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BST WITH VIDEO-FEEDBACK

Clinic-based behavioral skills training to teach caregivers adaptive skill interventions for

children with autism

Abstract

Behavioral skills training (BST) with video-based feedback may be an effective means of preparing caregivers of children with autism spectrum disorder (ASD) to implement behavioral interventions for adaptive skills. The purpose of this study was to evaluate the use of BST with video-based feedback to train caregivers to implement adaptive skill interventions in a natural setting (home/community). Three caregivers and their children participated in the study. The caregivers identified tooth brushing, drinking from a cup, and walking down the stairs as target adaptive skills. Researchers taught the caregivers to implement an intervention consisting of choice, prompting, chaining, positive reinforcement, and differential reinforcement. Researchers employed a single-case multiple-probe across-participants design to evaluate the effects of the training package on caregiver implementation of the intervention and child adaptive skill. Results demonstrated improved caregiver procedural fidelity with all three of the caregivers meeting the pre-set performance criteria. Changes in the caregiver behavior maintained up to eight weeks following the cessation of the intervention. Improvements in the child adaptive skill was also noted. Finally, all of the caregivers reported they found the intervention and training procedures acceptable. These results demonstrate the utility of BST with video-based feedback to train caregivers in adaptive skill interventions for children with ASD. Limitations of the study and future research are also discussed.

Keywords: single-case, video-based feedback, caregiver training, adaptive skill, autism

Clinic-based behavioral skills training to teach caregivers adaptive skill interventions for children with autism

Autism spectrum disorder (ASD) is a neurological disorder characterized by social-communication deficits and presence of repetitive and restricted behaviors and interests (American Psychiatric Association, 2013). Given the heterogeneity of ASD, children with ASD may present with a wide variability in symptom severity and cognitive functioning (Pelphrey, Shultz, Hudac, & Vander Wyk, 2011). Although deficits in social-communication skills and engagement in repetitive and restrictive behaviors are considered most prominent, many children on the autism spectrum also have impaired adaptive behavior skills (Koegel, Symon, & Kern Koegel, 2002). In particular, lower cognitive functioning is associated with more significant impairments in adaptive functioning overall. Adaptive skills include a variety of self-care and daily living skills that are necessary for everyday functioning (e.g., getting dressed in the morning or tooth brushing; Paul, Loomis, & Chawarska, 2014). Unfortunately, a lack of adaptive skills may result in diminished social functioning (Farley et al., 2009) and increased dependence on others (Liss et al., 2001; Mazefsky, Williams, & Minshew, 2008). Without intervention and specific skills teaching, adaptive skill deficits are unlikely to improve and may even degrade (Chadwick, Cuddy, Kusel, & Taylor, 2005; Rojahn, Matson, Naglieri, & Mayville, 2004).

Evidence-based practices for improving acquisition and fluency highlights behavioral based interventions as efficacious for teaching adaptive skills to individuals with ASD (Neely et al., 2016; Ninci et al., 2015). In particular, practices such as visual supports, prompting, use of task-analysis, and reinforcement of adaptive skills have been identified as evidence-based for teaching adaptive skills to individuals with ASD (National Autism Center, 2015). Regarding sustained intervention effects, a meta-analysis by Neely et al. (2015) highlighted that teaching

adaptive skills in the natural setting lead to strong maintenance and generalization of effects with statistically significant differences realized when comparing training in a natural setting to the default “train and hope” method. Therefore, it is recommended to teach adaptive skills in the setting which they are to be performed.

Caregivers play an important role in facilitating adaptive skill interventions for children with ASD in the natural setting. Caregivers naturally are essential in the teaching of adaptive behaviors as they most often interact with their child when they are engaging in the behaviors (e.g., showering before bed; Hsieh, Wilder, & Abellon, 2011). There is also emerging evidence suggesting that utilizing caregivers to implement adaptive skill interventions result in strong effects for the child adaptive behavior (e.g., Ninci et al., 2015). Research supports the use of caregivers as implementers with improvements in domestic skills, self-care skills, and continence noted for the children following caregiver-implemented interventions (Bainbridge & Smith Myles, 1999; Cavkaytar & Pollard, 2009; Leblanc, Carr, Crossett, Bennett, & Detweiler, 2005; Ozcan & Cavkaytar, 2009). For example, in a study by Ozcan and Cavkaytar (2009), researchers taught caregivers to implement a toileting intervention with positive results for the children’s toileting behavior. With the important role caregivers play in adaptive skill interventions, there is a need to identify effective approaches to teaching them effective interventions.

In behavioral-based programs, trainers teach caregivers the intervention using behavioral skills training (BST; e.g., Crockett, Fleming, Doepke, & Stevens, 2007; Elder, Valcante, Yarandi, White, & Elder, 2005; Laski, Charlop, & Schreibman, 1988; Lucyshyn et al., 2007; Najdowski et al., 2010; Symon, 2005). Specifically, BST follows an explicit instruction paradigm including instructions and content teaching, modeling, behavioral rehearsal, and performance feedback (Miles & Wilder, 2009). In a recent review by Maffei-Almodovar &

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4 Sturme y (2018), studies utilizing BST in caregiver training demonstrated the largest effects with
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6 large effects noted across change agent categories (i.e., staff members, caregivers, and college
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8 students). In particular, there is evidence to suggest that performance feedback may be an
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10 essential piece to improving procedural fidelity (Ward-Horner & Sturme y, 2012). Unfortunately,
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12 there are a number of barriers that can limit professionals from training caregivers in behavioral
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14 interventions for their children.
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18 The most cited barriers to access training include time and the monetary investments
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20 necessary to access trained professionals (Wainer & Ingersoll, 2013). This often leads to
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22 modifications such as large group trainings or training outside of the authentic context. For
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24 example, schools may conduct caregiver training in a group setting rather than individually due
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26 to time and resource constraints. Likewise, community organizations may offer trainings in their
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28 clinical settings setting rather than in private households. Although it is clear that individualized
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30 performance feedback and training in every setting in which the caregiver should implement the
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32 intervention is best practice, this is often impractical (Symon, 2001; Wacker et al., 2013).
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34 Therefore, there is a need to identify training procedures that improve implementation in the
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36 home and natural settings yet are flexible and effective. Furthermore, caregivers report a need to
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38 develop more effective and practical ways to support them in implementing behavioral
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40 techniques in home setting (Hall & Graff, 2011).
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48 With BST, all of the training steps can be conducted outside of the natural context with
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50 the exception of performance feedback. One option to facilitate performance feedback for the
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52 natural setting is to modify caregiver training to include video-based feedback (e.g., Heitzman-
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54 Powell et al., 2014; Suess et al., 2014; Vismara, McCormick, Young, Nadham, & Monlux, 2013;
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56 Wainer & Ingersoll, 2014). In video-based feedback, the implementer records their
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implementation of the target skills in the natural environment. The trainer then reviews the video later and provides feedback based on the performance in the video. Research has demonstrated the efficacy of video-based feedback in the initial acquisition of skills (e.g., Neely et al., 2016), and has suggested that video-based feedback may promote maintenance of learned skills (Keller, Brady, & Taylor, 2005). In addition, video-based feedback may allow coaches to provide feedback in the natural environment without being present in the environment. However, there is no research investigating the use of video-based performance feedback in the context of training caregivers in behavioral interventions to teach adaptive skills. As this modification to BST might alleviate some of the barriers associated with teaching adaptive skill interventions (e.g., travel to homes), there is a need to evaluate the effects of this modification on caregiver implementation of adaptive skill interventions. Therefore, the purpose of this study is to identify the effectiveness of clinic-based BST with video-based feedback on caregiver implementation of adaptive skill interventions in the home setting. A study of this nature is intended to inform researchers and clinicians on alternative training procedures when in-vivo BST is not feasible. The following research questions are addressed:

- (a) Is there a functional relation between a training package consisting of BST with video-based feedback conducted in a clinical setting and an increased mean level of procedural fidelity of adaptive skill interventions in natural settings by caregivers of children with ASD?
- (b) What are the distal effects of caregiver training on child adaptive behavior?
- (c) What is the acceptability of the training package consisting of BST with video-based feedback as rated by caregivers?

Method

Participants

Three caregivers participated in this study. Researchers recruited caregivers from a university-based autism center. Caregivers were eligible to participate if (a) they had a child with an ASD diagnosis currently receiving behavioral therapy at the center, (b) provided informed consent for the research, and (c) their child had an identified adaptive behavior skill goal. Researchers asked the caregivers to select a pseudonym to protect confidentiality.

All of the children were previously diagnosed with ASD prior to this study. However, in order to assess symptom severity in the child participants, parents were administered the Autism Spectrum Rating Scale (ASRS) Parent Rating Form for Ages 2-5. Goldstein and Naglieri (2009) indicated that the ASRS is an appropriate tool to identify symptoms, behaviors, and associated features of autism spectrum disorder. Goldstein and Naglieri also reported that the ASRS is a reliable and valid measure of autism related symptomatology with internal consistency ranging from .84 to .91, positive predictive power ranging from 88.2 to 99.4%, and negative predictive power ranging from 85.1 to 91.2%.

