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Teaching Appropriate Feedback Reception Skills Using Computer-Based Training

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TEACHING APPROPRIATE FEEDBACK RECEPTION SKILLS USING

COMPUTER-BASED TRAINING

by

Seth G. Walker

A dissertation submitted in partial fulfillment
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of

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ABSTRACT

TEACHING APPROPRIATE FEEDBACK RECEPTION SKILLS USING COMPUTER-BASED TRAINING

by

Seth G. Walker, Doctor of Philosophy

Utah State University, 2020

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Department: Special Education and Rehabilitation

Feedback is a commonly used intervention to address performance issues in a number of clinical and organizational settings. Most research on feedback has focused on manipulating parameters surrounding the delivery of feedback. The interaction between the person delivering the feedback and a feedback recipient may also influence the impact of performance feedback. The current study investigated the efficacy of training individuals to receive feedback in an appropriate manner using a computer-based training format. Individuals trained with this modality exhibited increases in accuracy of appropriate feedback behaviors compared to baseline. Participants also demonstrated slight increases in performance on primary job tasks. This study extends the application of computer-based training to a new and complex set of behaviors. This study also discusses how computer-based training may increase training efficiency when applied to settings where a significant portion of an organization needs to be trained in certain skills when compared to traditional in-person training formats. This study extends the research line of training appropriate feedback reception skills.

(135 Pages)

PUBLIC ABSTRACT

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Seth G. Walker

Feedback is a commonly used intervention to address performance issues in a number of settings. Most research on feedback has focused on manipulating parameters surrounding the delivery of feedback. However, the interaction between those delivering the feedback and a feedback recipient may also influence the impact of performance feedback. The current study investigated the efficacy of training individuals to receive feedback in an appropriate manner using a computer-based training format. Following computer-based training, participants exhibited increases in accuracy of appropriate feedback behaviors when compared to baseline. Participants also demonstrated slight increases in performance on primary job tasks. This study extends the application of computer-based trainings to a new and complex set of behaviors. This study also discusses how computer-based training may increase training efficiency when applied to settings where a sizable portion of an organization needs to be trained in certain skills when compared to traditional in-person training formats. This study extends the research line of training appropriate feedback reception skills.

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Seth Gregory Walker

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CHAPTER I

INTRODUCTION

In the field of applied behavior analysis, interventions involving the use of feedback are commonplace. Interventions using feedback typically target performance issues. In other words, the intervention is often used with individuals exhibiting a skill, but one or more dimensions of that skill are not exhibited accurately or at an acceptable rate. Feedback is typically defined as information about previous performance (Peterson, 1982). The primary researcher conducted a literature search across a number of applied journals (Journal of Applied Behavior Analysis, Behavior Analysis in Practice, The Journal of Organizational Behavior Management) to account for the prevalence of feedback in the field of behavior analysis. From 2009 to 2019, 466 articles included the term feedback in the title field across all three journals. It is likely that across those studies, feedback was used as both an isolated treatment component and as part of a more complex behavior change package. Feedback is typically used to correct some performance issue. It is most common for feedback to be delivered vocally from an individual in a supervisory role to an individual in a supervisee role (Alvero et al., 2001).

Although feedback as an intervention is popular, there is disagreement regarding the underlying behavioral principles responsible for individual change. Those who have engaged in the conceptual exploration of feedback have posited that feedback might function as a discriminative stimulus or a conditioned reinforcer (Peterson, 1982). However, others who have written on the topic of feedback have suggested that it likely functions to support self-generated rules (Duncan & Bruwelheide, 1985; Mangiapanello & Hemmes, 2015). Meaning, after listening to feedback, individuals may develop rules that help guide future performance. Because feedback is defined topographically, it is likely that the mechanisms responsible for behavioral change vary across applications of feedback. Even though there is disagreement about the behavioral processes that account for the effectiveness of feedback, it remains a popular research area.

