009) also reported that problem behavior re-emerged when the communicative response was exposed to extinction.

The degree to which fidelity errors affect treatment outcomes may be mediated by the types of errors made and the history of procedural fidelity. St. Peter-Pipkin et al. (2010) evaluated the effects of omission errors, commission errors, and combined omission and commission errors during a Differential Reinforcement of Alternative behavior (DRA) treatment. The results demonstrated that commission errors alone and the combination of omission and commission errors had more detrimental effects on treatment outcomes than did errors of omission alone. St. Peter-Pipkin et al. further showed that fidelity errors that followed sessions with good fidelity were less detrimental to treatment than fidelity errors made immediately after baseline. Although relevant to all behavioral treatment programs, the detrimental effects of commission or co-occurring commission and omission errors highlighted by St. Peter-Pipkin et al. may be especially relevant to a telehealth setting. Telehealth coaches are limited by the extent to which they can model treatment procedures and often rely on delivering specific instructions and feedback in a timely manner. Thus, it is almost expected that treatment fidelity errors will occur during telehealth sessions. Studies showing the conditions under which fidelity errors occur and their relation to treatment effects within a telehealth setting are needed.

Fryling et al. (2012) suggested a continued need for descriptive studies documenting levels of treatment fidelity errors and types of fidelity errors (e.g., omission and commission errors) made in "real-world" situations. Although Wacker and colleagues have reported the results of numerous studies showing that parents can implement FA and FCT procedures when coaching is conducted directly in their homes or in outpatient clinics, or when the coaching is conducted via telehealth, they have not reported on the fidelity with which the parents conduct the procedures outside of coached treatment trials. In the present investigation, parents received coaching via telehealth on how to implement FCT procedures within their homes. A behavior consultant housed at the UI Children's Hospital provided weekly remote consultation that consisted of prompting and correcting the parents while they implemented FCT procedures. In addition to participating in the weekly

coached trials, parents submitted weekly practice videos in which they independently implemented the same treatment procedures as in the coached trials. The behavior consultant provided feedback on the independent trials during the next weekly telehealth session. In this descriptive study, we evaluated the fidelity with which parents implemented treatment procedures and the types of fidelity errors they made during coached and independent trials.

Methods

Participants

Children

Three children who were enrolled in a federally funded research project (Lindgren and Wacker 2011) participated in this investigation. All children were referred to the project by clinical staff at the UI Children's Hospital or at regional pediatric clinics located throughout the state of Iowa. To participate in the project, the children had to meet the following inclusion criteria: (a) were between the ages of 18 months and 6 years 11 months at the time of the diagnostic evaluation (b) had an autism spectrum disorder diagnosis (i.e., autistic disorder, Asperger's disorder, or pervasive developmental disorder, not otherwise specified [PDD-NOS]) (c) lived within the state of Iowa at the time of enrollment, and (d) engaged in destructive and/or disruptive behavior. The three children who participated in the current investigation were selected because they were the first participants to complete the FA and FCT treatment package with the second author as the behavior consultant. Lane was a 2-year 11-month-old male diagnosed with PDD-NOS. Target problem behaviors were those behaviors reinforced during the FA and were self-injurious behavior (SIB; falling to the ground), aggression (e.g., hitting and kicking), and property destruction (e.g., throwing items, pulling on items, and knocking items out of his mother's hands). Nontarget problem behaviors were those behaviors placed on extinction during the FA and were crying, screaming, and noncompliance. He communicated vocally using two- to three-word phrases. Jace was a 2-year 7-month-old male diagnosed with PDD-NOS and intellectual disability. Target problem behaviors were SIB (e.g., head banging and head butting), aggression (e.g., hair pulling), and property destruction (e.g., throwing items). Nontarget problem behaviors were elopement, crying, screaming, and noncompliance. He communicated via gestures (e.g., pointing). Jude was a 3-year 3-month-old male diagnosed with PDD-NOS. Target problem behaviors were SIB (e.g., head hitting), aggression (e.g., hitting and kicking), and property destruction (e.g., throwing items). Nontarget problem behaviors were crying, screaming, and noncompliance. Jude communicated vocally using two- to three-word phrases.

Parents

The children's parents conducted all FA sessions and FCT trials within their homes. Parents were an average of 37 years of age, and their level of education ranged from

a high school diploma to a doctorate degree. Parents received formal didactic training two times during the course of this federally funded project. The first didactic training was a 1-h presentation conducted via telehealth at the beginning of the federally funded project. During this training, the behavior consultant reviewed the purpose of the FA and FCT treatment package and basic behavioral principles (e.g., antecedents, consequences, and positive and negative reinforcement). The parent also received an electronic copy of a parent manual (available from the first author) that included the information reviewed during the didactic training. During the first FCT visit, the behavior consultant reviewed the FA results and FCT procedures during a 15-min presentation prior to beginning FCT. The behavior consultant instructed the parent on how to structure the work and play areas of the room, described the steps of FCT, and informed the parent on the functions of the microswitch (e.g., turning on/off and recording messages) during this second didactic training.

Behavior Consultant

The behavior consultant (second author) was a doctoral student in School Psychology with 6 years of experience conducting behavioral assessments and treatments. The role of the behavior consultant during coached trials was to train and coach the parents on how to implement FA and FCT procedures. The consultant also reviewed FCT trials conducted independently and recorded by the parents each week. Feedback consisted of reviewing each step of the FCT task analysis and correcting steps completed incorrectly during the independent trials.

Setting and Materials

Telehealth Center

The behavior consultant was housed in the Telehealth Center (Wacker et al. 2013b) located at the Center for Disabilities and Development, which is part of the UI Children's Hospital. The Telehealth Center had four teleconferencing workstations. Each workstation was equipped with a Windows-based PC and video monitor. A webcam and headset were attached to the computers to capture and transmit audio and video from the behavior consultant to the families' homes. All computers were equipped with Debut videoconferencing software to view and record FA sessions and FCT trials for subsequent data coding and analysis. A 6-s interval audio track was added to all recordings to assist with data coding. Playback software allowed data coders to adjust the speed and volume of the recordings as needed.

Participant Homes

The parents received a Windows-based laptop, a webcam, and an Ethernet cable and used Skype™ to make video connections with the behavior consultant. The computers given to the parents were also equipped with Debut videoconferencing software that allowed parents to record the independent FCT trials. Each parent

conducted the FA and FCT procedures within their living rooms. During FCT, the behavior consultant provided instructions to help each parent divide their living room into a play area and a work area. Establishing defined play and work areas signaled the activities (e.g., toys or work tasks) that were available to the child and provided an opportunity to work on transitions between activities. A couch located across from the work area was designated as the play area for Lane and Jace; a separate space in the living room across from the work area was designated as the play area for Jude. The designated work areas for each participant consisted of a chair (Lane), a table (Jace), and a separate area of the living room across from the play area (Jude). Parents supplied the work and play activities used during their sessions. Parents were asked to select work activities that historically were associated with problem behavior and play activities that each participant regularly enjoyed. Work tasks consisted of structured activities in response to parent instructions and included pointing to a 5.08 cm by 5.08 cm picture in a book (Lane), putting a 2.54 cm by 6.35 cm block in a 20.32 cm by 25.4 cm bucket (Jace), and putting a toy (e.g., cars, stuffed animals, balls) in a 40.64 cm by 40.64 cm basket (Jude). The work tasks remained consistent across the FA sessions and FCT trials for all children.