Sarah and Evan

“Sarah” was a 29-year-old Caucasian female and “Evan” a 3-year-old Caucasian male made up the first dyad. Sarah, a homemaker with a two-year college degree in liberal arts, had no previous experience implementing ABA techniques. Sarah’s son was diagnosed with severe ASD by an outside agency at age 2. Results from the administered ASRS showed a “very elevated” score of 80 identifying that Evan had many behavioral characteristics of a child diagnosed with ASD. Evan had received ABA therapy for 2 weeks at the beginning of the study and was not concurrently enrolled in school outside of the clinic. Sarah identified tooth brushing in the home as an adaptive skill to be targeted for Evan as part of this study.

Diana and Keller

“Diana”, a 44-year-old Vietnamese American female and “Keller”, a 3-year-old Vietnamese American male comprised the second dyad. Diana had a high school degree received in Vietnam and no prior experience implementing ABA techniques. Diana’s son, “Keller” (age 3), was diagnosed at 20 months with severe ASD. Results from the administered ASRS yielded a score of 67, which is an “elevated” score indicating Keller had many behavioral characteristics of a child diagnosed with ASD. Keller had received ABA therapy for 2 weeks at the beginning of the study and was attending a public prekindergarten program for children with disabilities. Diane identified drinking from a sippy-cup in the home as a target adaptive skill for Keller to work on during the study.

Star and Joe

“Star,” a 42-year-old Hispanic female with a Bachelor of Arts degree in communication disorders, and her son, “Joe”, a 3-year-old Hispanic male made up the third dyad. Star also reported no prior experience implementing ABA techniques, however she had prior exposure to ABA therapy with an older child who had previously received ABA therapy. Joe was diagnosed with moderate ASD at age three by a community-based school psychologist. Results from the ASRS revealed a score of 72 representing showed a “very elevated” score of 72 scores indicating Joe had many behavioral characteristics similar to children with ASD. Joe had received ABA therapy for 2 weeks at the beginning of the study and was attending a public prekindergarten program for children with disabilities. Star identified walking down the stairs at their church as a target adaptive skill for Joe to work on during the study.

Coach

Throughout the duration of the study, the lead researcher (“coach”) administered each of the caregiver training sessions. The coach was a doctoral level Board Certified Behavior Analyst (BCBA-D) with a Ph.D. in Educational Psychology and five years of experience implementing ABA programs for children with ASD.

Settings and Materials

All coaching sessions occurred at the university-supported clinic in a 12.6 ft by 14.6 ft conference room. The coaching sessions took place at a conference table with the coach, caregiver, and were either attended by a research assistant or recorded on an iPad® for data collection purposes. All caregiver-implemented intervention sessions occurred in home or community settings (henceforth termed “natural setting”). This included the home bathroom for Sarah, the home kitchen for Diana, and a community-based stairwell for Star. Materials included a toothbrush, toothpaste, and child preferred items for Sara, a sippy-cup, highchair, and child preferred items for Diana, and the stairwell for Star and child preferred items. All participant dyads utilized an iPad Mini®, furnished by the researchers, to video-record the intervention sessions.

Dependent Variables and Measures

The primary dependent variable was caregiver implementation of the adaptive skill intervention as measured by percentage of correctly implemented steps in the caregiver fidelity checklist (Appendix A). All caregivers were taught the same intervention consisting of preparing materials, providing a choice of preferred items prior to initiating a session, prompting using most-to-least prompting, chaining (either backwards or forwards), delivery of verbal and tangible reinforcement, and implementing differential reinforcement. The lead researcher or a trained graduate student recorded procedural fidelity data from the video-recorded sessions conducted in

the natural setting. Each video-recorded session represented one trial. Researchers calculated adherence to the fidelity checklist for each video-recorded session by dividing the total number of procedural steps completed correctly by the total number of procedural steps and multiplying by 100 to obtain a percentage.

Child Behavior

The distal dependent variable was the child acquisition of their target adaptive skill. Prior to the beginning of the study, the coach worked with each parent to identify an adaptive skill to be targeted. The coach then prepared a task analysis for each target child behavior and finalized the task analysis with input from the parent. The task analyses are presented in Table 1. Data were collected on the child's adaptive skill at baseline (before parent training) and a follow-up (after the parent reached the predetermined criterion for procedural fidelity). The distal dependent variable was the child's independent completion of steps in the task-analysis as measured by percent accuracy on the task-analysis. This was calculated by dividing the number of steps independently completed by the child by the total number of steps in the task analysis by and multiplying by 100 to obtain a percentage. Data were collected by either the lead researcher or a trained graduate student by viewing the video recorded sessions.

<Insert Table 1 about here>

Treatment Acceptability Questionnaire

To assess treatment acceptability, caregivers completed the Modified Treatment Evaluation Inventory Short Form (TEI-SF; Kelley, Heffer, Gresham, & Elliott, 1989), which assessed caregiver's perceptions of the acceptability of the intervention for her respective child. The TEI-SF demonstrates internal consistency ranging of .85 (Kelley et al., 1989). The TEI-SF contains nine statements for which participants were asked to rate level of agreement from

strongly disagree to strongly agree. There were eight positively worded statements and one negatively worded statement. The lead research assigned responses values of 1-5 points, and reverse scoring to the negatively worded item. The lead researcher then calculated mean treatment acceptability across all three participants and for individual participants.

The caregivers also completed a researcher developed questionnaire at the end of the study (included as Appendix B). The questionnaire included 14 statements adapted from Behavioral Intervention Rating Scale (BIRS; Elliott and Treuting 1991). The BIRS was adapted to evaluate elements of the treatment delivery relevant to this study (e.g., coaching procedures, video-based feedback procedures, and the coaches). Possible responses ranged from “5” indicating that the caregiver “strongly agreed” with the statement to “1” indicating the caregiver strongly disagreed with the statement. The questionnaire was composed of three sections evaluating caregiver satisfaction with the coaching procedures, video-based feedback procedures, and the coach.

Experimental Phases and Design

Researchers used a multiple-probe across participants design to introduce the training procedures. As a variation of the multiple baseline design, the multiple probe design allows for demonstrations of intervention effect by determining change from baseline to intervention across multiple participants, behaviors, or settings but offers an alternative to continuous measurement in the baseline (Horner & Baer, 1978). Researchers chose a multiple probe design to reduce baseline effort for caregivers. This design is also appropriate because the participants did not know each other and results were unlikely to generalize across caregivers.

Researchers conducted this study in four phases. In the pre-assessment phase, caregivers met with the researchers to obtain informed consent and define the adaptive skill to target as part

of this study. The baseline phase consisted of caregivers videotaping themselves working with their child on the target skill. In the intervention phase, researchers taught caregivers the behavioral intervention to implement with their child using BST with video-based feedback. Finally, researchers conducted a maintenance phase to fade the support of the coach. The researchers utilized a response-guided approach to determine when each caregiver should move from baseline to intervention and from intervention to the maintenance phase.

Procedures

Pre-assessment

Prior to the start of the study, the coach met with each participant to discuss the purpose of the study and to review the informed consent document. After receipt of consent, the coach worked with each caregiver to identify and define the target adaptive skill. The coach and caregiver developed a task analyses for the target adaptive skills and the caregiver reported which steps their child could independently complete. Researchers also used the report to identify the use of forward or backward chaining for the intervention. There was no training provided during this phase.

Baseline

Researchers implemented a natural baseline in which researchers instructed the caregivers to videotape themselves working with their child on the identified adaptive skill. Caregivers had the task analysis for the adaptive skill but the coach did not provided any other instruction during this phase.

Intervention

The intervention consisted of a BST training package consisting of a) verbal and written instructions, b) modeling, c) role-play, and d) delayed performance feedback via video. The

coach first met with each caregiver and provided a copy of the caregiver fidelity rubric (Appendix A). The coach reviewed the written documents (caregiver fidelity rubric and task analysis) with the parent and provided verbal instruction on how to implement the behavioral intervention (i.e., preparing materials, providing a choice of preferred items prior to initiating a session, prompting using most-to-least prompting, chaining, delivery of verbal and tangible reinforcement, and implementing differential reinforcement). The coach then modeled any incorrect steps identified in the baseline videos and asked the caregiver if they had any questions. Following modeling of the intervention, the coach or research assistant acted as the confederate to role-play with the caregiver. The coach provided immediate feedback during role-play using the caregiver fidelity rubric (Appendix A). Throughout the first coaching session, the researcher encouraged the caregiver to ask questions and answered any questions the caregiver asked. Finally, at the end of the first coaching session, the coach instructed the caregiver to record herself implementing the intervention in the natural setting with their child and the next training session was scheduled.