As previously indicated, feedback can be used in isolation or as a component of an intervention package. Intervention packages used to increase skill accuracy often include some form of feedback. For instance, behavior skills training (BST) is an evidence-based training package that includes a step requiring trainees are to practice the target skill and receive feedback based on their performance, and that step is repeated until the trainee meets a pre-determined mastery criterion (Parsons et al., 2012). Other applications of feedback as an intervention include using feedback to increase appropriate performance in organizational settings, accuracy of sports skills, and increasing safety skills of individuals with intellectual disabilities (Goomas, 2008; Boyer et al., 2009; Gunby et al., 2010). It is important to note that the previous list is not exhaustive.

Feedback can vary across a number of dimensions that may impact its effectiveness in different contexts. In 1985, Balcazar, Hopkins, and Suarez, described six dimensions of feedback: 1) feedback source, or the role of those who deliver feedback; 2) feedback privacy, the degree to which feedback is available outside of the delivery-reception interaction; 3) feedback participants, the role of those receiving feedback; 4) feedback content, the type of information provided; 5) feedback mechanism, how feedback is delivered; and 6) feedback frequency, the rate at which feedback is delivered. Immediacy of feedback, the duration between performance and receiving feedback on that performance, likely also plays a role in feedback effectiveness. In most applications of feedback, the feedback source is another human being; however, it is possible for feedback to be automated in some way. For example, researchers have used automated (i.e., computerized) feedback systems to improve performance of community mental health care center staff (Kowalsky & Cohen, 1985). Although feedback can be delivered mechanically, it is much more common for feedback to be delivered via human interaction, especially by individuals who have some stake in the feedback recipient's performance.

Feedback is generally considered an easy-to-implement and effective intervention for producing behavior change across a wide variety of populations and settings. Until recently, investigations have typically focused on manipulating dimensions of feedback delivery and measuring the behavior change of the feedback recipient. However, there is a possibility that effectiveness might also be influenced by how the recipient responds to the feedback delivered.

Conceptual Analysis of Feedback

Feedback is effective to the degree that it produces immediate and appropriate behavior change and increases the probability that appropriate behavior will occur in the future. In order to conceptually explain how an individual's response to feedback may mediate the effectiveness of the feedback delivered, it is important to understand that feedback may serve many different functions. For example, feedback may function to aid in later effective rule governed behavior. Alternatively, feedback may function as a discriminative stimulus which evokes a response class of immediate responses related to interacting with their supervisor. These immediate responses may either support long-term behavior change (i.e., appropriate interaction with the supervisor by engaging in responses like having appropriate demeanor, acknowledging performance errors, developing a plan of action for future performance), or inhibit long-term behavior change (i.e., inappropriate interaction with the supervisor by engaging in responses like blaming others, poor demeanor, or arguing). It is also possible that feedback may function as a stimulus which elicits aversive private events in recipients.

When feedback effectively produces subsequent behavior change, the feedback recipient likely generates rules from the information provided in the feedback session (Mangiapanello & Hemmes, 2015). The way in which verbal stimuli could function as rules is best conceptualized by Zettle and Hayes (1982). Zettle and Hayes discuss three functions that likely account for rule following: pliance, tracking, and augmenting. Pliance is under the control of some speaker-mediated consequence. That is, a listener responds to verbal stimuli in a way that accesses or avoids consequences mediated by the speaker. For instance, if a supervisor asks their staff to ensure they are processing a specific document thoroughly, that staff may be more thorough with the document in the future to avoid punishment or access rewards delivered by their supervisor.

Tracking is facilitated by correspondence between speaker behavior and the natural consequences of the relevant behavior. With tracking, the listener responds to verbal stimuli in a way that increases the likelihood of contacting natural consequences. For instance, a supervisor could state, “In the past, we have found that customers respond very well to an enthusiastic greeting.” If that staff responds to the feedback by giving an enthusiastic greeting, it may increase the likelihood of obtaining a higher customer satisfaction score when the communication has ended.