All three children used picture cards and BIGmack® microswitches during FCT. The 5.08 cm by 5.08 cm play and work picture cards were created using Boardmaker™. The play picture card was attached to the microswitch. A message pre-recorded by the parent said "play, please" when the child touched the microswitch. Lane and Jace used a "safespot" during treatment, which was where preferred tangible items were placed while they completed their work tasks. Lane's safespot was a red circle 10.16 cm in diameter. Jace's safespot was a manila envelope that was approximately 22.86 cm by 15.24 cm. During Jude's treatment, four 21.59 cm by 27.94 cm pictures of reinforcers (e.g., toys) were attached to clipboards and signaled access to parent attention (a picture of his mother and father), playing a preferred game with his father (a picture of Jude and his father playing the game together), playing with toys alone (a picture of toys), and sitting alone with no toys or attention (a picture of an empty room).

Response Definitions, Observation System, and Interobserver Agreement

Child Behavior

Self-injurious behavior (SIB) was defined as any behavior that could result in tissue damage to the child (e.g., head banging, throwing self on the floor). *Aggression* was defined as any behavior that could result in tissue damage to another person (e.g., hitting, kicking, head butting, pulling hair). *Property destruction* was defined as any behavior that could result in damage to property (e.g., throwing items, kicking items, pulling on items). *Elopement* was defined as the child's moving or attempting to move away from the parent when the parent was delivering a demand or when the child attempted to leave the designated work area. *Crying/screaming* was defined as loud vocalizations that were above a conversational level. *Noncompliance* was defined as the child's refusal to complete a task for approximately 12 s after the

parent presented the first demand. During subsequent demand presentations, noncompliance was scored if the child did not start the task immediately following the parent's directive. *Task completion* was defined as the child's independent (i.e., without physical guidance) completion of the task specified by the parent. Task completion was scored as prompted if physical guidance was needed for the child to complete the task. *Communication* was defined for Jace as touching the microswitch with sufficient force to produce the vocal message, "Play please;" communication was defined for Lane and Jude as touching the microswitch with sufficient force to produce the vocal message, "Play please," or making a vocal statement that requested a reinforcer (e.g., "Toys please"). Communication was scored when the child manded independently or following a vocal or model prompt provided by the parent. Communication was scored as prompted if physical guidance was needed for the child to mand.

All FA sessions and FCT trials were video-recorded and child behavior was coded using a 6-s partial-interval recording system. An FA session was defined as a 5-min period of the free play, tangible, attention, or escape condition. An FCT trial was defined as a work period followed by a 2-min play period. If the child engaged in problem behavior and delayed completing the work task during the FCT trial, the trial continued until the task was completed. The duration of that trial was then divided into 5-min blocks and each block was coded as a separate FCT trial. This occurred for eight trials (four coached trials for Lane and four coached trials for Jude). For the purposes of the federally funded project, interobserver agreement for child behavior during the FA and FCT was calculated by sessions. A session during FCT was 5 min in length and included two FCT trials unless an FCT trial was extended due to problem behavior. Two trained data collectors independently recorded the occurrence of problem behavior, task completion, and manding during the FA sessions and FCT trials.

Data from the functional analysis of problem behavior were analyzed by dividing the number of intervals of problem behavior by the total number of intervals to yield percentage of intervals with problem behavior. Interobserver agreement of child behavior was conducted using interval-by-interval comparisons in which all codes were matched to determine agreements and disagreements. To calculate interobserver agreement, the number of agreements was divided by the number of agreements plus disagreements and the result was converted to a percentage. Interobserver agreement of child behavior in the FA was collected on 35 % of sessions and averaged 95 % across all children. Interobserver agreement averaged 96 % (range 94–100 %) for Lane, 97 % (range 94–100 %) for Jace, and 93 % (range 90–98 %) for Jude. Interobserver agreement of child behavior in FCT was collected on 32 % of sessions and averaged 96 % (range 91–100 %). Interobserver agreement averaged 96 % (range 91–100 %) for Lane, 98 % (range 92–100 %) for Jace, and 95 % (range 92–100 %) for Jude.

Interobserver agreement of task completion was conducted using a trial-by-trial comparison in which the number of agreements was divided by the number of agreements plus disagreements and converted into a percentage. Interobserver agreement of task completion in the FA was collected on 33 % of escape sessions

and was 100 % across all children. Interobserver agreement of task completion in FCT was collected on 32 % of sessions and was 100 % across all children.

Parent Behavior

Parent behavior was recorded only during FCT. Task analyses for each child's treatment program (see Tables 1, 2, and 3) were scored as a measure of parent fidelity. Each step of the task analysis was considered as one opportunity and was scored as correct, incorrect, or not applicable. A correct response was scored when the parent implemented the step as described in the child's task analysis. For example, correct parent responses for Lane were defined as follows: In Step 1, the parent presented the work card to Lane and said, "It is time to work." In Step 2, the parent said, "Put your toy on the safespot." In Step 3(a), the parent walked with Lane to the designated work area, and in Step 3(b), the parent or Lane put the toy he transitioned with on top of the safespot. In Step 4(a), if Lane refused to transition to the work area, the parent restricted Lane's access to the toy, and in Step 4(b), the parent gently guided Lane to the work area while ignoring all problem behavior (e.g., no reprimands or discussions). In Step 5, the parent said, "Point to the (picture)," and presented the appropriate number of tasks to Lane as prescribed in the FCT trial (i.e., one, three, or five tasks). In Step 6(a), the parent ignored all

Table 1 Lane's FCT trial task analysis

Steps	Tasks
1	Present the work card to Lane. Say, "It's time to work"
2	Remind Lane to bring the Kindle, or other toy he is playing with, to put on the safespot
3a	Walk to the work area
3b	If Lane transitioned with the Kindle, put the Kindle on the safespot (mom or Lane)
4a	If Lane refuses to transition to the work area, remove his access to the Kindle
4b	Guide him to the work area while ignoring all problem behavior (saying "it's time to work," "first work-then play," or "we will play with the Kindle later" are appropriate)
5	Present the demand(s) to Lane
6a	If Lane engages in problem behavior, restrict your attention
6b	And prompt Lane to complete the demand every 15–20 s
7	Restrict Lane's access to the Kindle when the establishing operation (demand) is in place
8a	After Lane completes the task
8b	Say, "If you want to play, say, 'play please'," (or similar phrase) if he wants to play again and present the microswitch if he does not emit a vocal mand
9a	Praise Lane for communicating
9b	And present him with the Kindle (or the other toy in the safespot)
10a	Allow him to transition to the play area
10b	And begin the play time
11a	If Lane engages in target problem behavior during play time, immediately restrict his access to toys
11b	And direct him back to the work area to complete another work activity

