ABSTRACT

A COMPARISON OF IN-PERSON, VIDEOCONFERENCE, AND BUG-IN-EAR FEEDBACK ON TREATMENT INTEGRITY WITH EARLY INTERVENTION EMPLOYEES

The prevalence of autism has increased substantially over the past decade, bringing early intensive behavioral intervention (EIBI) services into greater demand for families living in both urban and rural areas. Currently there are not enough behavior analysts to oversee these interventions and as a result many behavior analysts must travel long distances to see clients. By providing employee feedback through telemedicine approaches such as bug-in-ear (BIE) and videoconference technology, behavior analysts can assist clients by remotely monitoring the behavior technicians implementing the intervention. Doing so can save time and that time can be used to assist more clients. The current study utilized a multi-element research design to evaluate the relative effectiveness of BIE, videoconference, and in-person feedback on increasing treatment integrity with behavior technicians working for an EIBI company. Results suggest that all three feedback delivery methods were comparable in improving performance. In addition, potential secondary effects of the stimuli present during the feedback methods (i.e., distractibility) were low, particularly during BIE conditions. Participants also reported that in-person and BIE feedback were the most acceptable and effective feedback methods. As such, BIE feedback may be more economically feasible, and logistically flexible alternative to in-person feedback.

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A COMPARISON OF IN-PERSON, VIDEOCONFERENCE, AND BUG-IN-EAR FEEDBACK ON TREATMENT INTEGRITY WITH EARLY INTERVENTION EMPLOYEES

by

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APPROVED
For the Department of Psychology

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CHAPTER 1: INTRODUCTION

According to estimates from the Centers for Disease Control and Prevention’s Autism and Developmental Disabilities Monitoring Network, about 1 in 68 children have been identified with an autism spectrum disorder (Centers for Disease Control and Prevention, n.d.) in the United States. The Surgeon General of the United States and the recent National Standards Project state one of the most evidence-based and empirically validated treatments for autism is an early intensive behavioral intervention program using the teaching techniques developed from the basic principles of behavior analysis (U.S. Department of Health and Human Services, 1999). Most companies providing these services employ Board Certified Behavior Analysts (BCBAs ™) to oversee the intervention and to monitor client acquisition (Behavior Analyst Certification Board, 2015). Companies also hire behavior technicians (BTs) to work one-on-one with clients. The BCBA supervises the BT and is responsible for the implementation of behavioral programs. This is achieved in part by providing performance feedback. When BCBAs provide feedback they can reinforce correct performance, which can increase the BT’s effective performance of work duties (Reid & Parsons, 2006). However, despite effective treatment and supervision, the lack of BCBAs remains a barrier to delivering early intervention services to all children with autism.

According to Jang et al. (2012) and the Behavior Analyst Certification Board (2015), there is currently a shortage of behavior analysts to provide services based on the current demand. This shortage of supply leads to the struggle of providing adequate supervision and many must travel long distances to oversee the implementation of programs (Hay-Hanson & Eldevik, 2013; Nepo, 2010).
Traveling to monitor each behavioral technician results in time lost between sites, especially for community-based programs, thus decreasing time for services to more clients (Nepo, 2010). For this reason, it is critical to identify efficient, effective, and widely accessible procedures for monitoring technicians.

One such option for monitoring behavioral services is telemedicine (also referred to as telehealth). The number of publications related to providing clinical oversight via telemedicine has increased significantly over the last decade (Barretto, Wacker, Harding, Lee, & Berg, 2006; Granpeesheh et al., 2010; Jang et al., 2012; Rousmaniere, Abbass, & Frederickson, 2014; Scheeler, McKinnon, & Stout, 2012; Vismara, McCormick, Young, Nadhan, & Monlux, 2013; Wacker et al., 2013). Telemedicine enables individuals to receive professional services and support from a distance via electronic communications. This includes a growing variety of applications and services using live two-way video streaming to communicate in real time with a health care provider, interacting with online multimedia platforms, email, smartphones, wireless tools, and other forms of telecommunication technologies (Machalicek et al., 2009; Vismara et al., 2013).

Telemedicine is widely used today in the field of medicine for surgical telementoring, trauma, and acute medicine, post-operative follow-up of patients, evaluations of patients, and health education (Augestad & Lindsetmo, 2009; Olson, Rusell, & White, 2001). It is also used for training and supervision in psychotherapy (Abbass et al., 2011; Fishkin, Fishkin, Leli, Katz, & Snyder, 2011), training and feedback sessions for counseling interns and medical students (Baum, 1976; Gallant, Thyer, & Bailey, 1991; Hunt, 1980), and for the observation of teachers utilizing specific teaching techniques (Goodman, Brady, Duffy, Scott, & Pollard, 2008; Ottley & Hanline, 2014; Thomson, Holberg, & Baer, 1978). In the field of ABA, telemedicine has been used to conduct functional analyses of
behavior (Barretto et al., 2006; Wacker et al., 2013), to increase parent knowledge in ABA principles and procedures (Heitzman-Powell, Buzhardt, Rusinko, & Miller, 2014; Vismara et al., 2013), and to conduct initial training of employees on the implementation of discrete trial training (Fisher et al., 2014; Hay-Hanson & Eldevik, 2013; Vismara, Young, Stahmer, Griffith, & Rogers, 2009).

Given the research, there is strong support for telemedicine’s potential as an efficient and effective way to provide feedback to behavior technicians. However, using telemedicine is a relatively new approach to delivering ongoing feedback on previously learned behaviors in early intervention treatment. Additionally, secondary effects on behavior as a result of providing performance feedback through telemedicine have not been directly measured. For example, reactivity or distraction as measured by participant eye gaze, pauses between trials, and attending to the technology rather than to the client have yet to be assessed. For these reasons, a systematic evaluation should be conducted to determine whether results regarding the effectiveness of telemedicine feedback in previous research (Scheeler & Lee, 2002; Scheeler, Macluckie, & Albright, 2010) holds true when compared to more commonly used, evidence-based delivery methods, such as in-person feedback (O'Reilly, Renzaglia, & Lee, 1994; Van Vonderen, 2004).

The purpose of this study was to compare the separate effects of in-person feedback, videoconference feedback, and bug-in-ear (BIE) feedback on treatment integrity with EIBI employees. In addition, secondary effects on behavior such as reactivity or distraction of the technician and client and length of sessions were examined.
CHAPTER 2: LITERATURE REVIEW

Feedback

Currently, there are multiple definitions for feedback in the behavior analytic literature (Houmanfar, 2013). For example, feedback has been defined as “descriptive information provided directly to a staff member about the quality or quantity of the staff persons’ past work performance” (Reid & Parsons, 2006, p. 71). It has also been described as “information transmitted back to the individual following a particular performance” (Sulzer-Azaroff & Mayer, 1991). The critical components of feedback, based on these and other commonly used definitions, include an individual, some type of performance by that individual, and verbal behavior by another person that is contingent on the performance. This verbal behavior serves as a summary of performance and includes suggestions for improvement and/or praise.

Feedback also includes multiple dimensions or characteristics, many of which have been evaluated in the literature (Alvero, Bucklin, & Austin, 2001; Balcazar, Shupert, Daniels, Mawhinney, & Hopkins, 1989). While there are many characteristics to feedback, such as frequency, quantity of individuals receiving feedback (i.e., individual or group), content, specificity, source, privacy, form, and immediacy, the relative effectiveness of each characteristic varies. According to a review of the literature conducted by Alvero et al. (2001) and additional research (Bechtel, McGee, Huijtema, & Dickinson, 2015; Goomas, 2012; Lee, Shon, & Oah, 2014; Scheeler et al., 2012; Williams & Geller, 2000), variations within the source, privacy, form, and immediacy are the most critical for providing effective feedback.
With respect to source, feedback is most effective when delivered by both a supervisor and researcher in combination, followed by either in isolation, other sources (such as peers), and a combination of sources (Alvero et al., 2001). The privacy of feedback refers to how widely feedback information is made available (Alvero et al., 2001). The combination of private plus public displays of written or graphic feedback is the most effective, followed by private, and then public displays, respectively (Alvero et al., 2001). Immediacy of feedback refers to how quickly the feedback is provided in relation to the performance it follows (Bechtel et al., 2015). The degree of immediacy, with respect to clinical feedback, is typically distinguished as either immediate or delayed. Multiple studies have demonstrated the effectiveness of immediate feedback when compared to delayed feedback (Krumhus & Malott, 1980; Scheeler & Lee, 2002; Scheeler et al., 2010).

Feedback form describes the means used to communicate the feedback information to the recipient. Forms of feedback most commonly used are verbal, written, graphic, and video (Reid & Parsons, 2006). While most of the literature described here refers to a person speaking aloud as verbal feedback, what is actually being discussed is vocal feedback. Skinner (1957) defined verbal behavior as a behavior reinforced through the mediation of another individual’s behavior. Therefore, any movement made by one individual that is capable of affecting another individual, could be considered verbal. Skinner defined vocal verbal behavior as complex muscular responses of vocal behavior that affect the verbal environment by producing audible speech. Therefore, for clarification purposes, verbal feedback will be referred to as vocal feedback for the remainder of this manuscript. When Alvero et al. (2001) reviewed forms of feedback separately, vocal, written, and graphic were all comparable in effectiveness. However, when they were combined, there was some differentiation. For
example, when one combines vocal and graphic feedback, it is more effective than graphic feedback alone.