Zettle and Hayes (1982) define augmenting as rule-governed behavior under the control of apparent changes in capacity of environmental consequences to function as reinforcers or punishers. In other words, a listener may respond to verbal stimuli in a way that it changes the functional effect of certain stimuli in the environment. For instance, a supervisor may tell their staff that excellent customer experience is the most important company value. Following that feedback, the staff may find customer behaviors such as pauses, voice tone, and other interactions more punishing in the future because those responses do not correspond with the responses of satisfied customers.

In performance feedback scenarios, these three units of rule-governed behavior are likely all present. The structure and content of supervisor-delivered feedback may support each individual functional unit of rule governed behavior. For instance, a supervisor may share their "tricks of the trade" or actions they have taken in the past in order to produce a desired effect on the environment. If the staff responds by following the actions previously outlined by the manager and contacts favorable natural consequences, they have engaged in tracking. Supervisors may also identify errors in employee performance and restate the consequences for future errors. Staff responding to these statements may be engaging in pliance, increasing the likelihood that the recipient will avoid making a similar error in the future to avoid punishing consequences. Lastly, supervisors may identify aspects of the environment that serve as an indicator for performance accuracy, for example, aspects of customer behavior that may indicate satisfaction. If staff respond to these statements, it may increase the degree to which the presence of those indicators function as reinforcers. In this instance, the staff may be responding to an augmental.

One or all of the units of rule-governed behavior could produce changes in the listener's behavior in a given instance of performance feedback. For example, a manager may say, "It looks like you had quite a few grammar errors in your communications with customers this week. You will need to attend more closely to your grammar in your future communications with customers, as the company values the customer experience." The feedback recipient may generate a rule that produces a behavioral change when communicating with customers in the future. If the recipient responds due to the perceived consequences of reprimand or reward delivered by the supervisor, they have generated a ply to which they are responding. If the recipient responds to increase the likelihood that the customer would respond favorably, they are engaging in tracking. If the recipient begins identifying grammatical errors prior to sending communication, which now function as punishers, they are engaging in augmenting. It is important to understand that it may be difficult to determine which unit of rule-governed behavior is influencing an individual's behavior at any given time. There is also a possibility that a combination of two or more units of rule governed behavior are functioning to produce behavior change.

Whereas feedback is conceptualized stimuli that support rule-governed behavior change, feedback may also function to evoke an operant repertoire of appropriate responding. In this instance, the feedback functions as a discriminative stimulus. The feedback recipient may exhibit appropriate eye contact, attend to the information the supervisor is delivering, and thank them for their time at the end of the feedback session. This operant repertoire is likely maintained by conditioned reinforcement provided by their supervisor, colleagues, or work community. Although performance feedback may guide performance, it may also have undesirable effects due to the feedback recipient's history with verbal stimuli of a similar topography.

Feedback and reprimands share some common characteristics which may impact the way in which individuals receive feedback. Reprimands may include the indication that an individual made a performance error, or that an individual should refrain from making similar errors in the future. Reprimands may also be followed closely in time by unfavorable consequences. Similarly, feedback includes an indication of a performance error, however it also typically includes: 1) a rationale for why that performance error should not be repeated, 2) information for how an individual may remedy that error in the future, and 3) supportive feedback surrounding performance strengths. Individuals may have a lengthy history of receiving reprimands before ever experiencing performance feedback.

In performance feedback scenarios, feedback may evoke a class of inappropriate feedback reception responses due to the recipient's history with reprimands and punishment. Due to this history, feedback recipients may be more likely to exhibit inappropriate responses when receiving feedback. Inappropriate responses include things like explaining the error away, blaming others, or engaging in a variety of other behaviors that may allow the recipient to escape the aversive stimulation of feedback sessions. Engaging in these inappropriate responses may impede the development of rules that effectively guide future performance.