Table 2 Jace's FCT trial task analysis

Steps	Tasks
1	Present the work card to Jace. Say, "It's time to work"
2a	Go to the work area and
2b	Ask Jace to put the iPad or toy on the safespot
3a	If Jace refuses to transition to the work area, gently guide him to the work area
3b	And ignore problem behavior
4	Present the demand(s) to Jace
5a	If Jace engages in problem behavior, restrict your attention
5b	And prompt him to complete the demand every 15–20 s
6	Restrict Jace's access to the iPad when the establishing operation (demand) is in place (include if iPad is not turned off during work task)
7a	After Jace completes the task
7b	Present the microswitch and say, "If you want to play, say 'play please'," if he wants to play again
8a	Praise Jace for communicating
8b	And present him with his iPad/toys
9a	Allow him to transition to the play area
9b	And begin play time
10a	If Jace engages in target problem behavior during play time, immediately restrict his access to toys
10b	And direct him back to the work area to complete another work activity

Table 3 Jude's FCT trial task analysis

Steps	Tasks
1	Present the work card to Jude. Say, "It's time to work"
2a	Ask Jude what he would like to work for and
2b	Have Jude select one of the reinforcers
3a	If Jude refuses to select a reinforcer, select one for him after 15 s
3b	And ignore problem behavior
4	Present the demand(s) to Jude
5a	If Jude engages in problem behavior, restrict your attention
5b	And prompt him to complete the demand every 15–20 s
6	Restrict Jude's access to the previously chosen reinforcer when the establishing operation (demand) is in place
7a	After Jude completes the task
7b	Ask him to say, "play please" if he wants to play again and present the microswitch if he does not emit a vocal mand
8a	Praise Jude for communicating
8b	And present him with the activity he selected
9	Allow him to begin play time
10a	If Jude engages in target problem behavior during play time, immediately restrict his access to toys
10b	And direct him back to the work area to complete another work activity

problem behavior (e.g., no reprimands or discussions) that occurred during work, and in Step 6(b), the parent said, "Point to the (picture)," every 15–20 s if Lane did not complete the task after the first task directive was given. In Step 7, the parent restricted or blocked Lane's access to the toy on the safespot during work. In Step 8(a), the parent asked Lane to point independently (i.e., without physical guidance) to the pictures presented in the FCT trial, and in Step 8(b), the parent said, "If you want to play, say 'play please'" or similar phrases (e.g., "Kindle please"). If Lane did not emit a vocal mand, the parent held the microswitch directly in front of Lane and repeated the directive to mand. The parent continued to hold the microswitch in front of Lane until he emitted an appropriate mand. In Step 9(a), the parent provided vocal praise (e.g., "Good job!") within 5 s of Lane emitting an appropriate mand, and in Step 9(b), the parent handed Lane the toy from the safespot or allowed Lane to pick up the toy from the safespot within 5 s of completing the task requirements and emitting an appropriate mand. In Step 10(a), the parent allowed Lane to walk with the toy to the designated play area, and in Step 10(b), the parent allowed Lane to play with the toy for approximately 2 min. In Step 11(a), the parent restricted Lane's access to the toy within 5 s of aggression, destruction, or SIB occurring during play time, and in Step 11(b), the parent presented the work card to Lane, said, "It is time to work," and gently guided Lane to the designated work area. Similar descriptions were developed for the steps in the task analyses for Jace and Jude and are available from the first author on request.

Incorrect responses were classified as omission or commission errors. *Omission errors* were defined as steps omitted from the task analysis or failure to deliver earned reinforcers. For example, an omission error was recorded if the parent did not present the work card during Step 1 of the FCT trial. *Commission errors* were defined as the parent's incorrectly implementing steps on the task analysis or providing reinforcement for problem behavior. For example, commission errors were recorded if the parent implemented the steps of the task analysis out of sequence (e.g., saying "It is time to work," and presenting the work card after transitioning to the work area), completed the steps incorrectly (e.g., requiring the child to emit more than one mand to access reinforcement), presented nonspecific vocal directives (e.g., saying "Where is the rooster?" instead of "Point to the rooster"), or implemented steps on different reinforcement or prompt schedules (e.g., delivering social praise more than 5 s after the child emitted a mand). Examples of omission and commission errors that corresponded to the steps in Lane's task analysis are presented in Table 4.

Procedural fidelity was scored for all FCT trials during coached and independent trials. Data collectors recorded if the parent implemented each step of the treatment procedures correctly or incorrectly. During coached and independent trials, if the parent did not have the opportunity to complete a step because the step was not applicable during the FCT trial (e.g., the parent did not have to implement the response cost procedure because the child did not engage in problem behavior during play), that step was marked as not applicable and was not included in the fidelity calculations. During coached trials, if the behavior consultant prompted the parent to implement a step before the parent had the opportunity to complete the step independently, that step was marked as not applicable and was not included in

Table 4 Examples of omission and commission errors for each step of FCT conducted by Lane's parent

Step	Omission	Commission
Transition: play to work		
1	Did not present the work card and/or vocal directive for work	Presented a nonspecific vocal directive (e.g., "What time is it?")
2	Did not provide Lane with a specific vocal directive to put the toy on the safespot	Presented a nonspecific vocal directive to put the toy on the safespot (e.g., "Put it up" instead of, "Put the Kindle on the safespot")
3(a)	Did not have Lane transition to the work area	Had Lane transition to an area that was not designated for work
3(b)	Did not have Lane put the toy he transitioned with on the safespot	Had Lane put the toy he transitioned with in a location that was not designated as the safespot
4(a)	Did not remove Lane's access to the toys	Removed Lane's access to the toys but returned the toys to him while he transitioned to work or removed Lane's access to the toys after he transitioned
4b	Did not guide Lane to the work area	Attended to Lane's problem behavior (e.g., by reprimanding)
Work		
5	Did not present a specific vocal directive	Presented more or fewer tasks than prescribed in the FCT trial, presented a nonspecific vocal directive (e.g., "Where is the rooster?" instead of "Point to the rooster"), or presented a specific vocal directive after Lane started the task
6(a)	An omission error was not applicable for this step	Attended to Lane's problem behavior (e.g., by reprimanding)
6b	Did not provide task prompts	Delivered task prompts on a different prompt schedule than prescribed
7	Did not restrict or block Lane's access to the toys while the establishing operation was in place	Delivered the toys to Lane while the establishing operation (demand) was in place
8(a)	Did not require Lane to complete any of the tasks prescribed in the FCT trial	Allowed Lane to escape some of the tasks prescribed in the FCT trial
Communication		
8(b)	Did not require Lane to mand to access reinforcement, did not present the microswitch when Lane did not emit a vocal mand, or did not present a specific vocal directive	Required Lane to emit more than one mand to access reinforcement, allowed Lane to access reinforcement by emitting an inappropriate mand, presented a nonspecific vocal directive (e.g., "Use your words" instead of, "Say, 'Play please' "), or delayed the presentation of the mand directive (i.e., more than 5 s after Lane completed the task)
9(a)	Did not deliver social praise	Delayed the delivery of social praise (i.e., more than 5 s after Lane emitted a mand)
9(b)	Did not allow Lane to access the toy on the safespot	Delayed the presentation of the toy on the safespot (i.e., more than 5 s after Lane emitted a mand)