Despite not being explicitly defined, nor included in prior reviews (e.g., Alvero et al., 2001), the method of feedback delivery has the potential to be another critical characteristic of feedback, in other words, how the supervisor conveys the information to the recipient. This can be done in-person, electronically, or through public posting. To illustrate, in-person feedback can be provided formally, such as calling a meeting to provide feedback, or more informally on the job, when passing the supervisee in a hallway. Electronic feedback can be transmitted via a Bluetooth device, video conferencing, computer application, e-mail, or text message. Lastly, public posting can involve a graph, note, checklist, or any other method that involves placing information in the view of others.

There is some literature supporting each type of feedback delivery method, but only limited research regarding their relative effectiveness. Even those studies that have made some systematic comparisons have methodological considerations that may limit the results (McDuffie et al., 2013; Pantermuehl & Lechago, 2015). The following literature represents in-person, videoconference, and bug-in-ear (BIE) feedback delivery methods. The effect on performance of each and the methodological shortcomings of the current research will be evaluated. In addition, the potential secondary effects on behavior of each delivery method, such as distracting the participant, will be discussed.

**In-person**

In-person feedback involves the face-to-face physical presence of both the deliverer and recipient of feedback. O’Reilly et al. (1994) used in-person vocal
feedback to increase the correct implementation of prompting and positive reinforcement procedures for two student teachers. An adapted within-subject alternating treatment design was used to examine the effects of feedback delay. One teacher received immediate feedback on reinforcement and delayed feedback on prompting while the second teacher received delayed feedback on reinforcement and immediate feedback on prompting. Immediate feedback was delivered following any incorrect steps completed during observations. Teachers also met with the supervisor immediately after the observation for an average of 5 minutes to discuss their performance. Delayed feedback occurred away from the practicum site and was provided one to three days after the observation.

Behaviors receiving immediate feedback improved rapidly for both participants. Behaviors receiving delayed feedback did show improvement but did not reach levels achieved with immediate feedback. The procedures targeted a new skill, and both were close to or at criterion responding up to five weeks later. These results demonstrate the effectiveness of immediate after-response and after-session in-person feedback on improving performance.

In a study conducted by Van Vonderen (2004), six trainers were provided with in-person immediate vocal feedback while teaching communicative gestures to individuals with intellectual disabilities. A nonconcurrent multiple baseline design across subjects was used to examine the effects of feedback on trainer accuracy in implementing programs. The supervisor, trainer, and trainee were all present in the room for sessions. During the intervention, immediate corrective feedback was delivered after each incorrect trial. The supervisor explained the mistake observed and provided suggestions for improvement. If the trial was performed correctly, no feedback was delivered. Trainers’ accuracy increased from an average of 55.8% during baseline to 88.2% during intervention. This
increase was maintained at a 9-week follow-up. The results of this study indicate that in-person immediate feedback is an effective intervention for increasing and maintaining accuracy in teaching communicative gestures. However, unlike O’Reilly et al. (1994), this study demonstrates the effectiveness of in-person feedback in increasing a pre-existing behavior as opposed to teaching a new behavior. As such, it controls for the influence of potential practice effects.

In the aforementioned studies by Van Vonderen (2004) and O’Reilly et al. (1994), vocal feedback was the only form used, potentially making this procedure quicker to implement than an intervention package that includes graphic and/or written feedback, which can have an inherent delay. In a more explicit comparison of form, Arco (1997) used a multiple-baseline-across-participants design to examine whether in-person vocal feedback used alone would be just as effective as a treatment package including in-person vocal, written, and graphic feedback. Seven in-home EIBI instructors working with children with autism served as participants. The feedback provider collected data on vocal instruction, prompting, and the delivery of consequences. Feedback was delivered immediately during observations, but the range of time between response and feedback was not clarified. The feedback provider was physically present in the room and visible to both the instructor and child during both studies. In study one, instructor behavior was vocally reinforced immediately after each correct trial, and received immediate corrective feedback after any steps were missed. Following each series of trials (three total), instructors received a score sheet that assessed the instructor’s and the child’s performance. Instructors were then asked to graphically chart the child’s scores on a pre-designed rubric. This combination of vocal, written, and graphic performance feedback increased and stabilized accuracy of all target behaviors. In the second study, three new instructors were
used. Methods were the same except only immediate in-person vocal corrective feedback and praise were delivered. Results showed that vocal feedback alone was as effective as the previous combination of forms in improving instructor’s performance. This study suggests that feedback delivered during supervision can be done effectively in-person and vocally without the need for written score sheets or graphic feedback depicting client percentages correct.

The aforementioned literature demonstrates the efficacy of immediate, vocal, in-person feedback at improving new and previously learned skills. This makes in-person feedback an ideal delivery method by which to compare the effectiveness of feedback delivered via videoconferencing or BIE.

**Videoconference Feedback**

Delivering feedback via videoconference allows two or more individuals to simultaneously communicate using two-way video and audio transmissions (Machalicek et al., 2009). Studies using videoconference technology typically use desktop computers, laptops, tablet devices, video cameras and/or speakers for two-way communication between the participant and the researcher. Once the equipment is set up, a call is placed for observations to begin from a geographical distance. The following is research within behavior analysis that demonstrates the utility of feedback delivered via videoconference technology.

McDuffie et al. (2013) examined the effects of combining in-person parent education and feedback with feedback delivered through videoconference technology. Participants were eight parents seeking to increase their vocal responsiveness during interactions with their children. Researchers utilized a quasi-experimental design with a series of A-B replications to assess on-site and distance feedback. Parents were provided with four in-person parent education
lessons, once per month. Each lesson was immediately followed by an in-person vocal feedback session. While together in a room, the interventionist observed the mother, demonstrated strategy use with the child, and provided opportunities for practice with immediate vocal feedback. After each in-person session, three weekly videoconference feedback sessions were conducted. Parents positioned a laptop such that the clinician could observe the session but also allowed the parent and child to see the clinician. The clinician then provided feedback via the laptop. Results indicated that, on average, parents used the targeted techniques as frequently during the videoconference sessions as they did during the in-person sessions. However, due to the nature of the experimental design and how the two feedback methods were combined, it is difficult to determine the relative effectiveness of each.

In contrast, Machalicek et al. (2010) evaluated just the effectiveness of vocal feedback delivered via videoconference on teacher acquisition and maintenance of functional analysis procedures. A multiple baseline across student-teacher dyads with embedded multi-element designs was used. Before baseline was collected, teachers were provided with written instructions on how to run a functional analysis. Videoconference technology was then set up and used to record data in the teachers’ classroom. Other students and teachers were able to hear the researcher but only the targeted teacher and student could hear and see the researcher. After baseline observations, supervisors provided vocal performance feedback using the videoconference technology. Immediate corrective feedback was delivered after any incomplete or incorrect target response during the functional analysis. Immediate praise was delivered following any correct target response during the functional analysis. Teachers reached the pre-determined
criteria (100% accuracy) for each condition within 19, 5-minute sessions, averaging a total of 75 minutes per teacher.

In a similar study by Machalicek et al. (2009), identical videoconference and feedback procedures were used to assist teachers in learning how to run a preference assessment. All three student teachers implemented the paired-choice assessment protocol with 100% accuracy within 2 hours, over a 2-day period. Taken together, these studies demonstrate the effectiveness of utilizing videoconferencing as a method for feedback delivery. However, it should be noted that these studies were conducted in combination with other methods (McDuffie et al., 2013) or in isolation (Machalicek et al., 2009, 2010) and, as such, did not compare the effectiveness of videoconferencing to other methods.

In contrast, Pantermuehl and Lechago (2015) compared the separate effects of no feedback, in-person feedback, and videoconference feedback on treatment integrity in therapists working in an ABA clinic with children diagnosed with autism. A multiple baseline across student-therapist dyads with embedded multi-element designs was used to examine these effects. Before baseline data were taken, therapists were trained on an error-correction procedure until they met the mastery criterion of 100% correct implementation. During baseline, and the no feedback condition, data were taken secretly using videos of the sessions. Additionally, the supervisor observed the therapist by walking in and around their work area but did not provide feedback. During the in-person feedback condition, the supervisor entered the cubicle where therapy was taking place, notified the therapist of the observation, and then took data for 15 minutes. The supervisor was in clear view of the therapist and child. Supervisors interrupted the procedure and provided immediate vocal corrective feedback for any steps implemented incorrectly and praise was delivered for each error-correction procedure.
implemented correctly. During the videoconference condition, the supervisor observed using the Skype program on a laptop along with a webcam. Only the researcher’s face was visible to both the therapist and child. These observations were conducted from either a building next door or a city 45 miles away. Feedback was delivered procedurally just as described for in-person observations.