In follow-up training sessions, the caregiver brought the recently recorded video of them implementing the intervention with their child to the university-based clinic. The coach reviewed the video with the caregiver and provided feedback on caregiver implementation using the caregiver rubric (Appendix A). The coach provided descriptive praise on steps completed correctly. In the event the caregiver did not complete a step correctly, the coach provided corrective feedback in a neutral voice. The coach modeled any incorrect steps and asked the caregiver if they had any questions. Following modeling of the step, the coach provided immediate feedback during role-play using the caregiver fidelity rubric (Appendix A). Throughout the training session, the researcher encouraged the caregiver to ask questions and

answered any questions the caregiver asked. Finally, at the end of the first coaching session, the coach instructed the caregiver to record herself implementing the intervention in the natural setting with their child and the next training session was scheduled. The training sessions occurred one to three times a week.

The training phase continued until the caregiver met the predetermined performance criterion of 90% procedural fidelity as assessed via the recorded videos. The researchers selected the 90% performance criterion to ensure a high level of intervention procedural fidelity. In the event a caregiver reached the 90% criterion in the first two sessions, the researchers also required this phase to have a minimum of three sessions to meet single case design standards with reservations (Kratochwill et al., 2010).

Maintenance

During the maintenance phase, the researcher instructed the caregiver to continue teaching the child without coach support and to record a session after one week. If the caregiver maintained the 90% criterion, the researcher instructed the caregiver to continue recording at two-week intervals. If the caregiver did not maintain the 90% criterion, the coach reintroduced the training procedure until the caregiver obtained 90% fidelity and then instructed the caregiver to continue recording at one-week intervals. This continued until the caregiver met 90% criterion during the post-intervention follow-up for a minimum of three consecutive points.

After the final data point (week six to eight), the caregiver and coach met for a wrap-up session. During the wrap-up session, the coach provided the caregivers with the opportunity to review their own progress and their child's progress. The coach provided each caregiver with written recommendations for the next steps including continued prompt fading and fading of

contrived reinforcers to natural reinforcement. During this meeting, the caregivers also completed the treatment acceptability questionnaires.

Interobserver Agreement and Treatment Integrity

Researchers collected interobserver agreement (IOA) data for the dependent variable (i.e., caregiver fidelity of implementing behavioral intervention) for at least 50% of sessions within each condition (i.e., 50% of baseline, 50% of intervention, and 50% of follow-up) for each participant. A trained graduate student collected data from video-recorded sessions. Prior to collecting data, first author trained the graduate students to 100% reliability. The first author calculated IOA using percentage agreement by taking the total number of responses in agreement and dividing it by the total number of expected behaviors. Resulting IOA was 98.92% (range 81-100%) for caregiver procedural fidelity.

The coach's treatment integrity during the training sessions was collected using coaching fidelity checklists (available upon request from corresponding author). Independent raters collected fidelity data for 98% of coaching sessions across participants in both the training and follow-up phase. Coaching sessions were either video-recorded to facilitate data collection or attended by at least one rater. The lead researcher calculated treatment integrity as the percentage of steps in the fidelity checklist completed. Treatment integrity was 99% (range 97.7-100%) across all sessions. Raters also coded IOA data for the treatment integrity for 50% of coaching sessions for a resulting 100% IOA for all fidelity data.

Results

Descriptive Data

Data were collected regarding the total length of each skill video submitted by the caregiver. The tooth brushing videos submitted by Sarah averaged 2 min 3 s (range 20 s – 4 mins

16 s). The cup drinking videos submitted by Diana averaged 32 s (range 17 s – 1 min). The stair videos submitted by Star averaged 40 s (30 – 54 s).

Data were also collected regarding the total length of the training sessions from the video-recorded coaching sessions. The initial training sessions lasted 30 mins (Sarah), 28 mins 23 s (Diana), and 20 mins 44 s (Star). The follow-up training sessions lasted an average of 21 mins 38 s for Sarah (range 19 mins 34 s – 32 mins 30 s), 17 mins 29 s for Diana (range 15 min 17 s – 19 min 41 s), and 10 min 25 s for Star (range 9 min 47 s – 11 min 3 s). Both Sarah and Diana required additional training sessions after reaching criterion averaging 15 mins 12 s for Sarah (range 7 mins 31 s – 26 mins 5 s) and 9 mins 47 for Diana. Total training time was 162 mins 59 s for Sarah, 73 mins 9s for Diana, 41 mins 34 s for Star.

Intervention Effects on Caregiver Behavior

Results of caregiver training are displayed in Figure 1. During the baseline phase, all caregiver participants performed at low and stable levels ($M=11.71\%$, range 0-18%). Baseline data for Sarah demonstrate no trend and indicate a low, stable level of responding ($M=10.5\%$, range 9-18%). Baseline data for Diana also demonstrate no trend with a low, stable level of responding ($M=13.5\%$, range 9-18%). Baseline data for Star demonstrate no trend and a low, stable level of responding as well ($M=11.0\%$, range 0-22%).

<Insert Figure 1 about here>

Once the intervention was introduced, all caregivers improved above baseline levels and met criterion within five sessions. Training results for Sarah suggest a rapidly increasing trend and a high, variable level of responding ($M=57.6\%$, range 28-90%). Training results for Diana indicate an increasing trend and a high, stable level of responding ($M=96.3\%$, range 88.9-100%). Training results for Star demonstrate zero trend and a high, stable level of responding

($M=100\%$). Across participants, data indicate an immediate and positive intervention effect with no overlap with the baseline. Effect sizes calculated using Tau-U (a non-parametric effect size well suited for single-case research; Parker, Vannest, Davis, & Sauber, 2010), resulted in an effect size of 1.0 for all participants.

In the follow-up phase, all participants maintained performance levels above baseline (see Figure 1). However, although performance did remain above baseline levels, Sarah did not maintain the performance criterion at first follow-up. As a result, Sarah received additional coaching support to maintain performance at or above 90%, and at final follow-up, results indicated maintenance of performance criterion. Although performance remained above baseline levels, in the follow up phase, Diana fell below the 90% percent criterion at first follow-up. After one additional coaching session however, Diana maintained performance at or above the 90% criterion all the way through to the final follow-up ($M=94.67\%$, range 83.33-100%). Star maintained criterion throughout the follow-up phase with no additional support and her performance levels maintained at or above criterion into the final follow-up session ($M=100\%$, range 100-100%). Across participants, data for the follow-up phase indicated a high level of skill maintenance in the context of appropriate support fading ($M=93.54\%$, range 77.78-100%).

Distal Effects of Intervention on Child Behavior

Child behavior data were recorded for the parents' baseline and follow-up phases and are presented in Table 2. Child data were not collected during the parent's training phase in order to ensure that results reflect the children's progress after the parents were accurately implementing the children's interventions. Prior to parent training, the mean rate of adaptive skill performance for the children was 5.72% of steps (range 0-25%) across participants. Evan performed at low levels ($M=16.67$, range 0-25%). Keller performed consistently at very low levels ($M=0$, range 0-

0%). Joe also performed consistently at very low levels ($M=.5\%$, range 0-5%).

<Insert Table 2 about here>

After parent training, the children all showed increased accuracy and independence as demonstrated by improvement in percentage of steps performed independently and without incompatible behavior. Evan showed variable but improved performance ($M=23.78$, range 0-75) from baseline independence of 16.67% (range 0-25%). Keller demonstrated a high level of improvement with mean post parent-training performance at 55% of steps performed accurately and without incompatible behaviors and no variability (range 55%-55%) from baseline independence of 0% (range 0-0%). Joe also demonstrated a high level of improvement with mean post parent-training performance at 96.67% (range 90-100%) from baseline independence of <1% (range 0-5%). Across participants, independence increased from a mean of 5.72% to a mean of 58.48% of steps.

Treatment Acceptability

The mean score for treatment acceptability from the TEI-SF across all three participants was 4.7 out of a possible score of 5, and the individual scores ranged from 4.67 to 4.78 indicating that caregivers found the interventions designed for their children highly acceptable. Regarding the researcher developed questionnaire, the mean score for the coaching sessions was 4.91 out of 5 across participants (range 4.67 to 5). The mean rating for the video-based feedback procedure was 4.7 out of 5 (range 4.33 to 4.67). The mean rating for participant perceptions of the coaches was 4.92 out of 5 (range 4.67 to 5). Overall, these scores indicate that caregiver participants found the coaching sessions, video-based feedback procedures, and the coaches highly effective and acceptable.

In response to the open-ended questions, caregivers reported advantages of increased access to services and support, increased availability of providers, and ability to teach the child on a schedule that is convenient to the caregiver. The caregivers also reported that the advantages of video-based feedback were the “opportunity for improvement that would not otherwise occur,” “looking back and learning from [my] own progress”, and “identifying any areas of misunderstanding.”

Reported disadvantages of caregiver training included possible “misinterpretation of instructions” and “difficulty remembering the entire procedure.” The caregivers reported that disadvantages of the video-based feedback include feeling uncomfortable during video-evaluation and that it “Forces you to critique yourself; the good, bad, and ugly” a process which Sarah described as “Necessary yet cringe-worthy.”

Discussion

The purpose of this study was to determine the effectiveness of a BST with video-based feedback training program on caregiver implementation of adaptive skill interventions in the natural setting. Results indicate caregivers learned to implement strategies in the natural setting. Maintenance probes also indicated sustained behavioral change up to eight weeks post-intervention. Caregivers all reported that the BST with video-based feedback training program was effective and acceptable.