Table 4 continued

Step	Omission	Commission
Transition: work to play		
10(a)	Did not allow Lane to transition to the play area	Had Lane transition to an area not designated for play
10(b)	Did not allow Lane to have access to play time	Reduced or increased the amount of time Lane had access to play time
11(a)	Did not restrict Lane's access to the toys	Restricted Lane's access to the toys but returned the toys to him during play or delayed the removal of Lane's access to the toys (i.e., more than 5 s after Lane engaged in problem behavior)
11(b)	An omission error was not applicable for this step	Allowed Lane to continue playing with the toys or delayed the presentation of the work directive (i.e., more than 5 s after Lane engaged in problem behavior)

the fidelity calculations. Given the coding procedures, the number of steps to score parent fidelity varied across each trial. For Lane, the mean number of steps scored for coached trials was 9.6 (range 4–13) and for independent trials was 11.9 (range 10–14). For Jace, the mean number of steps scored for coached trials was 10.4 (range 3–13) and for independent trials was 11.8 (range 10–15). For Jude, the mean number of steps scored for coached trials was 9.5 (range 3–14) and for independent trials was 10.3 (range 10–12).

Procedural fidelity was calculated for each FCT trial by dividing the total correct responses by the total correct and incorrect responses. Interobserver agreement on procedural fidelity was calculated using point-by-point comparisons of each step of the task analysis by two independent data collectors. Steps marked as correct, incorrect, and not applicable were included in the interobserver agreement calculations. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and converting the result to a percentage. Across all children, interobserver agreement on procedural fidelity was collected for 32 % of trials and averaged 97 % (range 94–100 %). Interobserver agreement averaged 98 % (range 94–100 %) for Lane, 96 % (range 94–100 %) for Jace, and 98 % (range 94–100 %) for Jude. Interobserver agreement on error type was calculated using point-by-point comparisons of each error recorded by the primary data collector. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements on each step and converting the result to a percentage. Across all children, interobserver agreement on error type was collected for 32 % of trials and was 100 %.

The types of errors made by parents were analyzed by dividing the task analyses into four FCT components: (a) transition from play to work (i.e., Steps 1—4b for Lane, Steps 1—3b for Jace and Jude) (b) work (i.e., Steps 5—8a for Lane, Steps 4—7a for Jace and Jude) (c) communication (i.e., Steps 8b—9b for Lane, Steps 7b—8b

for Jace and Jude), and (d) transition from work to play (i.e., Steps 10a—11b for Lane, Steps 9a—10b for Jace, and Steps 9—10b for Jude). The percentage of omission and commission errors was calculated by tallying the frequency of errors in each FCT component and dividing by the total number of opportunities to complete each FCT component for both coached and independent trials. Some of the FCT components were not implemented during every trial because of child behavior and were not included in the total number of opportunities to complete the FCT component.

Experimental Design and Procedures

Functional analysis (FA) and FCT procedures were conducted as part of the federally funded project, and fidelity data analyses were conducted retrospectively. FAs were conducted within multielement designs prior to the implementation of FCT. All FAs were based on the procedures described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) and consisted of tests for positive (i.e., attention, tangible) and negative (i.e., escape) reinforcement functions and a free play condition. FA sessions were 5 min in length. All FA sessions were conducted by the parents with remote coaching from the behavior consultant similar to procedures described in Wacker et al. (2013b).

The level of parent fidelity during coached and independent FCT trials was conducted within a multielement design with alternations between coached (A) and independent (B) trials. Lane's analysis was conducted within an ABABAABA-BABABABAB design, Jace's analysis was conducted within an ABABAB design, and Jude's analysis was conducted within an ABAABAB design.

Coached FCT Trials

All coached trials were conducted during weekly 1-h telehealth visits. During coached trials, the behavior consultant coached the parent to implement FCT procedures according to the participant's task analysis. The task analysis functioned as a prompt for the behavior consultant, and the parent did not see the task analysis during treatment. Coaching took the form of prompting the parent to implement individual steps of the task analysis and providing feedback on the parent's performance. Feedback consisted of the behavior consultant praising the parent for correctly implementing the procedures and correcting procedural errors before, during, and after each trial. The delivery of the feedback varied across trials depending on when the behavior consultant thought it was necessary to provide feedback. The specificity of the feedback also varied across trials. The behavior consultant provided general praise if the parent adhered to the treatment procedures throughout the FCT trial (e.g., "You did a nice job implementing the steps on that trial."). More specific praise was given to the parent for correctly implementing steps that were consistently implemented incorrectly in previous trials (e.g., "Nice job presenting the microswitch on that trial."). For steps implemented incorrectly, the behavior consultant described the error and told the parent how to make corrections for the remainder of the trial or in subsequent trials (e.g., "Do not

reprimand Lane for hitting the book while he is completing the demand. Ignore the problem behavior, continue presenting the demand, and praise him for appropriate behavior.").

Independent FCT Trials

Parents were asked to practice implementing the treatment procedures outside of weekly telehealth visits. Parents conducted all independent FCT trials without direct supervision from the behavior consultant. Parents began recording and submitting practice videos when a decreasing trend or low levels of child problem behavior and an increasing trend or high levels of parent fidelity were observed during the coached trials. Parents began submitting practice videos after approximately 10 coached trials (range 8–12). Parents were asked to record and submit at least four FCT trials on a weekly basis. A Google account was created for each parent and was only used for the purpose of this project. Parents submitted their practice videos to the behavior consultant using Google Drive. The parent and behavior consultant were the only persons who had access to the practice videos on Google Drive. The behavior consultant transferred the practice videos from Google Drive to a secured computer network for subsequent data coding. The behavior consultant reviewed the independent trials prior to the following week's coached trials when he described which steps the parents performed correctly and incorrectly.

Functional Communication Training: General Description

Functional communication training (FCT) trials were conducted within a two-step chain. First, the child was asked to complete a small demand. When the child completed the task, the parent provided a microswitch or a vocal prompt to request play time. The microswitch was only available contingent on task completion. The presentation of the microswitch or vocal prompt to mand provided a cue that play time was available. Manding resulted in 2 min of access to toys and attention. If the child engaged in target problem behavior during play time, the play time ended and the child returned to work. Demand fading was used to gradually increase the work requirement necessary to access reinforcement. All children initially had to complete one task during each work trial (FCT [1]). After three consecutive sessions with at least a 90 % reduction in target problem behavior, the task requirement was increased to five tasks during an FCT trial (FCT [5]). For example, FCT (1) for Lane was pointing to one picture in a book and FCT (5) was pointing to five pictures in a book. Lane also had an FCT (3) work requirement because of the level of problem behavior observed during the initial FCT (5) trials. Jude had an FCT (10) work requirement. Treatment procedures were individualized for each participant and listed in Tables 1, 2, and 3. Following the completion of treatment, parents rated their satisfaction with the treatment procedures via the *treatment acceptability rating form-revised* ([*TARF-R*]; Reimers and Wacker 1988).