Results of the study by Pantermuehl and Lechago (2015) demonstrate that feedback delivered in-person and through videoconference have comparable effects on performance. All therapists reached mastery criterion and produced higher levels of treatment integrity while receiving feedback when compared to the no feedback condition. Overall, the videoconference literature demonstrates the efficacy of this delivery method. However, given some of the methodological considerations, more research is needed.

**Bug-in-Ear Feedback**

The use of wireless technology through an earpiece has been referred to in the literature as bug-in-ear (BIE) (Scheeler et al., 2012). BIE is a small, wireless, one or two-way communication instrument that allows the coach to communicate with the individual receiving feedback (Ottley & Hanline, 2014). The only required materials are a communication system, an earpiece, and a microphone. Similar to videoconferencing, this technology allows feedback to be delivered from a geographical distance. The following is research within behavior analysis that demonstrates the utility of feedback delivered via BIE technology.

Ottley and Hanline (2014) examined the effects of BIE feedback on the frequency of teachers’ correct use of targeted communication strategies, such as offering choices and modeling language. Four multiple-baseline single-case intervention design experiments were completed. After receiving training on three
communication strategies, teachers received immediate vocal feedback via BIE technology. More specifically, the teachers were vocally prompted to use a communication strategy and given positive praise contingent on correct implementation. During the feedback condition, the researcher remained in the classroom and stood behind a bookcase that came up to their waist. All teachers demonstrated improved implementation of at least one strategy. These results suggest that feedback delivered through BIE technology may increase the correct use of communication strategies by schoolteachers. However, the physical presence of the researcher may have contributed to the results. More specifically, it is possible that teachers were responding to facial expressions and other body language in addition to the vocal stimulus delivered via BIE. Similarly, in a study by Goodman et al. (2008), BIE feedback was delivered to teachers while the researcher sat approximately 5 to 15 feet away. While improvement in the accurate use of learn units (LU) was demonstrated, again, the influence of the researcher was not accounted for.

Using a more discrete method, Oliver and Brady (2014) delivered feedback via BIE while out of the view of the receiver but while still in the same vicinity. A multiple baseline across mother-child dyads was used to assess the effects of using BIE vocal feedback to increase effective prompts and praise delivered by three mothers of children with autism. Researchers instructed the mothers to use a least-to-most intrusive prompt hierarchy and to always deliver praise for accurate child performance. The target behaviors were selected because they were existing skills that needed improvement. A researcher delivered feedback while observing the families in their home but while out of the view of the mother and child. Their exact location within the house and strategy used to remain unseen were not described. Feedback was delivered using a one-way communication system,
microphone, and ear bud. Using the BIE technology, parents were prompted before target responses and praised immediately after the correct implementation of target responses. After receiving immediate vocal feedback, mothers accurately delivered least-to-most intrusive prompts and showed an increase in praise for accurate performance. This study limits the influence of the researcher’s presence by removing that stimulus from sight. However, it is unknown how much the presence of the researcher in the home may have contributed to the results.

McKinney and Vasquez (2014) also provided vocal BIE feedback while in the same physical location, but from behind a two-way mirror. The research participants were three undergraduate students learning how to implement discrete trial teaching (DTT). A multiple baseline across participants design was used to examine the effectiveness of this delivery method. Before the baseline phase, students received a one-page, self-instruction manual on DTT. During baseline, they ran trials with a confederate, while researchers observed through a two-way mirror. The researcher had a clear view of both the student and confederate, but the student and confederate could not see the researcher. During the intervention phase, the researcher observed the student-confederate pairs and provided immediate vocal scripted feedback via the BIE technology. Intermittent encouraging feedback was provided for correct implementation of DTT, and concise instructional feedback was provided for incorrect implementation of DTT. Researchers did not specify whether feedback was delivered after a response, or the entire trial. Results indicated a noticeable change (31% mean increase) between baseline and treatment for all three participants.

Scheeler et al. (2012) also demonstrated the effectiveness of vocal feedback delivered through BIE technology by increasing the number of three-term contingency (TTC) trials completed by student teachers. During baseline, the
teachers wore an inactivated Bluetooth device and were observed by researchers through a laptop web camera. Neither the researcher nor the child could see one another. Teachers received delayed, corrective and positive praise feedback, 5 to 15 minutes after observed sessions. During the intervention phase, the researcher could see and hear the teacher but the teacher could only hear the researcher. Teachers received immediate (0-3 seconds after target response occurred) vocal corrective or positive praise feedback after each response. All five participants reached criterion (90% completion of TTC) within four sessions of the intervention phase. The importance of this study is that it demonstrated the effectiveness of BIE feedback delivered from a different geographical area. This is in contrast to the other BIE studies cited where the researchers were visibly present in the room, or not visible but still on the premises (e.g., behind a wall or mirror).

In summary, the aforementioned literature has demonstrated that feedback delivered in-person, through videoconference, and via BIE all improve performance. However, with the exception of Pantermuehl and Lechago (2015) that compared in-person and videoconference feedback delivery, there has been no evaluation of their relative effectiveness. There is also no discussion in the literature regarding the effect on behavior of stimuli inherent to each delivery method. For example, a visual stimulus (e.g., facial expression) combined with an auditory stimulus (e.g., vocal) is different than just a vocal stimulus. This is particularly problematic in the BIE studies where the researcher was physically present and visible to the participants (e.g., O’Reilly et al., 1994; Van Vonderen, 2004). Beyond the performance directly targeted by the feedback, there may also be other behaviors influenced by these stimuli that warrant discussion.
Secondary Effects of Feedback

There are additional behavioral effects that should be examined due to the different stimuli present for each delivery method. During the in-person method, auditory and visual stimuli are present in conjunction with the physical presence of the observer. This includes body language, facial expressions, and tone of voice. Videoconference feedback includes similar stimuli: both deliver auditory and visual stimuli of the observer or person delivering feedback. However, the stimuli in videoconference are seen and heard through technology, and the visual stimulus is typically just the face of the individual. In contrast to the in-person and videoconference methods, BIE involves only an auditory stimulus. In addition, the participant is the only one to hear the feedback, versus videoconference and in-person feedback, where the client can hear the feedback as well.

Each of these differences in stimuli may have additional effects on behavior beyond performance. Specifically, these stimuli may serve to distract the participant and/or the client during sessions. For example, a behavior technician may spend an excessive amount of time attending to the observer, which could take time away from programming. However, this distraction or reactivity may decrease if feedback is delivered via BIE and there is no visual stimulus of the observer. The potential these stimuli have for distracting the participant or client could also vary based on the individual’s history with electronic communication. For example, the videoconference method may be more distracting than in-person if the individual is uncomfortable with technology. Alternatively, because the visual stimulus is more limited with the videoconference technology, and nonexistent with BIE, it may serve as less of a distraction. Indeed, since BIE is the delivery method with the least amount of stimuli present, assuming the
observer is not visible, BIE feedback may evoke the least amount of secondary effects.

The participant or client being distracted by the feedback delivery method is particularly relevant as it affects performance. If an individual is attending to the visual or auditory stimulus, this may delay responding on a task and impact the length of a session. This is particularly relevant if feedback is delivered immediately following a response rather than after a session. Immediacy is an extremely important characteristic of feedback, and yet the term has a high degree of imprecision when it comes to the description of time delays within the literature (Arco, 1997; O’Reilly et al., 1994; Van Vonderen, 2004). However, there is research that suggests feedback delivered within 3 seconds of the target response is more effective than feedback delivered within minutes of the observation, or one to three days later (O’Reilly et al., 1994; Scheeler & Lee, 2002; Scheeler et al., 2010, 2012). The current study used immediate feedback (within 3 seconds of the target response) across all feedback delivery methods.

The visual and auditory stimuli that are present for each of the delivery methods may have additional, unintended influence on behavior. Therefore it is important to balance the benefits of each delivery method with these potential secondary effects. In other words, if accuracy is increased by all delivery methods, the delivery method that participants and clients find the least distracting (as measured by increases in session length) and are most comfortable with (as measured by social validity questionnaire) should be implemented. As such, the current study not only compared the effects of in-person, videoconference, and BIE feedback on performance, but it also measured the secondary effects of each method via distracted behaviors by the participant and client, session length, and the social validity of each delivery method.
CHAPTER 3: METHODS

Participants

Nine adults working as behavior technicians for a local early intervention provider participated in the study. Experience with the company and the implementation of discrete trial training ranged from 2 months to 2.5 years. Mean experience for all participants was 1 year and 9 months. The early intervention company provides in-home, behavior analytic services to treat children with an Autism Spectrum Disorder (ASD) diagnosis. In their role with the company, the research participants provide one-on-one intensive therapy for these children. To qualify for the study, participants needed to be at least 18 years of age and additional inclusion criteria included (a) completion of all new hire training conducted by the company’s BCBA™, (b) availability for feedback delivery at least twice per week, and (c) the need for feedback on discrete trial teaching. The need for additional training was determined prior to the study. The researcher directly observed the potential participants as they worked with their client and scored their performance. A score of 70% or lower was required to qualify for the study.

The Institutional Review Board (IRB) completed a review of the study in order to protect the rights and health of the participants and clients. Once completed, all participants (see Appendix A) and guardian of each client (see Appendix B) signed an Informed Consent Form approved by the IRB.