The primary purpose of this study was to evaluate the effects of the BST with video-based feedback on caregiver implementation of an adaptive skill intervention. The training program was associated with increased caregiver implementation of the teaching strategies in the natural environment. Specifically, caregivers reached the pre-set performance criterion in one to five training sessions. This highlights the utility of the training approach and is particularly

noteworthy as the coach did not have to be present in the natural environment. Instead, video-based feedback allowed the coach to provide feedback on caregiver implementation without being present in the natural setting. As this allows for BST to be provided all outside of the context of the natural environment, this training method may allow for greater flexibility in training options by allowing for delayed performance feedback rather than live performance feedback. This may also address the barrier of limited resources (e.g., expert time) as it limits expert travel. In addition, this training could also occur simultaneously when children are attending clinical sessions. These results support other research findings highlighting the utility of video-based feedback (e.g., Neely et al., 2016) and adds to the growing literature base identifying effective training strategies to facilitate caregiver training. In addition, although Star reported no formal training in behavior analytic procedures, she did reach the performance criterion in the fewest sessions. This might be in part because she had an older child who had attended behavioral therapy for multiple years. These results support previous research indicating that previous exposure may correlate to efficient training (Neely et al., 2018).

In addition to acquisition data, we collected maintenance data on caregiver implementation of the targeted skill following the initial intervention phase. All of the caregivers were able to maintain their behavioral change following the initial intervention above baseline levels. However, both Sarah and Diana needed additional training sessions to maintain their skills above the target criterion. These results confirm previous conclusions that strategies to program for maintenance are often necessary (e.g., Neely, Garcia, Bankston, & Green, 2018). In addition, these results highlights that, caregivers might need additional sessions at criteria to maintain following training. For example, Star had three sessions at criteria prior to intervention. Although her maintenance of skills could be attributed to her acquisition rate, it may also be the

supported by her three sessions at criteria prior to maintenance phase. Future researchers might investigate the intervention components necessary to promote sustained behavioral change.

The third purpose of this study was to evaluate the treatment acceptability of the training procedures as rated by the caregivers. To address the acceptability of the program, we evaluated the acceptability of the child treatment and the coaching procedures. Of particular interest are the results of the caregiver evaluation of the coaching procedures. Overall, the caregivers rated the training procedure as highly effective and acceptable. However, we did have one caregiver comment on the video-feedback and indicate it was “uncomfortable” yet necessary to watch herself on video. This may have been a novelty affect and perhaps ongoing use of video-based feedback may reduce the aversiveness of the procedure.

Limitations & Future Research

There are a number of limitations and directions for future research. First, this study focused solely on procedural fidelity or the extent to which the caregivers implemented the intervention as planned. However, there are other aspects of implementation fidelity not addressed by this study (e.g., dosage or quality of the intervention). Future research might extend the investigation of video-based feedback to evaluate the effects on these additional components.

Second, this study only presents the results of video-based feedback and does not provide any comparative analysis. Therefore, it is unknown if video-based feedback is as effective as the in-vivo feedback typically used in BST. Future research might evaluate the comparative effects of the video-based performance feedback versus in-vivo performance feedback on caregiver fidelity and caregiver ratings of the acceptability of the procedures. As one of the caregivers noted that she was uncomfortable seeing herself on video, future research might also evaluate how to pair the video-based feedback with reinforcement to reduce the aversiveness of the task.

Readers should also consider the results of the current study as only three caregiver-child dyads were included in the study. There is a need to extend research with additional families as well as for systematic study replication. Although the study showed positive results, the multiple probe design has the potential to overestimate the magnitude of the results, and, readers should interpret our results with caution. Also, because there are limited studies evaluating the impact of video-based feedback with BST, systematic replications of the intervention strategies with diverse families is essential to strengthen and build upon the results of the current study.

Another limitation was the use of a natural baseline (rather than a contrived baseline) and individualization of child adaptive skill. Ideally, all caregivers would have experienced the same baseline condition and intervened on the same child adaptive skill. The use of natural baseline and individualized child adaptive skills (although valid for the individual participant), may have weakened the overall experimental control. For example, because each caregiver worked on a different adaptive skill, the difficulty of the skill could have moderated caregiver acquisition rate. However, a strength of this approach is the demonstration of effects across three topographically different adaptive skills. Future research might consider replicating this study with a stronger experimental design.

In addition, for the purpose of this study, each caregiver was issued an iPad® to complete the in-home interventions. Outside of this study, families may not have access to the technology necessary to implement the interventions. Finally, training occurred in a tightly controlled research setting with individuals highly trained in ABA. The same results may not be replicable in a less controlled setting in which the therapist is less familiar with ABA or BST. In addition, the caregivers attended the session without their children. Although this may be feasible for families whose children already attend clinical settings, this may not be scalable for families that

cannot meet coaches in clinical settings or may require accommodations (e.g., childcare for siblings).

Conclusions

In summary, this research offers a promising and technologically relevant approach to caregiver training. Overall, results from this study showed all caregivers met the predetermined fidelity criterion and were able to maintain high rates of procedural fidelity through the follow-up phase. This indicates that caregiver training via BST with video-based feedback has the potential to be an effective method of preparing caregivers to implement interventions for their children with ASD.

Compliance with Ethical Standards

Conflict of interest: The authors report no conflict of interest.

Funding: There is no funding to report.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

References

- American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Washington, DC: American Psychiatric Association
- Bainbridge, N., & Smith Myles, B. (1999). The use of priming to introduce toilet training to a child with autism. *Focus on Autism and Other Developmental Disabilities*, 14(2), 106–109. <https://doi.org/10.1177/108835769901400206>
- Barton, E. E., & Fettig, A. (2013). caregiver-implemented interventions for young children with disabilities: A review of fidelity features. *Journal of Early Intervention*, 35(2), 194-219. <https://doi.org/10.1177/1053815113504625>
- Cavkaytar, A. & Pollard, E. (2009). Effectiveness of caregiver and therapist collaboration program (PTCP) for teaching self-care and domestic skills to individuals with autism. *Education and Training in Developmental Disabilities*, 44(3), 381-395.
- Chadwick, O., Cuddy, M., Kusel, Y., & Taylor, E. (2005). Handicaps and the development of skills between childhood and early adolescence in young people with severe intellectual disabilities. *Journal of Intellectual Disability Research*, 49, 877-888. <https://doi.org/10.1111/j.1365-2788.2005.00716.x>
- Christensen, D., Baio, J., Van Naarden Braun, K., Bilder, D., Charles, J., Constantino, J., ... Yeargin-Allsopp, M. (2016). Prevalence and characteristics of autism spectrum disorder among children aged 8 years--Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2012. *Morbidity and Mortality Weekly Report. Surveillance Summaries (Washington, D.C.: 2002)*, 65(3), 1–23.
- Crockett, J. L., Fleming, R. K., Doepke, K. J., & Stevens, J. S. (2007). Caregiver training: Acquisition and generalization of discrete trials teaching skills with caregivers of children

with autism. *Research in Developmental Disabilities*, 28(1), 23-36.

<https://doi.org/10.1016/j.ridd.2005.10.003>

Elder, J., Valcante, G., Yarandi, H., Whicte, D., & Elder, T. (2005). Evaluating in-home training for fathers of children with autism using single-subject experimentation and group analysis methods. *Nursing Research*, 54, 22-32.

Farley, M. A., McMahon, W. M., Fombonne, E., Jenson, W. R., Miller, J., Gardner, M., ...

Coon, H. (2009). Twenty-year outcome for individuals with autism and average or near-average cognitive abilities. *Autism Research*, 2, 109-118. <https://doi.org/10.1002/aur.69>

Goldstein, S., & Naglieri, J. A. (2009). ASRS: Autism Spectrum Rating Scales. Toronto, Ontario, Canada: Multi-Health Systems

Hall, H. R., & Graff, J. C. (2011). The relationships among adaptive behaviors of children with autism, family support, caregiving stress, and coping. *Issues in Comprehensive Pediatric Nursing*, 34, 4-25. <https://doi.org/10.3109/01460862.2011.555270>

Heitzman-Powell, L., Buzhardt, J., Rusinko, L., & Miller, T. (2014). Formative evaluation of an ABA outreach training program for caregivers of children with autism in remote areas. *Focus on Autism and Other Developmental Disabilities*, 29(1), 23–38. <https://doi.org/10.1177/1088357613504992>

Horner, R. D., & Baer, D. M. (1978). Multiple-probe technique: A variation of the multiple baseline. *Journal of Applied Behavior Analysis*, 11(1), 189–196. <https://doi.org/10.1901/jaba.1978.11-189>

Hsieh, H., Wilder, D., & Abellon, O. (2011). The effects of training on caregiver implementation of incidental teaching. *Journal of Applied Behavior Analysis*, 44(1), 199–203. <https://doi.org/10.1901/jaba.2011.44-199>