Table 5 Mean percentages of intervals of target problem behavior across FA conditions

	Free play (%)	Tangible (%)	Attention (%)	Escape (%)
Lane	0	17	0	19
Jace	0	6	0	7
Jude	1	11	8	17

Results

Functional Analyses

The mean percentages of intervals of target problem behavior during the functional analysis are presented in Table 5. These results indicated that all three participants' target problem behavior was maintained by both negative and positive reinforcement in the form of escaping demands and gaining access to tangibles. Only Jude displayed target problem behavior during attention or free play conditions.

General Analyses

Mean data for treatment fidelity, problem behavior, manding, and task completion for Lane, Jace, and Jude are first presented in bar graphs to show general differences between the coached and independent FCT trials (Fig. 1).

It appeared that coached trials yielded slightly higher fidelity for Lane and Jace ($M = 77$ and 94 %, respectively) than the independent trials ($M = 73$ and 87 %, respectively). A similar difference in fidelity occurred for Jude with slightly higher fidelity during the independent trials ($M = 80$ %) than during the coached trials ($M = 78$ %).

For Lane and Jude, problem behavior was more likely to occur during the coached trials ($M = 21$ and 22 %, respectively) than during the independent trials ($M = 8$ and 5 %, respectively). These results were due to the high levels of problem behavior displayed at the beginning of treatment. Jace showed a different pattern, in which more problem behavior occurred during the independent trials ($M = 12$ %) than during the coached trials ($M = 2$ %).

Manding yielded slight differences for Lane, in which more manding occurred during the coached trials ($M = 98.3$ %) than during the independent trials ($M = 97.1$ %), and Jace, in which more manding occurred during the independent trials ($M = 100$ %) than during the coached trials ($M = 95.8$ %). No differences in manding occurred for Jude. For Lane and Jude, task completion was higher during the independent trials ($M = 100$ and 100 %) than during the coached trials ($M = 90$ and 88 %, respectively) due to the higher levels of problem behavior during the coached trials. For Jace, only a slight difference for task completion occurred between coached ($M = 100$ %) and independent ($M = 98$ %) trials. Trial-by-trial analyses of manding and task completion are not presented for each participant given the consistently high levels of responding during the coached and independent

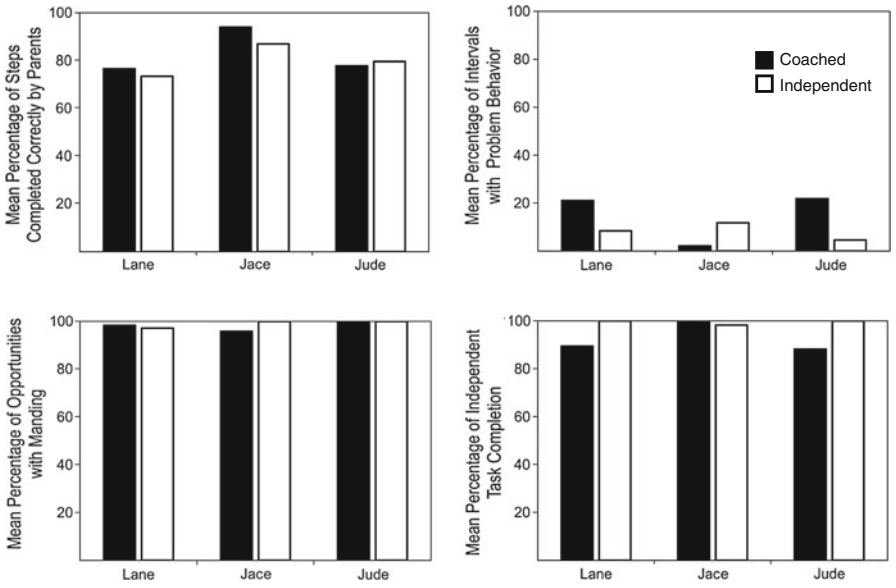

Fig. 1 Mean percentage of steps completed correctly by parents (*top left*); mean percentage of intervals with problem behavior (*top right*); mean percentage of opportunities with manding (*bottom left*); mean percentage of independent task completion (*bottom right*) during coached and independent trials across participants

trials. Overall, the general mean analyses showed no consistent differences between the coached and the independent trials across participants.

Participant differences between coached and independent trials were further analyzed by conducting Mann–Whitney U analyses with an alpha level set at 0.05. For Lane, a significant difference was shown for task completion ($U = 997.50$; $Z = -2.275$; $p = 0.023$) and problem behavior ($U = 892.50$; $Z = -1.999$; $p = 0.046$). During coached trials, less task completion and more problem behavior occurred. The average rank for task completion during the coached trials was 48.61 and during the independent trials was 55.50. The average rank for problem behavior during the coached trials was 54.98 and during the independent trials was 43.50. No significant differences were shown for treatment fidelity, problem behavior, or manding. For Jace, significant differences were shown for treatment fidelity ($U = 172.00$; $Z = -3.084$; $p = 0.002$), with higher fidelity occurring during the coached trials and for problem behavior ($U = 188.50$; $Z = -2.895$; $p = 0.004$), with higher levels of problem behavior occurring during the independent trials. The average rank for treatment fidelity during the coached trials was 33.33 and was 20.64 during the independent trials. The average rank for problem behavior during the coached trials was 20.35 and was 31.77 during the independent trials. No significant differences were shown for manding or task completion. For Jude, levels of problem behavior were significantly higher ($U = 205.00$; $Z = -2.753$; $p = 0.006$) during the coached trials. The average rank for problem behavior

during the coached trials was 31.47 and was 20.75 during the independent trials. No significant differences were shown for treatment fidelity, manding, or task completion.

Additional analyses were conducted to analyze the relation between treatment fidelity and problem behavior during coached and independent trials by conducting Spearman's rho correlations. For Lane, a significant relation between fidelity and problem behavior was shown during the coached trials ($rs = -0.583$; $p < 0.05$) but not during the independent trials. No significant relations between fidelity and problem behavior were shown for Jace and Jude across the coached and independent trials.

Overall, these statistical analyses suggested idiosyncratic differences across participants. These differences occurred individually across problem behavior, manding, and task completion during both the coached and independent trials. Further descriptions of individual treatment results are provided below for each participant.

Individual Analyses

Lane

Figure 2 displays the results for the treatment fidelity of Lane's parent and the effects of FCT on Lanes' problem behavior conducted over approximately 3 months. During the FCT (1) condition, the mean percentage of steps conducted accurately by Lane's parent during coached trials was 74.4 % and was 72.3 % for independently conducted trials. Problem behavior during the FCT (1) condition for both the coached and the independent trials averaged 22 %. During the FCT (3) condition, the mean percentage of steps conducted accurately during coached trials was 78.4 % and was 71 % for independently conducted trials. The mean percentage of problem behavior during FCT (3) coached trials was 23.2 % and was 6.1 % during trials conducted independently. During the FCT (5) condition, the mean percentage of steps accurately completed during coached trials was 77.5 % and was 78.9 % for independently conducted trials. The mean percentage of problem behavior during the FCT (5) condition during coached trials was 18.2 % and was 0.78 % during trials conducted independently.