Setting

All sessions were conducted in each client’s home, consistent with where therapy sessions were usually held (bedroom, dining room, etc). The rooms used for this study varied in size and location within the home. Depending on the
experimental condition, data collection observations took place either in the home of the client or from a remote location 9 to 31 miles away via HIPAA-compliant data transmission software.

**Telemedicine Equipment**

Sessions for videoconference and BIE feedback used (a) a 2.4 GHz Macbook™ laptop computer with a built-in camera and microphone which was located at the researchers office, (b) Ellipsis™ 8 tablets with built-in camera and microphone located in the room where therapy took place, (c) Jabra™ Bluetooth wireless headsets, which were worn by the participants during the BIE feedback sessions only, and (d) LG™ Cosmos 3 cellular phones. VSee® videoconference software was used on both the laptop and tablets. This software was selected because it complies with HIPAA privacy and security rules (Vsee Video Conferencing, 2016). The confidentiality of data transmission and recordings was secured through a subscription to VSee® with 256-bit AES encryption.

**Independent Variables**

The primary independent variable was the delivery method of the feedback. This study compared in-person feedback, videoconference feedback, and BIE feedback. The in-person feedback included face-to-face spoken interaction. Videoconference feedback included virtual face-to-face spoken interaction through the tablet. The BIE feedback included audio spoken interaction through a wireless earpiece. Vocal (spoken) feedback was selected as the feedback form because, while being well-established in the literature as an effective form of feedback as previously noted, it is also the only form that may be used across all three delivery methods.
Dependent Variables

The primary dependent variable was discrete trial performance as measured through a modified version of the Discrete-Trials Teaching Evaluation Form (DTTEF). This evaluation form is a tool to assess an instructor’s performance while conducting discrete trial teaching (Babel, Martin, Fazzio, Arnal, & Thomson, 2008). For the purposes of this study, the modified version was divided into three checklists: checklist 1, checklist 2, and checklist 3 (see Appendix C). There are 18 target behaviors within the three checklists, with six target behaviors in checklist 1, six in checklist 2, and six in checklist 3.

Correct implementation of a target behavior within each checklist was measured as successfully completing the target behavior in its entirety per its definition. Operational definitions of each target behavior were obtained through training material currently used by the early intervention provider (see Appendix D). If any step within a target behavior was missed or not completed as defined, that target behavior was counted as incorrect. Correct implementation of the discrete trial target behavior was calculated as a percentage by dividing the number of target behaviors completed correctly by the total number of target behaviors observed for each checklist. These data were then recorded in the upper right hand corner of each checklist.

In addition to discrete trial performance, the secondary effects of the intervention on both the participant and client’s behavior were measured. These secondary effects included distraction by the feedback delivery method, length of time to complete a checklist, and client tantrum behaviors. Regarding distraction, frequency data were collected whenever the participant or client looked in the direction of the researcher, tablet, and/or when either of the two refrained from any bodily movement (pauses) for at least 3 seconds while feedback was being
delivered or within 3 seconds after feedback was delivered. One possible outcome of increased distraction was an increase in the time it took to complete a checklist. As such, all discrete sessions were timed and duration recorded.

**Experimental Design**

A multi-element design was used to determine the effects of the three different feedback delivery methods on accuracy of discrete trial procedures. The design included a baseline (A) and a feedback phase which incorporated the different delivery methods (B).

As mentioned previously, three checklists derived from a modified version of the DTTEF were utilized. All three checklists were implemented concurrently, but independently, under the three different delivery methods. More specifically, each checklist (and the associated behaviors) were paired with a type of feedback delivery. These feedback-checklist pairings were then counterbalanced across participants. Three of the participants received in-person feedback on checklist 1, videoconference feedback on checklist 2, and BIE feedback on checklist 3. Another three participants received videoconference feedback on checklist 1, BIE feedback on checklist 2, and in-person feedback on checklist 3. The last three participants received BIE feedback on checklist 1, in-person feedback on checklist 2, and videoconference feedback on checklist 3.

**Procedures**

**Pretraining**

Prior to baseline, each participant was trained in using the technology. Training took place at the main office of the early intervention program. Participants were taught how to turn equipment on and off and how to adjust all
parts of the equipment. They were also shown how to wear the Bluetooth device and how to login and maneuver through the VSee® program. Baseline began once participants demonstrated, without error, that they were able to utilize the equipment proficiently.

**General Procedures**

Each participant was observed with only one of their clients during the course of the study. This was to control for potential variations in the difficulty of implementing behavioral program procedures across clients.

The setup of the electronic devices was identical for all experimental conditions. A tablet was placed in a location where the researcher could view the entire work area. The location of the devices ranged from 2 to 5 feet from the work area based on different work space sizes. Observations began once all equipment was working properly and data were collected by the researcher using a pen and the modified DTTEF checklists. Observations were conducted throughout the day and lasted between 3.31-13.29 minutes. All sessions were recorded using the laptop and tablet.

**Baseline**

Feedback was not delivered during baseline observations. Baseline data were collected by the researcher three times in-person, three times through videoconference, and three times through BIE in semi-random order. An observation was considered complete when all procedures included in the checklist were observed.
Feedback Conditions

Participants received feedback using each delivery method at least three times. The order in which the delivery methods were presented was semi-randomized. The order was established via a drawing, with the condition that the same delivery method was presented no more than twice consecutively.

Feedback was delivered immediately (within 3 seconds) after a target behavior. Providing feedback within 3 seconds of a behavior has been demonstrated in the research to be more effective than after session feedback (Scheeler & Lee, 2002; Scheeler et al., 2010, 2012). Similarly, though the aforementioned literature does not give a precise time between response and feedback, there is substantial research on delivering feedback during the observation and interrupting the session as soon as an incorrect step is identified (Arco, 1997; Machalicek et al., 2009, 2010; McDuffie et al., 2013; O’Reilly et al., 1994; Van Vonderen, 2004).

If a target behavior was incorrect, the researcher would immediately provide corrective feedback. Positive praise was also delivered immediately after any correct target behavior. The feedback was scripted to guarantee each participant received the same praise and corrective feedback comments (see Appendix E). However, comments were specific to the behavior when corrective feedback was delivered and general when praise was delivered.

In order to remain consistent across all three feedback delivery methods, the participant set up the tablet before every observation. Also, modeling of correct behavior was not provided nor was any other physical contact or movement that would assist in training. However, the participant was allowed to ask questions anytime during the session.
In-person feedback. During in-person feedback, the researcher was seated no more than 2 feet away from the tablet. The researcher and tablet were facing the same direction. The researcher directed the participant to begin once connection was made through the software and the participant’s work area was in clear view. The researcher sat approximately 3 to 5 feet from the participant while observing, delivering feedback and collecting data. In this condition, the physical presence, body language, and facial expressions of the researcher were in view of the participant and client. The vocal feedback delivered by the researcher was audible to anyone within the work area. Once all target behaviors within the checklist were observed, the researcher would state, “thank you,” turn off the video camera, and leave the work area.

Videoconference feedback. When the participant was scheduled to receive videoconference feedback, they would initiate a call to the researcher using the tablet. Once a connection was established and the participant’s work area was in clear view, the researcher directed the participant to begin. While delivering feedback, the researcher’s face and facial expressions were visible to the participant and client through the tablet. During this time, anyone within the work area could potentially hear the feedback delivered by the researcher. The participant and the researcher communicated vocally through the laptop and tablet microphones. Once all target behaviors within the checklist were observed, the researcher said, “thank you,” and ended the call. The researcher was always located at a distance of at least 5 miles from the participant and client.

Bug-in-ear (BIE) feedback. During BIE feedback observations, participants initiated a call to the researcher using the tablet. Once the connection was established and the participants work area was in clear view, the participant
initiated a phone call to the researcher. After being connected, the researcher directed the participant to begin. The researcher was not visible during this condition and only the participant could hear the feedback. Once all target behaviors within the checklist were observed, the researcher stated, “thank you,” and ended the call. The researcher was always located at a distance of at least 5 miles from the participant and client.

**Interobserver Agreement**

All sessions were video recorded and 35% were randomly selected for analysis by a research assistant. The research assistant was trained on all target behaviors within the checklists and was able to verbally define and demonstrate them in a mock scenario. A score of 90% or better was required prior to conducting any analyses. The research assistant collected interobserver agreement (IOA) data by counting the number of correct procedures completed by the participant on a copy of the same checklists used by the researcher. They also collected IOA data on the secondary effects of the feedback delivery method. IOA was calculated on the checklist scores by dividing the number of target behaviors in agreement by the total number of target behaviors on each checklist and multiplying by 100. IOA was collected on the distraction measure by dividing the smaller count of the two observers’ scores by the larger count and multiplying by 100.

**Treatment Integrity**

To ensure proper implementation of the intervention, data were collected on correct implementation of the different feedback delivery methods. For approximately 35% of the video recorded sessions, the trained research assistant gathered data on the positive praise comments and corrective feedback comments delivered by the researcher within each session. Comments had to be from the
scripted feedback list and provided within 3 seconds of the incorrect or correct response, and for praise comments, be delivered at the frequency previously specified.