Due to the similarities between reprimands and performance feedback, another potential undesirable outcome is that the feedback may elicit an emotional response. Likely, the emotional response is elicited by the feedback context and is unpleasant for the feedback recipient. The emotional response may include physiological responses (e.g., increases in heart rate, blood pressure, breathing, sweating) and covert verbal behavior (e.g., restating past punishing feedback statements of others, making negative self-statements). Experiencing an aversive emotional response in the feedback context may evoke one or more of the previously described inappropriate feedback reception responses. Similarly, those responses may be strengthened by escaping or avoiding the feedback context and alleviating the aversive emotional response.

Because of the similar characteristics between reprimand and feedback, the above escape-related responses are most likely at strength when in the presence of statements that are critical of staff performance, which may then impede performance improvement. It is possible that learning to engage in appropriate feedback reception skills can facilitate increases in the accuracy of work performance in two ways. First, the appropriate responses may be incompatible with inappropriate feedback responses. For example, a staff member acknowledging that they have made an error may reduce the likelihood that they will blame the error on others or make excuses. Second, the appropriate responses may increase the likelihood that the staff generates effective rules to guide future performance. For instance, committing to behavior change may increase the strength of the verbal stimulus which, in turn, may function as a rule to guide desirable performance in the future. A visualization of the way in which appropriate reception of feedback may influence performance can be found in Figure 1.

Feedback Reception and Computer-based Instruction

Recently, an application of BST produced an increase in the frequency and accuracy of a number of listener behaviors associated with appropriate reception of feedback (Ehrlich et al., 2020). Ehrlich et al. (2020) produced increases in appropriate reception of feedback skills after exposing participants to BST. BST is an evidence-based approach to teaching complex skills but, it is frequently used in a manner that requires a trainer to be present for at least some of the training session (Parsons et al., 2012).

Recent research conducted by (Geiger et al., 2018) compared the total time investment of BST to a similar training provided through computerized training. Although the computerized training required a significant initial time investment (i.e., creating the training modules), BST required the ongoing allocation of time in order to conduct continued trainings. There was only a slight difference in the range of outcome scores between the participants who received BST and the participants that received a computer-based training. Investigators found only a 4% mean score difference in favor of the participants who received BST after performance feedback was delivered. Thus, for standardized trainings that are repeated regularly, and do not have to be updated often, it may be beneficial to deliver the content in a more time-efficient manner that should result in cost savings over time. However, an investigation of computerized training to teach skills associated with the appropriate reception of feedback has yet to be conducted.

Erath and DiGennaro (2019) define the broad category of technology-based training as any training that uses technology-based methods, such as, video modeling or computerized trainings to deliver training. DiGennaro Reed, Hyman, and Hirst (2011), further define technology as the use of an electronic apparatus which can be programmed by the practitioner to deliver visual, auditory, proprioceptive cues, discriminative stimuli, or to display the modeling of desired behaviors in the context of a skills training intervention. The preceding definition provides some clarity as to what types of trainings may be considered “technology-based”, however a more precise definition may be helpful. Technology-based interventions involve the use of pre-programmed electronic apparatus which can be programmed by a practitioner to deliver a range of stimuli in the context of a skills training intervention allowing the practitioner to either be partially or completely removed from the training context.

Although technology-based training encompasses a broad range of training modalities, there is one subcategory of interest due to its use of technology, interactivity, and repeated demonstrations of increasing accuracy of target skills. That subcategory is computerized training. Several researchers have used computerized trainings to teach skills typically pertaining to the delivery of behavior analytic services to staff. For instance, computerized trainings have been shown to increase the accuracy of functional analysis implementation skills, increase accuracy in identifying antecedents and consequences in descriptive observations, and increase accuracy of implementation of discrete trial procedures (Schnell et al., 2018; Vladescu et al. 2012; Scott et al., 2018). Computerized trainings are often comprised of a number of interactive activities embedded within audio instructions, on-screen text, and video models. These interactive activities typically include open-ended questions, self-guided practice, competency check questions, and active responding.