Overall, treatment fidelity in which Lane's parent implemented the treatment procedures was the lowest at the start of treatment and when demand fading first occurred. However, there was an increase in fidelity across treatment implementation with no systematic differences between coached and independent trials. Similarly, Lane's problem behavior was the highest at the start of treatment and during the first demand fading condition. Problem behavior remained variable until the end of treatment, and more problem behavior was observed during coached trials.

Jace

Figure 3 displays the results for treatment fidelity of Jace's parent and the effects of FCT on Jace's problem behavior conducted over approximately 3.5 months. During

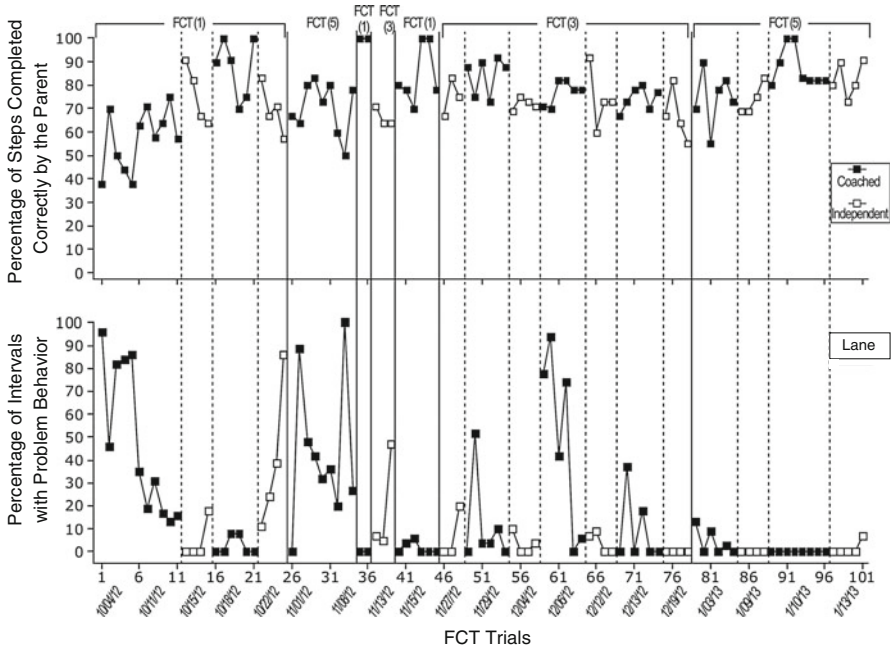

Fig. 2 Percentage of task analysis steps completed correctly (*top*); percentage of intervals with problem behavior (*bottom*) during coached and independent trials for Lane

the FCT (1) condition, the mean percentage of steps accurately conducted during coached trials was 93.7 % and was 88 % during trials conducted independently. Average problem behavior during the FCT (1) condition during coached trials was 3.7 % and was 11.1 % during trials conducted independently. During the FCT (5) condition, the mean percentage of steps conducted accurately during coached trials was 94.4 % and was 86.6 % during trials conducted independently. During the FCT (5) condition, the average percentage of problem behavior during coached trials was 0.58 % and was 12.1 % during trials conducted independently.

Overall, Jace's parent demonstrated an increase in treatment fidelity following the first coached trial. Fidelity remained at high levels until Jace's parent implemented the first set of demand fading trials independently. Following these independent trials, parent fidelity remained on an increasing trend throughout treatment with only slight differences occurring between coached and independent trials. Problem behavior occurred in a similar pattern with higher levels occurring during independent trials.

Jude

Figure 4 displays the results for the treatment fidelity of Jude's parents and the effects of FCT on Jude's problem behavior conducted over approximately 2 months. During the FCT (1) condition, the mean percentage of steps conducted accurately during coached trials was 78.6 % and was 72.7 % during trials conducted

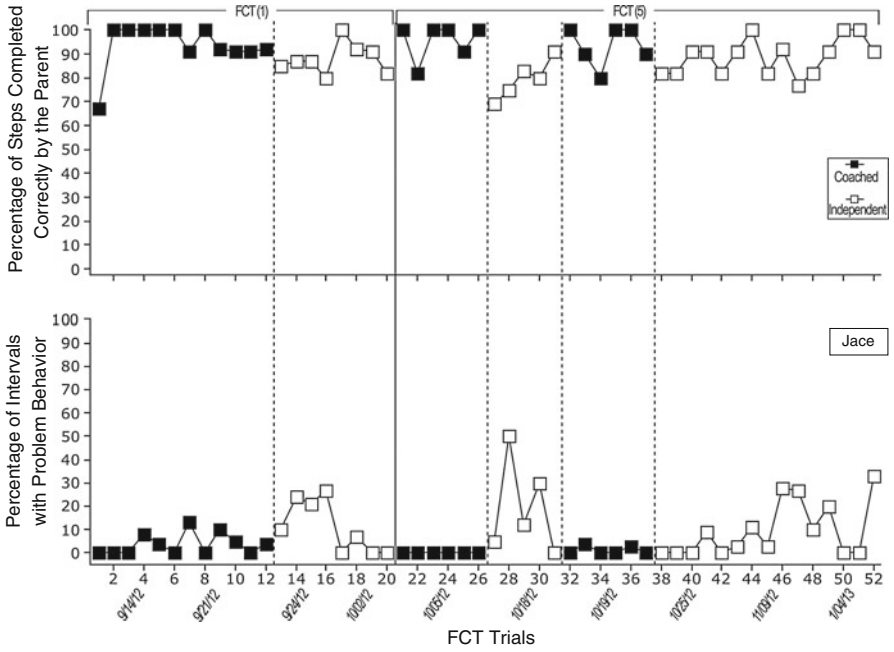

Fig. 3 Percentage of task analysis steps completed correctly (*top*); percentage of intervals with problem behavior (*bottom*) during coached and independent trials for Jace

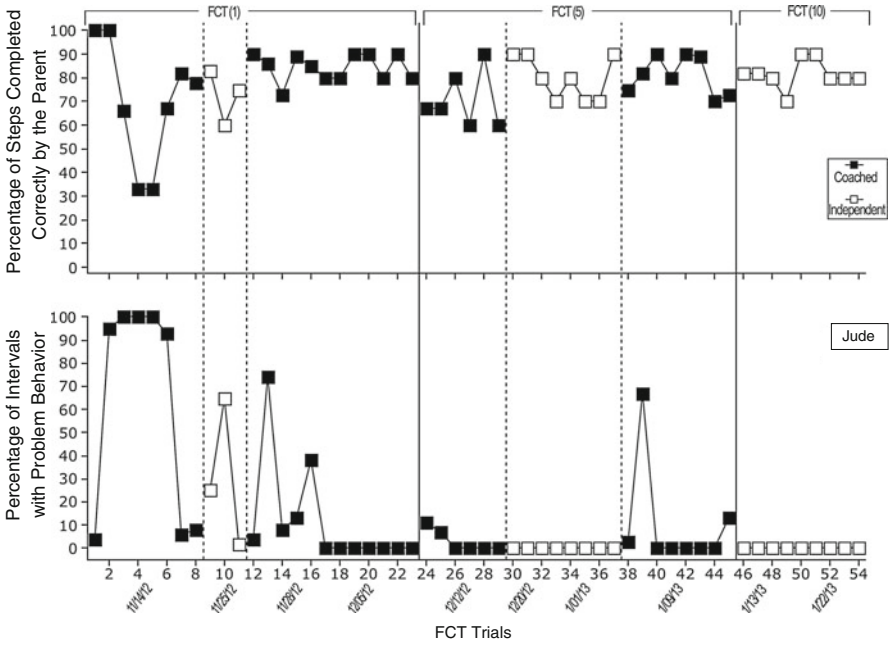

Fig. 4 Percentage of task analysis steps completed correctly (*top*); percentage of intervals with problem behavior (*bottom*) during coached and independent trials for Jude