- Keller, C. L., Brady, M. P., & Taylor, R. L. (2005). Using self-evaluation to improve student teacher interns' use of specific praise. *Education and Training in Developmental Disabilities*, 40, 368-376. Retrieved from:
<http://daddcec.org/Publications/ETADDJournal.aspx>
- Kelley, M., Heffer, R., Gresham, F., & Elliott, S. (1989). Development of a modified treatment evaluation inventory. *Journal of Psychopathology and Behavioral Assessment*, 11(3), 235–247. <https://doi.org/10.1007/BF00960495>
- Koegel, R. L., Symon, J. B., & Kern Koegel, L. (2002). Caregiver education for families of children with autism living in geographically distant areas. *Journal of Positive Behavior Interventions*, 4(2), 88-103. doi:10.1177/109830070200400204
- Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2010). Single-case designs technical documentation.
http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf
- Laski, K. E., Charlop, M. H., & Schreibman, L. (1988). Training caregivers to use the natural language paradigm to increase their autistic children's speech. *Journal of Applied Behavior Analysis*, 21(4), 291-400. <https://doi.org/10.1901/jaba.1988.21-391>
- LeBlanc, L. A., Carr, J. E., Crossett, S. E., Bennett, C. M., & Detweiler, D. D. (2005). Intensive outpatient behavioral treatment of primary urinary incontinence of children with autism. *Focus on Autism and Other Developmental Disabilities*, 20(2), 98-105.
<https://doi.org/10.1177/10883576050200020601>
- Liss, M., Harel, B., Fein, D., Allen, D., Dunn, M., Feinstein, C., ... Rapin, I. (2001). Predictors and correlates of adaptive functioning in children with developmental disorders. *Journal*

of *Autism and Developmental Disorders*, 31, 219-230.

<https://doi.org/10.1023/A:1010707417274>

Lucyshyn, J. M., Albin, R. W., Horner, R. H., Mann, J. C., Mann, J. A., & Wadsworth, G.

(2007). Family implementation of positive behavior support for a child with autism:

Longitudinal, single-case, experimental, and descriptive replication and extension.

Journal of Positive Behavior Interventions, 9(3), 131-150.

<https://doi.org/10.1177/10983007070090030201>

Maffei-Almodovar, L. & Sturmey, P. (2018). Change agent training in behavior analytic

procedures for people with developmental and intellectual disabilities: A meta-analysis.

Review Journal of Autism and Developmental Disorders, 5, 129 – 141.

<https://doi.org/10.1007/s40489-018-0128-6>

Mazefsky, C., Williams, D., & Minshew, N. (2008). Variability in adaptive behavior in autism:

Evidence for the importance of family history. *Journal of Abnormal Child Psychology*

36(4), 591-599. <https://doi.org/10.1007/s10802-007-9202-8>

Miles, N., & Wilder, D. (2009). The effects of behavioral skills training on caregiver

implementation of guided compliance. *Journal of Applied Behavior Analysis*, 42(2), 405–

410. <https://doi.org/10.1901/jaba.2009.42-405>

Najdowski, A., Wallace, M., Reagon, K., Penrod, B., Higbee, T., & Tarbox, J. (2010). Utilizing a

home-based caregiver training approach in the treatment of food selectivity. *Behavioral*

Interventions, 25(2), 89-107. <https://doi.org/10.1002/bin.298>

Neely, L., Ganz, J., Davis, J., Boles, M., Hong, E., Ninci, J., & Gilliland, W. (2016).

Generalization and maintenance of functional living skills for individuals with Autism

- Spectrum Disorder: A review and meta-analysis. *Review Journal of Autism and Developmental Disorders*, 3(1), 37-47. <https://doi.org/10.1007/s40489-015-0064-7>
- Neely, L., Garcia, E., Bankston, B., & Green, A. (2018). Generalization and maintenance of functional communication training for individuals with developmental disabilities: A systematic and quality review. *Research in Developmental Disabilities*, 79, 116-129. <https://doi.org/10.1016/j.ridd.2018.02.002>
- Neely, L., Rispoli, M., Boles, M., Morin, K., Gregori, E., Ninci, J., & Hagan-Burke, S. (2018). Interventionist acquisition of incidental teaching using pyramidal training via telehealth. *Behavior Modification*, 43(5), 711-733. <https://doi.org/10.1177/0145445518781770>
- Neely, L., Rispoli, M., Gerow, S., & Hong, E. (2016). Preparing educators via telepractice to implement incidental teaching procedures for children with autism. *Journal of Behavioral Education*, 24, 393-416. <https://doi.org/10.1007/s10864-016-9250-7>
- Ninci, J., Neely, L., Hong, E., Boles, M., Gilliland, W., Ganz, J., ... Vannest, K. (2015). Meta-analysis of single-case research on teaching functional living skills to individuals with ASD. *Review Journal of Autism and Developmental Disorders*, 2(2), 184-198. <https://doi.org/10.1007/s40489-014-0046-1>
- Ozcan, N. & Cavkaytar, A. (2009). caregivers as teachers: Teaching caregivers how to teach toilet skills to their children with Autism and Mental Retardation. *Education and Training in Developmental Disabilities*, 44(2), 237-243.
- Parker, R. I., Vannest, K. J., Davis, J. L., & Sauber, S. B. (2011). Combining nonoverlap and trend for single-case research: Tau-U. *Behavior Therapy*, 42(2), 284-299. <https://doi.org/10.1016/j.beth.2010.08.006>

- Paul, R., Loomis, R., & Chawarska, K. (2014). Adaptive behavior in toddlers under two with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 44(2), 264-270. <https://doi.org/10.1007/s10803-011-1279-9>
- Pelphrey, K., Shultz, S., Hudac, C., & Vander Wyk, B. (2011). Research Review: Constraining heterogeneity: The social brain and its development in autism spectrum disorder. *Journal of Child Psychology and Psychiatry* 52(6), 631-644. <https://doi.org/10.1111/j.1469-7610.2010.02349.x>
- Peterson, C. A., Luze, G. J., Eshbaugh, E. M., Jeon, H.-J., & Kantz, K. R. (2007). Enhancing caregiver-child interactions through home visiting: Promising practice or unfulfilled promise? *Journal of Early Intervention*, 29(2), 119-140. <https://doi.org/10.1177/105381510702900205>
- Rojahn, J., Matson, J. L., Naglieri, J. A., & Mayville, E. (2004). Relationships between psychiatric conditions and behavior problems among adults with mental retardation. *American Journal on Mental Retardation*, 109(1), 21-33.
- Stahmer, A. C., & Pellecchia, M. (2015). Moving towards a more ecologically valid model of caregiver-implemented interventions in autism. *Autism*, 19(3), 259–261. <https://doi.org/10.1177/1362361314566739>
- Suess, A., Romani, P., Wacker, D., Dyson, S., Kuhle, J., Lee, J., ... Waldron, D. (2014). Evaluating the treatment fidelity of caregivers who conduct in-home functional communication training with coaching via telehealth. *Journal of Behavioral Education*, 23(1), 34–59. <https://doi.org/10.1007/s10864-013-9183-3>

Symon, J. B. (2001). Caregiver education for autism: Issues in providing service at a distance.

Journal of Positive Behavior Interventions, 3(3), 160-174.

<https://doi.org/10.1177/109830070100300304>

Symon, J. B. (2005). Expanding interventions for children with autism: caregivers as trainers.

Journal of Positive Behavior Interventions, 7(3), 159-173.

<https://doi.org/10.1177/10983007050070030501>

Vismara, L., McCormick, C., Young, G., Nadhan, A., & Monlux, K. (2013). Preliminary

findings of a telehealth approach to caregiver training in autism. *Journal of Autism and*

Developmental Disorders, 43(12), 2953–2969. [https://doi.org/10.1007/s10803-013-1841-](https://doi.org/10.1007/s10803-013-1841-8)

[8](https://doi.org/10.1007/s10803-013-1841-8)

Wacker, D. P., Lee, J. F., Padilla Dalmau, Y. C., Kopelman, T. G., Lindgren, S. D., Kuhle, J., &

Waldron, D. B. (2013). Conducting functional communication training via telehealth to

reduce the problem behavior of young children with autism. *Journal of Developmental*

and Physical Disabilities, 25, 35–48. <https://doi.org/10.1007/s10882-012-9314-0>

Wainer, A. L., & Ingersoll, B. R. (2014). Increasing access to an ASD imitation intervention via

a telehealth caregiver training program. *Journal of Autism and Developmental Disorders*,

45(12), 3877-3890. <https://doi.org/10.1007/s10803-014-2186-7>

Wright, M. R., Ellis, D. N., & Baxter, A. (2012). The effect of immediate or delayed video-based

teacher self-evaluation on Head Start teachers' use of praise. *Journal of Research in*

Childhood Education, 26(2), 187-198. <https://doi.org/10.1080/02568543.2012.657745>

Table 1.