Social Validity
In the current study, a social validity questionnaire was given to the participants at the beginning, middle, and end of the study (see Appendix F). There were four, Likert-scale questions and two open-ended questions on the questionnaire. The questions addressed acceptability, comfort level, distractibility, and preference amongst the feedback delivery methods.
CHAPTER 4: RESULTS

Performance

In-person Feedback

Delivery of in-person feedback produced a noticeable difference in performance for five out of nine participants (A, E, F, H and I). For participants A, F, and I baseline levels of performance were somewhat variable, though higher levels of responding and stabilization were observed upon the introduction of in-person feedback (see Figure 1, Figure 6, and Figure 9). Participants E and H (see Figure 5 and Figure 8), however, had more stable responding during baseline before increasing contingent on feedback delivery. In contrast, performance by participants C, D, and G showed an upward trend during baseline (see Figure 3, Figure 4, and Figure 7). Similarly, participant B showed variable responding with a high data point before the introduction of feedback (see Figure 2). While performance by participants B, C, D and G showed some increase in level and stability contingent on feedback delivery, there was still some variability and an increasing trend continued from baseline.

Videoconference Feedback

With respect to videoconference feedback, the intervention appeared to improve performance for six of the nine participants. Participants E, F, and I had relatively stable performance during baseline (see Figure 5, Figure 6, and Figure 9). Following the introduction of feedback, participants E and F showed an increase in levels of the target behavior and participant I exhibited an increasing trend. In contrast, performance was variable for participants A, B, G, and H during baseline. Specifically, participants B and G had one high data point mid-
baseline (see Figure 2 and Figure 7), and participants A and H had high data points at the end of baseline (see Figure 1 and Figure 8). It is worth noting that despite some initial variability, the introduction of videoconference feedback resulted in stabilization and increased levels of performance for participants A, B, and G. Performance by participant H (see Figure 8) also improved and stabilized following baseline, but the last data point in baseline may indicate an increasing trend. Participants C and D demonstrated an upward trend in baseline prior to intervention (see Figure 3 and Figure 4). Similarly, while performance improved for participants C and D following the intervention, the increasing trend from baseline may indicate an alternative explanation for the results.

**Bug-in-Ear Feedback**

Participants B, G, H, and I showed some variability in performance during BIE baseline observations (see Figure 2, Figure 7, Figure 8, and Figure 9). In contrast, participants E and F exhibited stable, or decreasing trends during baseline (see Figure 5 and Figure 6). After the introduction of BIE feedback, performance stabilized and levels increased for all six of these participants. For participant A, however, variability in baseline continued following the introduction of feedback, though overall performance levels did increase (see Figure 1). In addition, participants C and D demonstrated an increasing trend or high levels of performance and variability that overlapped with data post-intervention (see Figure 3 and Figure 4). Participants C and D either showed a continuation of the trend from baseline or a slight increase in level, but performance remained variable.
Summary

Participant performance data indicate that all three delivery methods resulted in similar increases in performance for the majority of participants. Participants C and D were the exception across all feedback delivery methods, exhibiting an increasing trend prior to feedback introduction. Altogether, regardless of method, all participants were above 90% correct within three feedback sessions. This includes those (participants G and H) with high variability during baseline (see Figure 7 and Figure 8).

In addition to visual analysis, percentage of non-overlapping data points was calculated. Treatments that result in percentages of non-overlapping data points that are greater than 70 are considered effective treatments. The effectiveness of treatments with percentages lower than 70 and larger than 50 are considered to be questionable, and treatments with percentages below 50 are judged to have no effective results (Bellini, Peters, Benner, & Hopf, 2007). Across participants and feedback delivery methods, most were above 70%, such that each intervention was deemed effective. However, in-person feedback delivery had questionable levels of overlap for participant G and no effect for participant B. Similarly, videoconference feedback also had no effect for participant B, and questionable effects for participants D and G. Finally, BIE feedback only had questionable effects for participant D. The percentages of nonoverlapping data points for each comparison are summarized in Table 1.
Figure 1. Percentage of discrete trial target behaviors implemented correctly during in-person, videoconference, and BIE sessions for participant A.

Figure 2. Percentage of discrete trial target behaviors implemented correctly during in-person, videoconference, and BIE sessions for participant B.
Figure 3. Percentage of discrete trial target behaviors implemented correctly during in-person, videoconference, and BIE sessions for participant C.

Figure 4. Percentage of discrete trial target behaviors implemented correctly during in-person, videoconference, and BIE sessions for participant D.
Figure 5. Percentage of discrete trial target behaviors implemented correctly during in-person, videoconference, and BIE sessions for participant E.

Figure 6. Percentage of discrete trial target behaviors implemented correctly during in-person, videoconference, and BIE sessions for participant F.
**Figure 7.** Percentage of discrete trial target behaviors implemented correctly during in-person, videoconference, and BIE sessions for participant G.

**Figure 8.** Percentage of discrete trial target behaviors implemented correctly during in-person, videoconference, and bug-in-ear sessions for participant H.
Figure 9. Percentage of discrete trial target behaviors implemented correctly during in-person, videoconference, and bug-in-ear sessions for participant I.

Table 1

Percentage of Non-overlapping Data Points for Each Delivery Method

<table>
<thead>
<tr>
<th>Participant</th>
<th>In-person</th>
<th>Videoconference</th>
<th>Bug-in-ear</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>D</td>
<td>100</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>E</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>F</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>G</td>
<td>67</td>
<td>67</td>
<td>100</td>
</tr>
<tr>
<td>H</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>I</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Secondary Effects

Participant Distraction

Participants C, D, E, and F engaged in little to no distraction behavior throughout the duration of the study across all delivery methods. When one of these participants did engage in glancing or pausing, it was only during in-person or videoconference feedback sessions (see Figure 12, Figure 13, Figure 14, and Figure 15). Participants B, G, and H showed zero levels of distraction during baseline for all delivery methods. Following the introduction of feedback, low levels of responding were observed in at least one delivery method for each participant (see Figure 11, Figure 16, and Figure 17). Variable responding is seen across both phases for participant I (see Figure 18) with some increase in level during in-person and videoconference feedback sessions. Similarly, participant A also demonstrated some level of responding during baseline. After feedback was introduced, zero levels of responding were seen during the BIE condition. An immediate increase in responding was seen during the first in-person session, but fell to low levels by the end of the study. Responding during videoconference showed very low variability and dropped to zero levels by the end of the study (see Figure 10). Overall, levels of distraction were low across all participants. When distraction was observed, it was most frequent during the in-person condition and rarely exhibited during BIE feedback.
Figure 10. Frequency of glances or pauses for participant A during in-person, videoconference, and BIE sessions.

Figure 11. Frequency of glances or pauses for participant B during in-person, videoconference, and BIE sessions.
Figure 12. Frequency of glances or pauses for participant C during in-person, videoconference, and BIE sessions.

Figure 13. Frequency of glances or pauses for participant D during in-person, videoconference, and BIE sessions.
**Figure 14.** Frequency of glances or pauses for participant E during in-person, videoconference, and BIE sessions.

**Figure 15.** Frequency of glances or pauses for participant F during in-person, videoconference, and BIE sessions.
Figure 16. Frequency of glances or pauses for participant G during in-person, videoconference, and BIE sessions.

Figure 17. Frequency of glances or pauses for participant H during in-person, videoconference, and BIE sessions.
Figure 18. Frequency of glances or pauses for participant I during in-person, videoconference, and BIE sessions.

Client Distraction

Across all three delivery methods, clients A, C, F, G, and H exhibited very low levels of distraction, with most occurring during in-person and videoconference feedback sessions (see Figure 19, Figure 21, Figure 24, Figure 25, and Figure 26). Client D was not distracted during baseline, but after the introduction of feedback, levels of distraction increased dramatically for both in-person and videoconference sessions. However, levels decreased back to zero levels by the end of the study (see Figure 22). During baseline, client E demonstrated zero levels of responding for BIE, a decreasing level of distraction during in-person and an increasing trend in responding during videoconference sessions (see Figure 23). Once feedback was introduced, all levels decreased to zero and glances were observed only briefly during one videoconference session.
Client B demonstrated zero to low levels of distraction across all conditions during baseline. This level of responding continued after feedback was introduced with the exception of the last in-person feedback session where the client exhibited higher levels of distraction (see Figure 20). Lastly, client I was frequently distracted for both baseline and feedback sessions during the in-person condition and only occasionally during videoconference and BIE feedback (see Figure 27). To summarize, results showed that distraction overall occurred primarily during in-person sessions for participants and during in-person and videoconference sessions for clients. Distraction rarely occurred during BIE sessions for either participants or clients.

![Client A Distraction](image)

*Figure 19.* Frequency of glances or pauses for client A during in-person, videoconference, and bug-in-ear sessions.
Figure 20. Frequency of glances or pauses for client B during in-person, videoconference, and bug-in-ear sessions.

Figure 21. Frequency of glances or pauses for client C during in-person, videoconference, and bug-in-ear sessions.
Figure 22. Frequency of glances or pauses for client D during in-person, videoconference, and bug-in-ear sessions.