A recent review of technology-based training showed that, of those individuals who participated in computerized training, few needed supplemental training to reach pre-established mastery criteria. Those who failed to reach appropriate levels of performance after exposure to the computerized training were typically provided performance feedback or BST, which produced the desired effects on target skills (Erath

& DiGennaro Reed, 2019). These results suggest that computerized training methods may be an effective training method for complex skills. Also, considering the resource consumption of computerized trainings versus BST for ongoing trainings with relatively static content, computerized training may be an acceptable training method for specific job positions that may have a high turn-over rate at larger organizations. In order to teach a large number of workers appropriate feedback reception skills, it is important to consider appropriate training delivery methods that will be sustainable and effective in increasing the target skill. In this instance, a computerized training may be warranted.

The demonstration of behaviors typically considered to be appropriate responses to feedback require individuals to exhibit a series of overt responses. There may be several benefits from using computerized training to teach appropriate responses to feedback. First, those who are trained in effective responses to feedback via computerized training may exhibit those skills to a greater extent in future feedback contexts. Second, with those for whom performance feedback does not seem to be effective in increasing target skills to a level of acceptability, training appropriate reception of feedback skills may increase the likelihood that performance increases to an appropriate level in the future. Lastly, individuals who are tasked with delivering performance feedback may be impacted when the feedback recipient engages in appropriate feedback reception, as those individuals may engage in audience behavior that reinforces certain aspects of feedback delivery. Previous research has indicated that feedback is a common intervention, feedback reception skills can be taught, and that computer-based instruction is an appropriate training mechanism for relatively static content which needs to be delivered to a large number of staff. Thus, the purpose of this project is to carry out an initial investigation the impact of computerized training to teach skills associated with the appropriate reception of feedback. The specific research questions of this investigation are as follows:

RQ1: To what extent does exposure to computerized training impact the demonstration of target skills associated with the appropriate reception of feedback?

RQ2: To what extent does exposure to computerized training on feedback reception skills impact the accuracy of a workplace performance task for which feedback is provided?

RQ3: To what extent do participants find the training acceptable and to what extent do managers find the behavior change acceptable after participants are exposed to a computer-based training on appropriate reception of feedback?

CHAPTER II

Literature Review

It is no surprise that complex skills often need specific training to exhibit those skills accurately. Applied behavior analysis has had a long history of identifying efficient training strategies in order to increase the accuracy and frequency of target skills. There are a number of intervention packages that have been used to address issues of social significance over the years, including rapidly teaching children to toilet, reducing the prevalence of tics with Habit Reversal Training, increasing functional communication, and increasing accuracy of organizational skills (Azrin & Nunn, 1973; Carr & Durand, 1985; Foxx & Azrin, 1973; Parsons et al., 2012). These intervention packages adhere to all of the central tenants of applied behavior analysis outlined by Baer, Wolf, and Risley (1968). Because the above intervention packages are described in a conceptually systematic, technological manner, they are easily replicable. Meaning, many researchers have directly replicated the findings from the original studies and systematically replicated the effects of the intervention packages to new populations and dependent variables, and practitioners can easily follow the procedures in the applied setting.

One of the more common intervention packages for training in recent years is BST (Parsons et al., 2012). BST consists of four major components. The first component is description, where the target skill is described in detail and a rationale for the skill is typically provided. The second component is modeling, where the target skill is demonstrated. The third component of the package is practice, where a participant or trainee is asked to practice the skill. The fourth component is feedback, where an individual fluent in the particular skill delivers performance feedback on the skill that has just been practiced. The last two components of the training are typically repeated until a predetermined accuracy criterion is achieved by the participant or trainee. BST is largely considered to be the gold standard for training complex skills in the field of behavior analysis (Buck, 2014). It has been applied across a number of different participant populations and across a wide variety of skills.