Task Analyses

Step	Participant		
	Evan	Keller	Joe
1	Pick up toothbrush from counter	Grasp cup with both hands	Stand with both feet on the floor facing the first step
2	Bring toothbrush to position just in front of mouth	Lift cup off the table	Grasp rail with the hand on the rail side
3	Place toothbrush in mouth	Bring cup up in front of mouth	Step down a single step with right leg
4	Brush left side 3 seconds	Rotate cup to place spout of sippy cup into mouth	Bring left leg to position next to right leg
5	Brush right side 3 seconds	Tilt cup	Release rail and grasp rail next to the new step
6	Brush front 3 seconds	Drink at least three sips of water	Continue steps 2 – 5 until at bottom of stairs
7	Rinse Toothbrush	Bring cup down from mouth and place on table	Stand with both feet on the floor at bottom of the stairs
8	Place toothbrush on counter	Release hands from cup	Walk away from the stairs (no running)

Table 2.

Average number of steps in target skill independently completed by the child

Name	Baseline Mean	Baseline Range	Follow-up Mean	Follow-up Range
Evan	16.7%	0-25%	23.8%	0-75%
Keller	0.0%	0-0%	55.0%	55-55%
Joe	0.5%	0-5%	96.7 %	90-100%

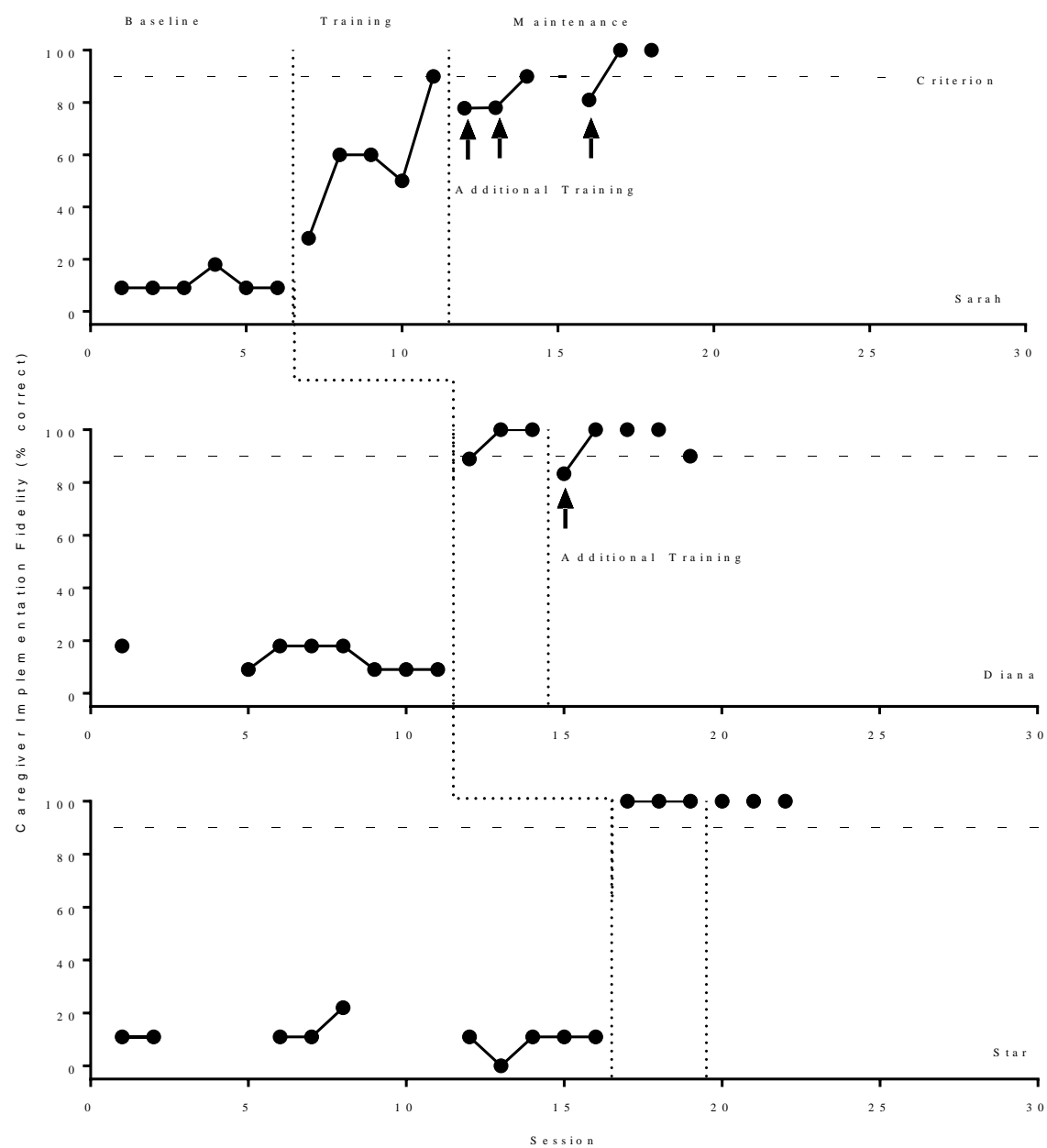


Figure 1. Caregiver fidelity of implementing adaptive skill intervention in natural setting as assessed via video-analysis

Appendix B

Researcher Developed Social Validity Questionnaire

Parent Training					
Directions: Please complete the following survey. There are no correct answers so please share your honest opinion.	Parent:				
	Date:				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Coaching Sessions					
The coaching sessions were helpful for learning the intervention strategies	5	4	3	2	1
I like the coaching sessions	5	4	3	2	1
I found the coaching sessions to be effective	5	4	3	2	1
The amount of coaching I received was sufficient for me to learn the intervention strategies	5	4	3	2	1
Video-based feedback					
The procedure was helpful for learning the intervention strategies	5	4	3	2	1
I like the procedure	5	4	3	2	1
The procedure was easy to use	5	4	3	2	1
I found the to be effective	5	4	3	2	1
I believe the procedure to be cost efficient training method (time, cost, etc.)	5	4	3	2	1
Coaches					
The coach was interested in me	5	4	3	2	1

The coach understood me	5	4	3	2	1
The coach understood my child	5	4	3	2	1
I found the coach to be effective	5	4	3	2	1
I liked meeting with the coach	5	4	3	2	1

Please respond to the following questions:

1. What do you think are the advantages of parent training within a clinic setting for parent implemented home interventions? Why?
2. What do you think are the disadvantages of parent training within a clinic setting for parent implemented home interventions? Why?
3. What do you think are the advantages of using video feedback? Why?
4. What do you think are the disadvantages of using video feedback? Why?

Reviewer Comments	Reply
Overall Formatting	
Revise to adhere to APA 7 guidelines	Revised manuscript formatting
Format according to Journal requirements – see journal quick guide	We reviewed the Journal Author Guidelines and revised the length of the abstract. However, we did not find a “quick guide”. We are happy to revise again if there are additional modifications needed.
Page 3, line 19: change the first parenthesis next to 2011 to a comma	Revised
Page 6, line 38: add an "s" to the first instance of caregiver	Revised
Page 10, line 16, Page 16, line 53, and Page 17, line 17: APA guidelines state that "since" should only refer to time (i.e., to mean "after"; "because" is more appropriate here)	Revised
Page 13, lines 24 and 31, Page 16, line 48 and Page 17, lines 14 and 41: APA guidelines state that the use of while should be limited to its temporal meaning (i.e., to link events occurring simultaneously; "although" is more appropriate here)	Revised
Page 11, line 9: add "a)" prior to verbal and written instructions	Revised
Page 13, line 7: change "5" to "five"	Revised
Page 15, line 43: change "caregiver C" to the pseudonym assigned to this participant	Revised
Page 15, line 49: change to "Neely et al., 2018" per APA guidelines	Revised
Page 16, line 4: change "caregiver A" and "caregiver B" to the pseudonyms assigned to these participants	Revised
Revise title to “Clinic-based behavioral skills training to teach caregivers adaptive skill interventions for children with autism”	We agree and have revised the title accordingly
Abstract & Introduction	
Abstract *Includes all relevant information	We revised the manuscript to be between 200-250 words per the guidelines.
Abstract: Fix keywords to align with APA. Perhaps add single-case as a keyword	We revised and added single-case to the keywords
Carefully think about organization and highlighting prior literature in the introduction	Thank you for the guidance. We have revised the introduction accordingly.