Figure 23. Frequency of glances or pauses for client E during in-person, videoconference, and bug-in-ear sessions.
Figure 24. Frequency of glances or pauses for client F during in-person, videoconference, and bug-in-ear sessions.

Figure 25. Frequency of glances or pauses for client G during in-person, videoconference, and bug-in-ear sessions.
Figure 26. Frequency of glances or pauses for client H during in-person, videoconference, and bug-in-ear sessions.

Figure 27. Frequency of glances or pauses made by client I during in-person, videoconference, and bug-in-ear sessions.
Client Tantrum Behavior

Overall clients H, E, and I showed zero to low levels of tantrum behavior across both baseline and feedback phases for all three delivery methods (see Figure 32, Figure 35, and Figure 36). In addition, clients G and F had variable responding and overlapping data across phases for all three delivery methods (see Figure 33 and Figure 34). Clients A, B, C and D exhibited some differential levels of tantrum behavior across phases and delivery methods as outlined below. However, none of the feedback delivery methods resulted in a consistent increase or decrease in tantrum behavior.

**In-person condition.** During the in-person baseline condition, clients B, C, and D showed low levels of tantrum behavior, with an increase in responding after the introduction of feedback (see Figure 29 to 31). Conversely, client A showed high, variable tantrum behavior during baseline and upon the introduction of feedback, responding decreased (see Figure 28).

**Videoconference condition.** Client B showed low levels of tantrum behavior during baseline, with the exception of a high data point at the end of the phase. After feedback was introduced, tantrum behavior returned to low levels (see Figure 29). Client D displayed zero levels of responding during baseline and then increased tantrum behavior during the initial feedback session (see Figure 31). However, this decreased to zero again by the end of the feedback condition. Similarly, client A demonstrated a downward trend in tantrum behavior during baseline, however responding increased briefly when feedback was introduced, before decreasing again (see Figure 28). Finally, client C showed high, variable levels of tantrum behavior during baseline, however, this variability decreased after feedback was introduced (see Figure 30).
During the BIE condition zero levels of tantrum behavior were observed across both phases for client D, and low levels of responding were observed for client B (see Figure 29 and Figure 31). Clients A and C demonstrated variable responding during baseline, and after the introduction of feedback, variability and responding decreased (see Figure 28 and Figure 30).

Figure 28. Frequency of tantrum behavior during in-person, videoconference, and bug-in-ear sessions for client A.
Figure 29. Frequency of tantrum behavior during in-person, videoconference, and bug-in-ear sessions for client B.

Figure 30. Frequency of tantrum behavior during in-person, videoconference, and bug-in-ear sessions for client C.
Figure 31. Frequency of tantrum behavior during in-person, videoconference, and bug-in-ear sessions for client D.

Figure 32. Frequency of tantrum behavior during in-person, videoconference, and bug-in-ear sessions for client E.
Figure 33. Frequency of tantrum behavior during in-person, videoconference, and bug-in-ear sessions for client F.

Figure 34. Frequency of tantrum behavior during in-person, videoconference, and bug-in-ear sessions for client G.
Figure 35. Frequency of tantrum behavior during in-person, videoconference, and bug-in-ear sessions for client H.

Figure 36. Frequency of tantrum behavior during in-person, videoconference, and bug-in-ear sessions for client I.
Duration of Session

Session duration was calculated to account for any effects the different feedback delivery methods, or their secondary effects, may have on session length. The change in session duration was calculated by subtracting the average duration of treatment sessions from the average duration of baseline sessions for each condition for each participant. Results indicated an overall decrease in session length following the introduction of feedback for each delivery method (see Figures 37-39).

Videoconference feedback demonstrated the smallest difference in session length, with sessions lasting an average of 6 min 52 s during baseline and 6 min 31 s during the feedback condition. The average decrease was 21 s. Session length ranged from 4 min 16 s to 9 min 48 s in baseline and 3 min 52 s and 10 min 21 s during feedback. In-person feedback averaged 6 min 54 s during baseline and 6 min 24 s during feedback, for an average decrease of 30 seconds. Sessions ranged from 4 min 15 s to 12 min 28 s and 4 min 6 s to 13 min 30 s in length respectively. Average BIE session length was 5 min 57 s during baseline and 5 min 10 s during feedback, for a decrease of 47 s on average. Sessions ranged from 3 min 20 s to 10 min 1 s and from 3 min 30 s to 10 min 7 s in length.

As noted previously, average session length decreased for each delivery method. However, with respect to session length per participant, many experienced an increase during at least one method (see Figures 37-39). Even so, the time difference was not substantial when compared to the participant’s average length for the delivery method. In addition to the type of delivery method, it should be noted that session length decreased despite the fact that the researcher was providing feedback while the participants were working with the client. Essentially, the participant was being interrupted for every incorrect and correct answer and yet it can be assumed that the immediacy of the feedback had little effect on session length.
Figure 37. The average difference in time it took to complete an observation after in-person feedback was introduced. The letters represent the participants.

Figure 38. The average difference in time it took to complete an observation after videoconference feedback was introduced. The letters represent the participants.
Figure 39. The average difference in time it took to complete an observation after bug-in-ear feedback was introduced. The letters represent the participants.

Social Validity

A social validity questionnaire was given to all participants at the beginning, middle, and end of the study. The questionnaire measured comfort level, acceptance of the treatment, perceived effectiveness, preference, distractibility and whether they would recommend the delivery method to another technician (see Appendix F). The questionnaire contained a 5-point Likert scale that provided numerical ratings ranging from 1 = strongly agree to 5 = strongly disagree for four questions and two open-ended questions. Results for the Likert scale questions are summarized in Table 2. Altogether, there were high levels of acceptability, comfort, perceived effectiveness, and the probability of recommendation regardless of the delivery method. With that being said, it appears that the participants became more comfortable with in-person and BIE from the beginning to the end of the study. However, with videoconference it
remained the same. Similarly, participants reported that in-person and BIE became increasingly acceptable, while videoconference did not. Still, there was an increase in perceived effectiveness for all delivery methods and an overall agreement that they would recommend all three feedback methods. The open-ended questions addressed favorite delivery method and which method was most distracting. The in-person delivery method was the most preferred amongst participants and videoconference feedback was reported to be the most distracting.

Table 2

Results of Participant Social Validity Questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Beginning of study</th>
<th>Middle of study</th>
<th>End of study</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>Range</td>
<td>M</td>
</tr>
<tr>
<td>I feel comfortable receiving feedback through this method.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-person</td>
<td>1.75</td>
<td>(1-4)</td>
<td>1.0</td>
</tr>
<tr>
<td>Bluetooth</td>
<td>2.25</td>
<td>(1-4)</td>
<td>1.75</td>
</tr>
<tr>
<td>Videoconference</td>
<td>1.5</td>
<td>(1-3)</td>
<td>1.25</td>
</tr>
<tr>
<td>This feedback delivery method was effective in increasing my accuracy in DTT.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-person</td>
<td>1.75</td>
<td>(1-4)</td>
<td>1.0</td>
</tr>
<tr>
<td>Bluetooth</td>
<td>2.0</td>
<td>(1-3)</td>
<td>2.0</td>
</tr>
<tr>
<td>Videoconference</td>
<td>2.0</td>
<td>(1-3)</td>
<td>1.5</td>
</tr>
<tr>
<td>How acceptable do you find the following delivery methods in regards to performance feedback?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-person</td>
<td>1.25</td>
<td>(1-2)</td>
<td>1.0</td>
</tr>
<tr>
<td>Bluetooth</td>
<td>1.5</td>
<td>(1-2)</td>
<td>1.5</td>
</tr>
<tr>
<td>Videoconference</td>
<td>1.5</td>
<td>(1-2)</td>
<td>1.5</td>
</tr>
<tr>
<td>I would recommend receiving this delivery method to other therapists.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-person</td>
<td>1.0</td>
<td>(1)</td>
<td>1.0</td>
</tr>
<tr>
<td>Bluetooth</td>
<td>1.75</td>
<td>(1-3)</td>
<td>1.5</td>
</tr>
<tr>
<td>Videoconference</td>
<td>2.0</td>
<td>(1-3)</td>
<td>1.75</td>
</tr>
</tbody>
</table>
Interobserver Agreement

The research assistant (RA) collected interobserver agreement (IOA) data via video recordings of sessions. Using the same checklist as the experimenter, the RA counted the number of correct and incorrect discrete trial target behaviors. IOA was calculated by dividing the number of target behaviors in agreement by the total number of target behaviors on each checklist and multiplied by 100. Interobserver agreement for participant performance averaged 91%, ranging from 74% to 100%. There was only one checklist with a score of 74%. The remaining scores were no lower than 84%.

Interobserver agreement was also calculated for client tantrum behavior, client distractibility, and participant distractibility. IOA was calculated on these behaviors by dividing the smaller count of the two observers’ scores by the larger count and multiplying by 100. Agreement averaged 97% for these behaviors ranging from 67% to 100% across all sessions. Though the range does begin in a low percentile, it should be noted that only five scores fell below 80%.