For instance, BST has been used to teach abduction prevention skills to children, appropriate implementation of discrete-trial teaching steps, firearms injury prevention skills, and many others (Gatheridge, 2004; Johnson et al., 2005; Sarokoff & Sturmey, 2004; Buck, 2014). In 2012, researchers conducted a component analysis of BST (Ward-Horner & Sturmey, 2012). In this study, different functional analysis conditions were trained with independent and combined components of BST using an alternating treatments design. After isolating components and some combinations of components, these researchers concluded that the most effective components of BST were feedback and modeling. Authors indicated that modeling produced behavior change to a lesser extent than the application of feedback alone. Component analyses of BST have been conducted on multiple occasions since initial study by Ward-Horner and Sturmey. All of the component analyses confirmed that the application of performance feedback as an isolated component produced the greatest increase in skill accuracy when compared to the application of any other component of BST in isolation (Davis et al., 2019; Drifke et al., 2017; Johnson, 2013; LaBrot et al., 2018). Collectively, the results of those component analyses indicate that feedback in isolation is a powerful intervention technique.

A review of the current literature surrounding appropriate feedback reception responses yielded two articles from the fields of medicine and business discussing specific component actions associated with reception of feedback (Algiraigri, 2014; Jug et al., 2019). Although these articles focus on feedback, there is no empirical validation of the feedback skills suggested therein. However, it is important to note that suggestions present in each of these articles have significant similarity to the primary dependent measures proposed by Ehrlich et al., (2020). For instance, Jug et al., (2019) suggest that individuals listen to feedback, express gratitude, and clarify feedback. Algiraigri, (2014) suggests that individuals self-assess, openly receive feedback, connect with the feedback deliverer, request feedback, be confident and take positive feedback wisely, control emotions, make an action plan, acknowledge the generations, ask question about general feedback, and be ready. The presence of these skills provides some non-empirical support for the skills targeted in Ehrlich et al., (2020). A comparison of articles that discuss specific recommendations around feedback reception skills can be found in Table 2.

There is little doubt that the use of feedback is prevalent in the literature and produces significant effects in terms of behavior change. For instance, the primary researcher conducted a title search of three major behavior analytic journals, 466 articles have been published across the last 10 years with feedback in the title field of the journal article. Also, in a review of organizational interventions in human services settings, feedback was found to be the second most common intervention strategy following antecedent training procedures (Gravina et al., 2018).

Practices in Developing and Delivering Computer-based Trainings

With the proliferation of technology over the past 40 years, the use of computers and technology in training has increased dramatically. Regarding behavior analytic applications of computer technology, there has been a significant increase in the use of computerized instruction in the past 10 years evidenced by the presence of publications using computer-based instruction as an independent variable. Even though the frequency of publications investigating computerized training is on an upward trend, the literature base is still in its infancy. It is also important to understand that although the literature base is small, researchers have replicated the effects of successfully teaching complex skills via computerized training.

In order to identify relevant evidence for the following literature review, a digital search was conducted. The search consisted of searching across five databases (Education Source, Education Full Text, ERIC, Psychology and Behavioral Sciences Collection, PsycINFO) with a number of search terms. The following terms were used in order to identify relevant research. Title terms that were used in the search consisted of "Computer* OR Computer-based" AND "train* OR teach* or improve*." The subject terms that were used in the search included only the term "applied behavior analysis" 137 initial results were identified, and 81 articles remained after eliminating duplicate results. Additional articles were excluded after review of the abstract resulting in 12 applicable studies. Studies were excluded if they did not meet the inclusion criteria below. Additional articles were included based on an ancestral and descendent search (n = 5). After the conclusion of the ancestral and descendent search a total of 17 articles were identified for the literature review. These articles were chosen because they met the inclusion criteria for the present literature review. All studies included a primary independent variable which included a training program that was computer-based, the skills targeted were relevant to professional performance, and the participants in the study were typically developing adults. We included only behavior analytic research as the focus was to identify an evidence-based appropriate organizational solution to teach a specific set of target skills (i.e., feedback reception) that might be scalable to train a large number of individuals. Whereas there are likely to be many studies in other related fields, the current study is intended to extend earlier behavior-analytic work in this area. Indeed, future researchers may wish to explore the research base in other related fields or collaborate with experts in those areas to explore other applications and refinements of computer-based training. Additional discussion of effective construction of computer-based trainings can be found in the discussion. A visual representation of the literature search process can be found in Figure 2.