to paint the purpose for the study	
Carefully consider the literature on evaluating implementation fidelity beyond just procedural fidelity	We addressed this comment by adding a discussion regarding fidelity in the discussion.
A child level DV is not possible at this point (I do not think this is a deal breaker) but highlight WHY it is ultimately important to consider whether fidelity actually leads to a change in the DV of the child.	In a previous submission we were asked to remove the pre/post child data. We apologize as we did not add it back in for the submission to ANDI. However, we have added it back to this revised submission.
Add to the introduction: It is important to note however, significant variation among presentations of ASD, often dependent on the cognitive functioning level of the person. Lower cognitive functioning is associated with more significant impairments in adaptive functioning overall, while higher cognitive functioning is often associated with the sensory aspect of these impairments	We added the following to the introduction: “In particular, lower cognitive functioning is associated with more significant impairments in adaptive functioning overall.”
I'd consider finding other references to suggest caregivers can be effective interventionists. In Ninci et al. (2015) only 2 studies used parents (effects were strong). Plus, what was the IV the parents were providing? In Ninci et al.'s meta the IV was categorized as audio cuing, behavioral in vivo, visual cueing, or video modeling. Did the parents provide behavioral in vivo (this would align with your current study, correct?)?	Revised
(p. 4, second paragraph). It would be helpful to distinguish/highlight how the components of BST differ from other models used to increase natural change agents' usage of behavioral practices	We significantly revised the introduction. Given the revised introduction, the addition of comparison of models did not seem relevant in the new introduction.
line 52, p. 4 ("in change agent training") sounds a little wonky	We changed to “caregiver” training.
I suggest providing a more thorough review of video-analysis frameworks used in prior research and then articulate which framework was adapted for the current experiment. See work by Nagro....specifically Nagro & Cornelius (2013)	Reviewing the Nagro & Cornelius references, we concluded that video-analysis might be an inappropriate term to describe what we did. The video-analysis seems more consistent with self-management procedures. Rather, we utilized the video in order to provide context specific performance feedback within a behavioral skills

	training procedure. As such, we have revised throughout the manuscript. Hopefully this clarifies our procedures.
As I reach the "purpose of the study" paragraph on p. 6, I am left wondering what void your study is filling in the literature. More research on caregivers implementing in natural settings? What research has been done here (highlighting this in the lit review would be beneficial)? Is the types of DVs you are focused on? I suggest revisiting the outline and funnel to highlight what you are adding to the literature base.	We significantly revised the introduction to highlight the purpose of the paper was clinic-based training to train caregivers in adaptive skill interventions for the home environment. Hopefully the new introduction clarifies the purpose.
I enjoyed reading and reviewing this very interesting research study, although it would need some significant revisions for publication. My main concern is how the research is presented related to the actual purpose of the study: Was the point of the study to show that adding video analysis as the feedback method was an effective way to increase fidelity? Or was it to show that BST coaching could be done entirely in the clinic and still achieve treatment fidelity?	See comment above. We have significantly revised the introduction accordingly.
Research Questions. I suggest revising the Qs to be more explicit in what you are looking for. *Is there a functional relation between a training package consisting of BST with video analysis and an increased mean level of implementation fidelity of adaptive e skill interventions in natural settings by caregivers of children with ASD? *I am assuming RQ #2 is focused on social validity? Social validity is such a broad concept I'd suggest trying to make the language here more precise depending on what you were looking at.	We have revised the research questions
Method	
For each caregiver it would be helpful to know how long their child was attending the research-affiliated center and how much exposure the parents had to the ABA sessions. The way it reads parents never observed sessions, had no communication about ABA practices they might consider using at home.	We had substantially reduced the description of the caregivers and children based on previous feedback. However, we agree this information is pertinent. As such, we have added it back to the method section.

Just clarify this information because it most clinics parents communicate with the BCBAs/RBTs on how to continue support at home.	
Describe the children: Were the children all similar in terms of cognitive levels? Were they very limited cognitively, or were the limitations mild? How old were the children? Were there any psychiatric disorders, behavioral challenges or related issues? Is there any assessment of the child's level of adaptive functioning overall, such as a Vineland ABS? While the dependent variable is related to the parent's performance, knowing aspects of the children would indicate what each parent was challenged with.	We had substantially reduced the description of the caregivers and children based on previous feedback. However, we agree this information is pertinent. As such, we have added it back to the method section.
Give the focus of the study it would be helpful to describe each caregiver and child dyad. Provide some information about the children with ASD who participated in the study.	See comment above.
Please provide relevant demographic information on the children in the study (e.g., age, gender, functioning level, etc.).	See comment above.
How was the "setting" determined for each caregiver? Why was home or community selected?	We have added to the description of the participants that the caregivers chose the skill and the location as this was an adaptive skill that was meaningful for their family.
Include the social validity tool as an Appendix and discuss how it was developed	Added Appendix B (social validity questionnaire) and detail to the discussion of the measurement section.
For the TEI-SF, it is important to describe the reliability and validity of this scale at least in some cursory manner, rather than simply directing the reader to research	Added the following: "The TEI-SF demonstrates internal consistency ranging of .85 (Kelley et al., 1989)"
It is difficult to interpret the results of the social validity questionnaire without context. It would be very helpful to include the questionnaires as appendices. If this is not possible, then please provide information about the questions in the narrative of the manuscript.	Added as Appendix B.
Please provide the task analyses for each of the target adaptive skills in either a table or appendix.	Added
Remove section about coach	We did not remove this as this information is

	pertinent for replication.
Integrate settings and materials into the procedures	The placement of the “setting and materials” section is in line with most single-case research manuscripts. Therefore, we did not revise the placement.
Revise methods section to be organized accordingly: participants, measures, experimental phases and design/procedure (start with pre-assessment, consent, identification of the adaptive skill, and development of the task analysis, describe any training that occurred during this phase)	We moved the description of IOA and Fidelity to the end of the methods. We also added explicit statements regarding training to pre-assessment and baseline to clarify there was no training beyond providing the task analysis
The intervention section begins with an initial sentence that contains a lot of information and needs to be more fully explained. The reader is expecting to see how the participants were trained using 1) instruction and content teaching, 2) modeling, 3) behavioral rehearsal, and 4) feedback and video analysis for a package of choice – prompting – chaining - positive reinforcement - differential reinforcement. I would suggest describing specifically how the entire treatment package was first instructed, and the specific wording or format used. Currently, what is noted is only how to present preferred items using a paired choice assessment (??), when verbal and written instructions are needed for choice, prompting, chaining, and the remainder of the treatment package. Also, this section seems contrary to the second sentence in the “Dependent variable and data collection” paragraph. There is no information on least-to-most prompting, chaining or DR; only “steps completed correctly.”	<p>Thank you for pointing this out. In review of the methods, it appears our use of “e.g.” was the confusing aspect of this sentence. We clarified by repeating the steps of the intervention in the procedures for ease in reading:</p> <p>“The coach reviewed the written documents (caregiver fidelity rubric and task analysis) with the parent and provided verbal instruction on how to implement the behavioral intervention (i.e., preparing materials, providing a choice of preferred items prior to initiating a session, prompting using most-to-least prompting, chaining, delivery of verbal and tangible reinforcement, and implementing differential reinforcement)”.</p> <p>We also agree that we did not explicitly mention the modeling and role-play portion of the intervention. As such, we added the following to the intervention section:</p> <p>“The coach then modeled the intervention and role-played the intervention with the caregiver.”</p>
The authors need to then describe how the treatment package was modeled in similar detail, and how the behavioral rehearsal was done. It is unclear why the researchers moved on from the verbal instruction to viewing the baseline video which most likely reviews incorrect procedures. This is not a logical component of BST, and what needed to happen next was modeling of the complete	<p>We agree the way we described our procedures was confusing. We updated this entire section to clarify.</p> <p>We added to the results section the data regarding training times and length of the coaching sessions.</p>

<p>instructed treatment package. Some of this information is contained in this section; however, it needs to be clearly presented in step-by-step fashion, and fully explained. The measure of implementation fidelity is clear and helpful. It would be helpful to know how much of this training each of the participants needed for this initial training phase and for maintenance training phases, as the amount of coaching that each parent received varied widely from 7 minutes to 1.5 hours per week which is a very wide range. Was this solely dependent on parent performance? Were some parents more easily corrected than others? Was there any type of pattern to this learning and correction? And if a parent needs 30 minutes, three times per week consistently, is there any actual time savings over going to the home vs. video analysis?</p>	
<p>A revised Experimental Phases and Design/Procedure should be followed by an IOA and Treatment Integrity section (together to simplify is suggested), and then the results section.</p>	<p>We moved the IOA and treatment integrity section to the end of the methods section</p>
<p>Please include information related to dosage. How long was the initial training session with each caregiver? How long were the coaching sessions? How often were the coaching sessions held?</p>	<p>We added the following to the method section “The training sessions occurred one to three times a week” and added a section to the results section that provides the data regarding the coaching sessions.</p>
<p>Please specify the session lengths for each participant (i.e., the length of the videos they reviewed). If session lengths are different, please provide the mean and range for each participant.</p>	<p>We added this information to the results section.</p>
<p>In the method please specify the approach used to determine when participants entered intervention. Was a response guided framework used? Randomization procedures? Were fixed schedules used?</p>	<p>Added the following “The researchers utilized a response-guided approach to determine when each caregiver should move from baseline to intervention and from intervention to the maintenance phase.”</p>
<p>Please add information about subsequent training sessions. The first training is well described; however, I am assuming subsequent training sessions were different given that Page 7 states "the coach and caregiver independently and then</p>	<p>We substantially revised the method section.</p>

collaboratively reviewed videos." What did the independent review look like? Did caregivers use the checklist to rate their own behavior or did they just view the video? What happened if there were discrepancies between the caregiver's rating of herself and the coach's rating of her? Were role play and modeling a part of all coaching sessions or just the first one? Were all coaching sessions conducted in person?	
Results	
Comment: Why was the decision made to not collect data on the children? Fidelity of implementation is a useless construct IF it does not translate to improved outcomes for the child. I'd list this as a limitations.	We added back the child data.
For the results related to the Social Validity measures, the results from the researcher-developed tool should come first since that tool is described first earlier in the text. How the social validity tools are scored should go back in the measures section, not the results section. The titles of the sub-sections of the researcher-developed tool should match the earlier description in the "measures" section	Revised accordingly.
I am curious as to why the child participant data are not included. On page 12, the authors state "the coach provided the caregivers with the opportunity to review their own progress and their child's progress" which suggests that child data were collected. If possible, please add these data. If there is a reason why these data cannot be added to the manuscript, please provide a rationale for not reporting these data within the manuscript and discuss the need to collect these data in the future under a "future research" heading.	See above comment. We added back in the child data.
Are you against using effect sizes to quantify the magnitude of effect of the intervention? I'd suggest providing a file with the raw data as a supplemental file so your study can be included in future systematic reviews/meta-analysis.	We added the calculations for the effect size. "Effect sizes calculated using Tau-U (a non-parametric effect size well suited for single-case research; Parker, Vannest, Davis, & Sauber, 2010), resulted in an effect size of 1.0 for all participants." We originally didn't do this as it quite clear that the effect size using non-overlap effect size measures would be 1.0 just from a visual review of the graphs.