Treatment Integrity

The research assistant collected data on the delivery of feedback to verify that experimental protocols were appropriately followed. Data were collected on both corrective feedback and positive praise statements for approximately 35% of all sessions. Treatment integrity averaged 95% across all sessions, with a range of 64% to 100%, however, only two sessions fell below 85%.
CHAPTER 5: DISCUSSION

The current study evaluated whether videoconference and BIE feedback were as effective as in-person feedback at increasing correct discrete trial training performance in early intervention employees. Possible secondary effects on behavior as a result of the stimuli present were also examined. Results showed that in-person, videoconference and BIE feedback are comparably effective. It should be clear that when the term comparable is used, it refers to an increase of 90% or more from baseline to intervention within three feedback sessions and not across the phases of the study. Despite some variable responding across conditions during baseline, most of the participants improved in performance. All things considered, companies could utilize any of these methods based on their need. For example, an organization may choose to use in-person feedback for supervising new employees. This method would allow for much more modeling and physical prompting when necessary. Alternatively, an organization may choose to use videoconference feedback in order to save time while still maintaining the ability to model behavior. Finally, BIE feedback could allow for more mobility when conducting sessions around a room, home, or workplace. This could be a significant benefit for organizations that are focused on more naturalistic teaching programs.

Aside from the effectiveness of each delivery method, knowing their secondary effects on the behavior could assist in deciding which is best for the organization, employee, and client. Though there was some level of distraction among participants and clients across delivery methods, it was very limited and did not result in an increase in session length. In fact, average session length for all delivery methods decreased following feedback implementation. Similarly, client tantrum behavior showed little consistent change across phases and
conditions, which may imply that delivery method does not have a differential effect on this behavior. This suggests that distraction and problem behavior need not be of concern when deciding on a feedback delivery method.

Organizations should also consider the input of their employees in determining which method to select. In the current study, there were high social validity ratings for comfort level, acceptability, and perceived effectiveness for all three feedback delivery methods. Participants also reported that they would recommend all methods to a fellow employee. Although participants preferred in-person feedback throughout the study, they reported being more comfortable and accepting of BIE feedback as the study progressed. These results suggest that if an employee is initially reluctant to use BIE technology for feedback, simple exposure may increase comfort and acceptability.

Additional considerations not mentioned in the beginning of the study are the immediacy of feedback and cost per delivery method. As stated before, session length was not increased due to feedback delivery. In fact, session length was reduced on average. Therefore, rather than providing feedback after the session, immediate real-time vocal feedback following each target response could be used to save even more time. As was demonstrated in the Arco (1997) study, feedback delivered during supervision can be done effectively in-person and vocally without the need for written score sheets or graphic feedback.

Lastly, if one were to estimate cost, it is likely that the telemedicine delivery methods would generate significant cost savings. In an informal cost analysis for the organization that participated in the current study, BIE or videoconference delivered feedback would decrease costs by over 50%. Organizations could use the money saved from the decrease in drive time and
mileage for additional resources, including training convenience and additional staff support.

**Limitations and Future Research**

The present study has several limitations that should be addressed. To start, only the researcher, who had no prior interactions with the participants, delivered feedback. It is unknown whether this could have influenced the behavior of the participants. Future research may evaluate the relative effectiveness of the delivery methods when provided by the participant’s direct supervisor. However, it is important to note that if you have different supervisors with different supervision styles this may affect the social validity. If a supervisor is considered aversive to an employee then BIE may be preferable. Additionally, fluency with the electronic devices and software may influence the decision of the supervisor with respect to delivery method.

Another limitation was the length of study. Data were collected for only three sessions per delivery method during both baseline and intervention phases, and high levels of variability were an issue. Future research should utilize a longer baseline in order to obtain more stable levels of performance prior to introducing the intervention. However, the intervention phase may remain short since, in the current study, participants’ performance reached 90% or better within three sessions.

Next, problems with video transmission occurred during observations. Freezing video and tiled or pixilated images were the most common technical problems. When this occurred, the researcher cancelled the call and made another attempt to re-connect with the participant. This strategy worked each time, however, attention was taken away from the client in order to resolve these issues.
In addition, there were times when a participant initiated call did not go through to the researcher. The participant would call, and ringing would commence, but the researcher never received the call. During these situations, the researcher would call the participant and the call would go through on either the first or second attempt. Future researchers or practitioners may want to use cellular phones instead of tablets or use different software to communicate. Another consideration with respect to equipment is the type of device used to record sessions. The current study used tablets to view performance, and as such, observations were limited to one area of the room. A rotating camera would allow the observer to follow the participant around the entire room.

Finally, while there may be multiple-treatment interference or practice effects, the data do not support either concern. The current study was designed as a multi-element study with each feedback delivery method paired with a specific set of target behaviors. With that being said, many participants had specific target behaviors that were missed within each checklist. This suggests that they were skipping steps during trials and required a prompt for specific behaviors in each checklist. For example, participant G had the most difficulty with number 6 in checklist 1, number 4 in checklist 2, and number 5 in checklist 3 (see Table 3). Participant H had the most difficulty with number 6 in checklist 1, number 6 in checklist 2, and number 5 in checklist 3 (see Table 3). Upon review of all target behaviors, there appears to be no overlapping target behaviors across the checklists. Therefore, it is unlikely that feedback on one checklist affected target behaviors across other checklists.

It is also unlikely that practice effects influenced results. With the exception of participants A and I, all participants had been with the organization for over a year and had been receiving feedback on discrete trial training from the beginning.
of their employment. As such, increasing trends in performance during baseline and intervention for participants C and D could be a result of observer reactivity.

Table 3

<table>
<thead>
<tr>
<th>Target Behaviors by Checklist</th>
<th>Checklist 1</th>
<th>Checklist 2</th>
<th>Checklist 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Secure child’s attention</td>
<td>1. Deliver instruction with flat affect</td>
<td>1. Present teaching materials within child’s reach and in field of three</td>
<td></td>
</tr>
<tr>
<td>2. Use only most important words during instruction</td>
<td>2. Deliver instruction only once before providing prompt/reinforcer</td>
<td>2. Re-position materials</td>
<td></td>
</tr>
<tr>
<td>3. Allow child 3-5 seconds to respond to instruction</td>
<td>3. Uses distractors with target item</td>
<td>3. Do not smile during corrective feedback and avoid using the word “no”</td>
<td></td>
</tr>
<tr>
<td>4. If child does not respond, provide least intrusive prompt</td>
<td>4. If correct, praise and present additional reinforcer</td>
<td>4. Give only praise after prompted response</td>
<td></td>
</tr>
<tr>
<td>5. If incorrect after least intrusive prompt, provide feedback in neutral tone and provide correct response</td>
<td>5. Have brief inter-trial interval after delivery of reinforcer (2-5secs)</td>
<td>5. Fade prompts across trials</td>
<td></td>
</tr>
<tr>
<td>6. Re-present instruction and prompts to guarantee correct response</td>
<td>6. Does not use same comment for praise more than two consecutive trials.</td>
<td>6. Follows schedule of reinforcement</td>
<td></td>
</tr>
</tbody>
</table>

Note. Light grey represents participant G and the dark grey represents participant H.

**Conclusion**

Due to the increasing number of children diagnosed with autism spectrum disorder and the shortage of BCBAs (Behavior Analyst Certification Board, 2015; Jang et al., 2012), many clients may experience a delay in services. The current study suggests that organizations may be able to start addressing this issue by providing feedback to their employees using telemedicine. As a result, supervisors may have more time to provide services to additional clients. Furthermore, utilizing telemedicine delivery methods may result in significant cost savings for the organization, without concerns regarding buy-in by employees or side-effects on client behavior. Telemedicine, particularly BIE, also has the potential to be more discrete and flexible in its utilization than in-person feedback. It is also worth noting that these results should apply beyond discrete trial
performance and future could evaluate these conclusions across additional employee behaviors and in different organizational settings.
REFERENCES
REFERENCES


APPENDIX A: PARTICIPANT INFORMED CONSENT FORM
Participant Informed Consent Form

Purpose:
You are invited to participate in a study conducted by Crystal Loza, a graduate student at California State University, Fresno, under the supervision of Dr. Sharlet Rafacz. The purpose of this study is to determine whether the delivery of feedback through telemedicine technology is as effective as feedback delivered in-person. In addition, secondary effects on behavior such as distraction, length of sessions, and length of trials will be examined.

Procedures:
If you decide to participate, you will be video recorded and observed by the researcher either in person or through a tablet during a portion of your regular shift with the KC Kids STARS program. Three checklists aimed to assess discrete-trail training will be filled out based on your performance. You will receive immediate feedback while working with your client on your performance from the researcher. The estimated length of this study is 6-10 weeks. You may remove your consent and end your participation without consequences at any point of the study.

Benefits and Risks:
The benefit of participating in this study is contributing to the research on employee feedback and on the possible secondary effects the feedback can have on employee behavior. An additional potential benefit is the acquisition of skills in regards to discrete-trial training. Participants will also receive a $50 visa gift card at the end of the study. If you decide to withdrawal at any time, you will be compensated for the weeks you participated. Any possible risks, distress, inconveniences, or other effects in this study are considered more than minimal risk.