independently. Average problem behavior during the FCT (1) condition during coached trials was 32.2 % and was 30.7 % during trials conducted independently. During the FCT (5) condition, the mean percentage of steps accurately completed during coached trials was 76.6 % and was 80 % during trials conducted independently. During the FCT (5) condition, the average percentage of problem behavior during coached trials was 7.2 % and no problem behavior occurred during trials conducted independently. During the FCT (10) condition, the mean percentage of steps conducted accurately during independent trials was 81.6 % and no problem behavior was observed.

Overall, the fidelity with which Jude's parent implemented the treatment procedures was lowest during both the first set of coached and independent trials and then again when demand fading occurred during the coached trials. Conversely, Jude's parent demonstrated relatively higher levels of fidelity during independent trials when demand fading was implemented. Jude's high levels of problem behavior initially may have affected parent fidelity. However, this relation was not observed later during treatment as problem behavior decreased to near zero or 0 %.

Fidelity Analyses

Each parent's fidelity errors were further divided into errors of omission or commission during the four components of the treatment program to determine which treatment component was associated with the highest percentage of errors and the types of errors parents most often made (see Table 6). Below are the percentages for each parent's omission and commission errors for each component of treatment.

Transition from Play to Work

For Lane, the transition from play to work produced an average of 27 % errors of omission and 31 % errors of commission during coached trials. During independent trials, Lane's parent engaged in a similar level of omission errors ($M = 31$ %) but higher levels of commission errors ($M = 74$ %). During coached trials, Jace's parent engaged in an average of 4 % errors of omission and 4 % errors of commission. No errors of omission and an average of 46 % errors of commission occurred during independent trials. Jude's parent engaged in an average of 30 % errors of omission and 13 % errors of commission during coached trials, and 20 % errors of omission and 5 % errors of commission during independent trials. Jude's parent engaged in a similar percentage of errors of omission and commission across both coached and independent trials, whereas Lane's and Jace's parents made more errors of commission. These errors took the form of providing attention (e.g., reprimands) to problem behavior.

Work

During the work component, Lane's parent engaged in an average of 23 % errors of omission and 56 % errors of commission during coached trials. A similar pattern of errors occurred during independent trials ($M = 20$ % errors of omission, $M = 46$ % errors of commission). Jace's parent engaged in an average of 21 % errors of

Table 6 Mean percentage of omission and commission errors by FCT component across all FCT trials conducted

FCT component	Lane				Jace				Jude			
	Coached		Independent		Coached		Independent		Coached		Independent	
	O (%)	C (%)	O (%)	C (%)	O (%)	C (%)	O (%)	C (%)	O (%)	C (%)	O (%)	C (%)
Transition: play to work	27	31	31	**74**	4	4	0	**46**	**30**	13	20	5
Work	23	**56**	20	46	21	8	**46**	32	12	**29**	15	10
Communication	65	24	**91**	46	0	13	**21**	7	63	63	**95**	55
Transition: work to play	2	0	**6**	**6**	0	0	0	0	3	3	**5**	**5**

Coached = FCT trials with the behavior consultant present; Independent = FCT trials without the behavior consultant present; O = errors of omission; C = errors of commission. Bolded numbers are the highest percentage of errors during each FCT component

omission and 8 % errors of commission during coached trials. A higher average percentage of omission and commission errors occurred during independent trials when Jace's parent engaged in an average of 46 % errors of omission and 32 % errors of commission. Jude's parent engaged in an average of 12 % errors of omission and 29 % errors of commission during coached trials, and 15 % errors of omission and 10 % errors of commission during independent trials.

No clear pattern of errors of omission or commission occurred during the work component across all three parents. Lane's parent engaged in similar percentages of omission and commission errors during coached and independent trials, Jace's parent engaged in more omission errors than commission errors, and Jude's parent engaged in slightly fewer errors during independent trials. Jace's parent engaged in high levels of fidelity errors during this treatment component. Further analysis showed the most frequent error was an error of omission in the form of not restricting Jace's access to preferred items during work.

Communication

During the communication component, Lane's parent made an average of 65 % errors of omission and 24 % errors of commission during coached trials, and an average of 91 % errors of omission and 46 % errors of commission during independent trials. Jace's parent had no errors of omission and 13 % errors of commission during coached trials, and an average of 21 % errors of omission and 7 % errors of commission during independent trials. Jude's parent engaged in an average of 63 % errors of omission and 63 % errors of commission during coached trials, and an average of 95 % errors of omission and 55 % errors of commission was recorded during independent trials.

Lane's and Jude's parents engaged in a high percentage of both omission and commission errors during the communication component. Lane's parent was most likely to engage in errors of omission in the form of not praising independent

manding. Jude's parent engaged in high levels of errors of both commission and omission. The most common error of commission was requiring Jude to mand multiple times before delivering reinforcement. The most common error of omission was not praising Jude for manding independently. Overall, both parents made more errors of omission during the independent trials.

Work to Play

The fewest errors occurred during the transition from the work to play component. Lane's parent engaged in an average of 2 % errors omission and no errors of commission during coached trials, and an average of 6 % errors of both omission and commission during independent trials. Jace's parent engaged in no errors of omission or commission across both coached and independent trials. Jude's parents engaged in an average of 3 % errors of both omission and commission during coached trials and an average of 5 % errors of omission and commission during independent trials.

Overall, the highest number of errors occurred during the communication component for Lane's and Jude's parents. For both, the highest number of errors occurred during independent trials, with the highest percentage occurring for omission errors. Jace's parent also engaged in relatively high levels of omission errors during the communication component but made the most errors during the work component. No consistent pattern of errors was observed across participants. More errors were made during independent trials, but patterns of errors were similar across coached and independent trials.

Treatment Acceptability

Parents rated their acceptability of the treatment procedures following the completion of treatment via the *TARF-R* (Reimers and Wacker 1988). Parent responses to the question, "How acceptable do you find the treatment to be regarding your concerns about your child?" were used to measure treatment acceptability. Parents rated the treatment on a Likert scale with responses that ranged from (1) *Not at all acceptable* to (7) *Very acceptable*. Acceptability ratings from the parents of Lane, Jace, and Jude were 7, 6, and 7, respectively.