	Regarding the raw data, we are happy to provide our raw data as supplementary file. We just don't know how we are to store it in a repository (which is the question on the submission interface). To note, we have conducted numerous meta-analysis and rank-order or digitization of data are both feasible options for single-case meta-analysis.
Range is not necessary for Star as her mean is 100%.	Removed
Discussion	
I suggest putting in the limitations that the study did not adhere to some of the guidelines suggested for single-case designs (i.e., 3 concurrent baseline probes were not collected across cases at the beginning)	We utilized a multiple-probe design (not a multiple-baseline) to reduce the video burden on the caregivers. With a multiple-probe, there is not a need to collect concurrent baseline data points at the beginning.
In the discussion you mentioned "Sarah" and "Diana" required additional training during maintenance to reach criterion? Or did I misread that. If they did please reflect this additional training on the graph in Figure 1	Added
The discussion mostly restates the results without discussing the implications of these results. For example, why is it noteworthy that the coach did not have to be present in the natural environment? Why is it important that the caregiver with the least amount of formal training reached performance criterion the fastest? Why is it important that the caregivers were able to maintain behavioral change and how should readers interpret the need for two of the three caregivers to need additional training sessions in maintenance? What are the implications and significance of these findings for practitioners or other coaches attempting to train caregivers in video analysis procedures?	<p>We added the following to the discussion</p> <p>“As this allows for BST to be provided all outside of the context of the natural environment, this training method may allow for greater flexibility in training options by allowing for delayed performance feedback rather than live performance feedback. This may also address the barrier of limited resources (e.g., expert time) as it limits expert travel. In addition, this training could also occur simultaneously when children are attending clinical sessions.”</p> <p>“In addition, these results highlights that, caregivers might need additional sessions at criteria to maintain following training. For example, Star had three sessions at criteria prior to intervention. Although her maintenance of skills could be attributed to her acquisition rate, it may also be the supported by her three sessions at criteria prior to maintenance phase. Future researchers might investigate the intervention components necessary to promote</p>

	<p>sustained behavioral change.”</p> <p>Regarding caregiver previous experience, none of the caregivers had any training. However, the caregiver with the most exposure to ABA acquired the skills the quickest.</p> <p>We revised that section to read: “In addition, although Star reported no formal training in behavior analytic procedures, she did reach the performance criterion in the fewest sessions. This might be in part because she had an older child who had attended behavioral therapy for multiple years. These results support previous research indicating that previous exposure may correlate to efficient training (Neely et al., 2018).”</p>
<p>I would also like to see more discussion around the results of the social validity survey, particularly the caregivers' comments about the advantages and limitations of video analysis. One caregiver stated that the process of viewing herself of video was uncomfortable but necessary. Is it possible that the reason viewing her videos was uncomfortable is because it is something she hadn't done before? Perhaps with more exposure to video analysis, the process wouldn't have been so aversive? See Morin et al. (2019) for data to support these hypotheses with other caregivers and a discussion of similar findings.</p>	<p>We revised the discussion and added additional information regarding treatment acceptability survey. Morin et al. focused on video-analysis and was not applicable in the revised paragraph.</p>
<p>Add citation</p> <p>Morin, K., Vannest, K. J., Hong, E. R., Haas, A., Nagro, S. A., Ganz, J. B., & Lavadia, C. (2019). Using remote delivery to train parents in video analysis procedures. <i>Journal of Behavioral Education</i>. doi:10.1007/s10864-019-09361-6</p>	<p>We did not add this citation as we revised the manuscript to clarify we did not utilize video-analysis, rather, video-based performance feedback.</p>
<p>Lastly, it is important to discuss these results in relation to other research on traditional BST training (i.e., without the video analysis component). The one caregiver stated that viewing her video was necessary. Does prior research support this claim? I would bet that</p>	<p>We did not add this to the discussion as we removed the video-analysis component. The videos were used by the coach to provide performance feedback rather than “video-analysis”</p>

caregivers can make progress without the video analysis component to the training, but it probably isn't as effective. In other words, I am guessing it would take more sessions to reach criterion without the self-evaluation component, which would support the use of video analysis despite the aversiveness (for some participants) of watching oneself on video. Discussion around this topic is needed.	
I suggest adding a future research section and moving the last sentence on Page 16 to this section (i.e., "Also, since there are limited studies...").	We combined the limitations and future research section and revised the section
I'd suggest looking at some literature that conceptualized fidelity (see https://nam03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fedarxiv.org%2Fvhrp5%2F&data=02%7C01%7CFelicia.CastroVillarreal%40utsa.edu%7C6782f16206c94fb0c6ed08d78f935638%7C3a228dfbc64744cb88357b20617fc906%7C0%7C0%7C637135736076303461&sdata=FAbU334rGYX%2FdXIpCLAykZCe2dk0PIp9JnVO7VGqOyQ%3D&reserved=0) it is focused on academic outcomes but the literature review highlights why procedural fidelity is merely one aspect in evaluating fidelity. Because you focused specifically on procedural fidelity, I suggest revising language throughout manuscript to highlight this and then perhaps highlight future research should consider evaluating more aspects of fidelity.	We revised fidelity to procedural fidelity throughout the manuscript and added the following to the discussion.
Perhaps highlight future research should consider evaluating more aspects of fidelity beyond procedural fidelity	Added the following to the discussion: "First, this study focused solely on procedural fidelity or the extent to which the caregivers implemented the intervention as planned. However, there are other aspects of implementation fidelity not addressed by this study (e.g., dosage or quality of the intervention). Future research might extend the investigation of video-based feedback to evaluate the effects on these additional components."

RUNNING HEAD: BST WITH VIDEO-FEEDBACK

Clinic-based behavioral skills training to teach caregivers adaptive skill interventions for
children with autism

Leslie Neely¹, Felicia Castro-Villarreal¹, Ee Rea Hong², Kelly Ponce¹ & Stephanie Gerow³

¹The University of Texas at San Antonio

²Baekseok University, Republic of Korea

³Baylor University

Corresponding Author: Leslie Neely, Department of Educational Psychology, The University of
Texas at San Antonio, TX 78207, United States. Tel.: +1 210-458-2732.

Email address: leslie.neely@utsa.edu

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Dr. Leslie Neely, BCBA-D, is an Assistant Professor in the Department of Educational Psychology and Coordinator for the University of Texas at San Antonio Applied Behavior Analysis Program. Dr. Neely's research focuses on the application of behavior analysis to the functional assessment and treatment of challenging behavior for individuals with autism and developmental disabilities and evaluates ways to improve the acquisition and sustained use of evidence-based practices by parents, teachers, and other interventionists working with individuals with developmental disabilities.

Dr. Felicia Castro-Villarreal, LSSP, is an Associate Professor of School Psychology in the Department of Educational Psychology and Coordinator for the University of Texas at San Antonio School Psychology Program. Dr. Castro-Villarreal specializes and has research interests in multicultural assessment and practice and consultation with school staff

Dr. Ee Rea Hong, BCBA-D, is an Assistant Professor at Baekseok University in South Korea. Her research focuses on early childhood, communication and children with developmental disabilities. Dr. Hong also investigates interventions to prepare caregivers in evidence-based interventions for individuals with developmental disabilities.

Ms. Kelly Ponce, LSSP, is a School Psychologist in Texas. Ms. Ponce studied under Dr. Neely and Dr. Castro-Villarreal and graduated from the UTSA School Psychology Program.

Dr. Stephanie Gerow, BCBA-D, is an Assistant Professor at Baylor University in Texas. Dr. Gerow conducts research in developing, evaluating, and disseminating interventions for children with developmental disabilities. Her research interests include applied behavior analysis, challenging behavior interventions, and teaching natural change agents (e.g., parents, teachers) to implement interventions.