Confidentiality
All information that is accrued in this study, including that which can identify you, will be confidential. If you sign this document, only those involved in the study will have access to the information. Information will be placed in a locked cabinet in the office of Dr. Sharlet Rafacz, the committee advisor of this thesis in order to prevent violation of confidentiality.

Questions and Contact:
If you have any additional questions or concerns regarding this study, please contact either Dr. Sharlet Rafacz by phone (559) 278-2479, or email: srafacz@csufresno.edu; or Crystal Loza by phone (559) 250-3996; or email ub50028@mail.fresnostate.edu.

Statement of Consent
Your signature indicates that you have read the information provided above, and have agreed to participate.

Name of Participant: _________________________________
Signature of Participant: _______________________________ Date: __________
Signature of Researcher: _____________________________ Date: __________
APPENDIX B: CLIENT INFORMED CONSENT FORM
Client Informed Consent Form

Purpose:
Your child is invited to participate in a study conducted by Crystal Loza, a graduate student at California State University, Fresno, under the supervision of Dr. Sharlet Rafacz. The purpose of this study is to improve how the employees of the KC Kids STARS program provide services to your child. In addition, behavior such as distraction, length of sessions, and length of trials will be examined.

Procedures:
If you decide to allow your child to participate, they will be video recorded and observed by the researcher either in person or through a tablet during a portion of your regular shift with the KC Kids STARS program. The only data taken on your child will be their level of distraction during the sessions. The estimated length of this study is 6-10 weeks. You may remove your consent and end their participation without consequences at any point of the study.

Benefits and Risks:
The benefit of participating in this study is contributing to the research on employee feedback and on the possible secondary effects the feedback can have on employee and client behavior. Any possible risks, distress, inconveniences, or other effects in this study are considered more than minimal risk.

Confidentiality
All information that is accrued in this study, including that which can identify your child, will be confidential. If you sign this document, only those involved in the study will have access to the information. Information will be placed in a locked cabinet in the office of Dr. Sharlet Rafacz, the committee advisor of this thesis in order to prevent violation of confidentiality.

Questions and Contact:
If you have any additional questions or concerns regarding this study, please contact either Dr. Sharlet Rafacz by phone (559) 278-2479, or email: srafacz@csufresno.edu; or Crystal Loza by phone (559) 250-3996; or email ub50028@mail.fresnostate.edu.

Statement of Consent
Your signature indicates that you have read the information provided above, and have agreed to participate.

I give permission for videotaping of ABA programs for the initial purposes of this study.

Name of Client: _________________________________
Signature of Parent/Guardian: ______________________________Date: _______
Signature of Researcher: ______________________________Date: _______
APPENDIX C: MODIFIED CHECKLISTS
Checkerlist 1

Participant: _______________________________
Date: _________________________________
Method: _______________________________

<table>
<thead>
<tr>
<th>Components</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7</th>
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<th>17</th>
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<th>20</th>
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<tbody>
<tr>
<td>1. Secure child’s attention</td>
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<td>2. Use only most important words during instruction (amount determined by supervisor)</td>
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<td>3. Allow child 3-5 seconds to respond to instruction</td>
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<td>4. If child does not respond, provide least intrusive prompt</td>
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<td>5. If incorrect after least intrusive prompt, provide feedback in neutral tone and provide correct response</td>
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<td>6. Re-present instruction and prompts to guarantee correct response</td>
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</tbody>
</table>
Checklist 2

Participant: _______________________________
Date: _______________________________
Method: _______________________________

<table>
<thead>
<tr>
<th>Incorrect Response</th>
<th>Trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
</tr>
<tr>
<td>1. Deliver instruction with flat affect</td>
<td></td>
</tr>
<tr>
<td>2. Deliver instruction only once before providing prompt/reinforcer</td>
<td></td>
</tr>
<tr>
<td>3. Uses distractors with target item</td>
<td></td>
</tr>
<tr>
<td>4. If correct, praise and present additional reinforcer</td>
<td></td>
</tr>
<tr>
<td>5. Have brief inter-trial interval after delivery of reinforcer (2-5secs)</td>
<td></td>
</tr>
<tr>
<td>6. Does not use same comment for praise more than two consecutive trials.</td>
<td></td>
</tr>
</tbody>
</table>
Score: _______________________

Checklist 3

Participant: ___________________________
Date: ________________________________
Method: ______________________________

<table>
<thead>
<tr>
<th>Incorrect Response</th>
<th>Trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components</td>
<td>1</td>
</tr>
<tr>
<td>1. Present teaching materials within child’s reach and in field of three</td>
<td></td>
</tr>
<tr>
<td>2. Re-position materials</td>
<td></td>
</tr>
<tr>
<td>3. Do not smile during corrective feedback and avoid using the word “no”</td>
<td></td>
</tr>
<tr>
<td>4. Give only praise after prompted response</td>
<td></td>
</tr>
<tr>
<td>5. Fade prompts across trials</td>
<td></td>
</tr>
<tr>
<td>6. Follows schedule of reinforcement (continuous/token economy)</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX D: OPERATIONAL DEFINITIONS OF TARGET BEHAVIORS
Operational Definitions of Components

Re-position materials: move target item from where it was during the previous trial to a new location within a field of three.

Present teaching materials: If physical items are being used, make sure target items are within child’s reach and within a field of three.

Use distractors: use items that child is/isn’t familiar with. This depends on supervisors instructions.

Present correct instruction:
- Clear, simple, appropriate, and only once
- Deliver with flat affect
- Concise, using only the most important words
- Allow child time to respond without a prompt (eg. 3-5 seconds)

Present prompts:
- If child does not respond within 3-5 seconds, provide least intrusive prompt.

Praise and present additional reinforcer:
- If child answers correctly, immediately provide verbal praise and deliver tangible reinforcer.
- If child answers correctly after prompt is given, only provide verbal praise.
- Do not use same phrase for praise more than two times consecutively.

Schedule of reinforcement: determined by supervisor

Have brief inter-trial interval (3-5 secs): wait 3-5 seconds after delivering a tangible reinforcer before delivering next instruction.

Error correction:
- If child does not respond or responds incorrectly, provide corrective feedback in a neutral voice (eg. “nice try.”) and provide correct response.
- Do not smile while providing feedback and avoid using the word “no.”

Secure child’s attention:
- Make sure child is seated or still
- make sure to obtain eye-contact before delivering instruction

Re-present introduction and prompts to guarantee correct response:
- If the child responds incorrectly one time to an item, he/she should be prompted in the next trial.
- Use a less intrusive prompt for the second attempt.
- If a second incorrect response occurs, a more intrusive prompt will accompany the third instruction to ensure the child gets a correct response on the third attempt.
Give praise only: provide only verbal praise after correct responses that are prompted.

Fade prompts across trials: Fade prompting from least intrusive to most intrusive within a session and/or lesson. Fade within the prompt type if it is the only type utilized for that lesson (E.g. fade within verbal prompt when teaching expressive skills).

- Look Prompt: least intrusive
  o Using your eye gaze to indicate correct response

- Position Prompt:
  o Position the correct stimulus physically close to the client.
  o Begin to bring the correct stimulus closer to distractor(s) until they are parallel.

- Point Prompt
  o Tap correct response
  o Point to correct response using your finger

- Verbal Prompt
  o Pronouncing part or all of the correct response

- Modeling Prompt
  o Show the client the correct behavior
  o Begin to only model the steps or a part of the behavior the client has a hard time learning.

- Physical Prompt: most intrusive
  o Using your hands to guide the client to the correct answer.
  o With your hand over the clients hand, help them to complete the entire process of choosing the correct stimulus or completing the correct action (e.g. motor imitation)
  o Gradually begin to reduce your touch by moving from full hand-over-hand until all you have to give is the instruction.
APPENDIX E: SCRIPTED FEEDBACK
Scripted Feedback

Corrective Feedback

Checklist 1
1. Get eye contact
2. Use less/more wording
3. Give them more time to respond
4. Least intrusive prompt
5. Next time switch up stimuli
6. Next time prompt immediately

Checklist 2
1. Use neutral tone during instruction
2. Deliver instruction once
3. Use distractors
4. Don’t forget praise/other reinforcer
5. Wait after reinforcing
6. Change up praise

Checklist 3
1. Make sure they can reach
2. Use neutral tone/provide correct response
3. Don’t smile, don’t use “no”
4. Only praise after prompts
5. Fade your prompts
6. Check schedule of reinforcement

Positive Praise Feedback

1. Good job
2. Excellent work
3. You’re doing great
4. Very good
5. Well done
APPENDIX F: SOCIAL VALIDITY QUESTIONNAIRE
Social Validity Questionnaire

Circle one response for each delivery method.

<table>
<thead>
<tr>
<th>Question</th>
<th>In-person</th>
<th>Bluetooth</th>
<th>Videoconference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel comfortable receiving feedback through this method.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. This feedback delivery method was effective in increasing my accuracy in DTT.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3. How acceptable do you find the following delivery methods in regards to performance feedback?</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4. I would recommend receiving this delivery method to other therapists.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5. Which feedback delivery method (BIE, videoconference, or in-person) did you prefer and why?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Which delivery method was most distracting and why?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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November 28, 2016

Date