Discussion

The results of the current investigation support those reported by Barretto et al. (2006) and Wacker et al. (2013a) in showing that behavioral treatments such as FCT can be delivered effectively via telehealth. In the most extensive study conducted to date evaluating FCT delivered via telehealth, Wacker et al. (2013a) reported that problem behavior was reduced by an average of 94 % for 17 young children with autism spectrum disorders. The three children in the current investigation showed similar reductions with no to very little problem behavior occurring during the telehealth FCT coached trials by the end of treatment. Thus, the use of telehealth

can be an effective method to deliver behavioral treatments and warrants further investigation to determine the procedures that will produce optimal outcomes.

As behavioral treatments are implemented more frequently via telehealth, issues related to treatment fidelity need to be studied. As discussed by Wacker et al. (2013a), the fidelity with which parents practice treatment procedures becomes increasingly important when physical contact between clinicians and parents or children occurs less frequently. Several research teams have shown that the effects of treatment can be impacted negatively by poor implementation of components of the treatment package (e.g., Arkoosh et al. 2007; Carroll et al. 2013; St. Peter-Pipkin et al. 2010). Telehealth precludes clinicians from directly modeling procedures with the child or assisting in the delivery of FCT components. Thus, parents must be responsive to the feedback provided during telehealth sessions and must practice procedures independently outside of those sessions.

The first issue addressed in the current investigation was the identification of differences between coached and independent trials relative to the fidelity with which parents delivered the procedures. No consistent differences occurred for these three families. Lane's and Jude's parents showed improvement in their fidelity across both coached and independent trials, and Jace's parent displayed high fidelity during all trials. For Jace's parent, there were only slight differences in fidelity between coached and independent trials, and these differences were apparent only during the initial trials. Two aspects of these results are promising. First, the fidelity observed during coached trials appeared to be highly related to the fidelity that occurred during independent trials. If this finding is replicated across other parents, then behavior analysts can rely more heavily on coached sessions to make needed adjustments to treatment. Second, it appears that needed adjustments to the delivery of treatment can be made because all parents either had high fidelity or showed improvement across trials, and substantial reductions in problem behavior occurred by the end of treatment.

These preliminary findings on treatment fidelity continue to support the use of telehealth to deliver FCT. Telehealth has not disrupted the efficacy of treatment. One factor related to these positive findings may be that the parents had the skills needed to follow verbal directions and rules. Jace's parent showed high fidelity from the first trial, and although the fidelity of the other two parents was not as high initially, immediate improvement often occurred with coaching and often generalized to the independent trials. For parents who require models or direct demonstrations of the procedures, effective use of telehealth may be more challenging.

A second factor may be the acceptability of the procedures to parents. As reported by Wacker et al., the package of FA plus FCT was consistently rated as highly acceptable to parents on the *TARF-R* (Reimers and Wacker 1988), regardless of whether treatment was delivered in vivo (Wacker et al. 1998, 2011) or via telehealth (Wacker et al. 2013a). Similar ratings were given by the parents of the three participants in the current investigation suggesting positive experiences with in-home telehealth. The parents in the studies conducted by Wacker et al. volunteered to participate, and this was likely based, at least in part, on the acceptability of the procedures. What is unclear is the generalizability of parents'

acceptance of telehealth and whether some subgroups of parents view telehealth more favorably than others.

The relationship between the occurrence of child problem behavior and the fidelity of treatment delivered by the parents was a second issue assessed in this investigation. No consistent results occurred across parents for the coached and independent trials. No relationship between problem behavior and treatment fidelity occurred for Jace's and Jude's parents, whereas significant correlations were obtained for Lane's parent during the coached trials. However, these significant relations most often occurred earlier rather than later in treatment. During the final treatment trials, Lane and Jude rarely displayed problem behavior, and Jace's behavior appeared to show no relation to observed fidelity. Of interest is that the majority of errors committed by Lane's and Jude's parents during independent trials were omission and commission errors related to mands. In most cases, the parents failed to provide social praise following an appropriate mand or the children needed to mand several times before they received reinforcement. Volkert et al. (2009) showed that a failure to reinforce mands often produced a resurgence of problem behavior, which did not occur consistently in this investigation. However, Volkert et al. used a thinner schedule of reinforcement than what occurred in the current investigation suggesting that there may be a critical level of fidelity to observe a reduction in manding and the resurgence of problem behavior.

Another reason a more consistent relationship did not emerge between problem behavior and omission errors may be the history of procedural fidelity that occurred during early trials in this investigation. St. Peter-Pipkin et al. (2010) showed that fidelity errors that followed sessions with good fidelity had fewer adverse effects on treatment than when sessions with good fidelity did not occur. In the current investigation, parents first conducted several sessions of an FA in which every trial was coached and tightly controlled. The parents then completed at least eight coached trials of FCT with high levels or an increasing trend of fidelity, which were also tightly controlled, before they were asked to conduct independent trials. It may be the case that this local history of tightly controlled procedures led to relatively low occurrences of child problem behavior. Although the initial effectiveness of FCT was not severely compromised by omission and commission errors for manding, this may still be a problem for long-term maintenance. Wacker et al. (2011) showed that FCT produced persistent long-term treatment effects related to problem behavior and task completion but not to mands. Periodically, over the long-term course of treatment, all adaptive behaviors were exposed to brief periods of extinction. Both problem behavior and task completion showed better treatment effects during maintenance than did manding. In the current investigation, extinction/response cost procedures were delivered consistently for problem behavior and noncompliance, but mands did not consistently produce reinforcement for two of three children. Over trials, this may have weakened manding relative to both problem behavior and task completion (Nevin and Wacker 2013). Studies evaluating the relation of fidelity and type of fidelity errors to long-term maintenance of specific topographies of behavior are needed.

In the future studies, the independently conducted trials might be considered a challenge to treatment delivered during the coached trials (e.g., Mace et al. 1990,

2009). Mace et al. (1990) showed that distractors can affect ongoing displays of adaptive behavior. Relative to the current investigation, the independent trials might be viewed as potential challenges to both parent and child behavior given that the behavior consultant is neither visibly present nor correcting procedural errors while the parent is implementing the treatment procedures. If consistently good behavior occurs across these trials, then good long-term treatment effects can be predicted. Only one child (Jace) appeared to behave differentially across coached and independent trials, and no consistent differences occurred for the parents' behavior. These results and those of Wacker et al. (2011) and (2013a) suggest that good long-term effects of FCT can be achieved, meaning that the effects of treatment often persist despite being challenged. It seems likely that the independent sessions conducted by parents are highly related to the overall effects of treatment, but further analyses of this relationship are needed before specific conclusions can be reached.

Continued analysis of telehealth-delivered behavioral treatment is warranted given the positive treatment effects achieved to date. The identification of variables associated with improved parent and child behavior is needed to maximize the benefits of treatment. The results of this investigation suggest that parent behavior can be impacted positively through telehealth and that this learned behavior may be resistant to challenges such as the absence of a coach or changes in the treatment conditions such as those that occur with demand fading. As more telehealth treatment is conducted in the future, many more children can be served who live in areas that do not provide routine access to behavioral services.

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