Tudor (1995) conducted one of the first investigations of computerized training, exploring the impact of different types of responding to instructional frames in a computer delivered programmed instruction module. In that investigation, 75 undergraduate students participated in a programmed instruction in a group design. The experimental manipulation involved exposing groups to varying requirements regarding responses to advance across instructional frames. The researcher required the first group to press a button to advance through programmed instruction material. The researcher required the second group to press the enter button to access an answer to the prompt that was presented on the previous slide. The researcher asked the third group to “think” and answer each competency check question covertly to themselves. Lastly, the researcher asked the fourth and final group to “think” and type in correct answers to the competency check question prior to advancing to the next slide. The results of that study indicated that individuals who answered covertly and overtly significantly outperformed individuals in the first two groups on a fill-in-the-blank posttest.

In a replication and extension of the above study, Tudor utilized an alternating treatment design to assess the extent to which students correctly answered posttest questions when required to exhibit overt responding to programmed instruction frames (1995). Four participants were either exposed to programmed instruction frames where the frame was complete, and no overt response was required, or to an instructional frame that had blanks requiring a typed response. In that application of programmed instruction and active responding, Tudor confirmed that even when the same participant was exposed to different response requirements during programmed instruction, there was an increased likelihood that the student would answer posttest questions correctly when required to actively respond to competency check questions. Although these initial studies focused more on the impact of certain instructional design considerations, it is important to note the use of computerized instruction as early as the year 1991.

Applications of Computer-based Training in Complex Discrimination Tasks

More recent investigations of computerized instruction include the application of validated design strategies housed in a programmed instruction format. These programmed instructions target socially significant skills of participants in an attempt to increase the accuracy of a response in a quicker timeframe than traditional instruction. Ingvarsson and Hanley (2006) designed a computer-based programmed instruction module targeting increasing the use of parent names in teacher greetings. This study used a used a multiple baseline design across four undergraduate student teachers and included the instructional design considerations discussed above, requiring participants to exhibit overt responses embedded throughout the programmed instruction sequence. For instance, one educational frame might have included a picture of a child and requested a typed response to the question, “Who typically brings this child to the classroom in the morning?” All participants exhibited a marked increase in using parent names after the computer delivered programmed instruction as compared to baseline levels of performance. For two of the participants, use of parent names was highly variable after programmed instruction was delivered, resulting in feedback delivery from the investigators in order to remedy the performance issue. Although the target response in this study was not especially vital to job execution, it does demonstrate the feasibility of using computer delivered programmed instruction as a training mechanism to change behavior of multiple participants.

In the previous study, participants were essentially trained in matching a visual stimulus (picture) to a vocal response (name) and matching a parent’s name to a photograph. There are some instances where training more complex discrimination is important for clinician success. For instance, researchers have developed visual analysis skills via computer training (Wolfe & Slocum, 2015). The investigators used a group design to assess the effects of different training modalities on the performance of 123 participants separated into three different groups. Specifically, the training focused on teaching participants how to evaluate changes in slope and level of data using visually analysis. The control group consisted of a group of participants that were only exposed to pre-and post-tests. The lecture group was exposed to a video-based lecture of the target content. Lastly, the computer-based instruction group was asked to participate in a computer-based training that targeted the same content. In order to assess baseline levels of visual analysis skills, researchers asked participants to view a graph and rate if a hypothetical treatment caused an improvement in the level of the behavior and if the graph suggested the hypothetical treatment caused an improvement in the slope of the behavior. The researchers provided the participants with graphs to rate that depicted hypothetical treatments designed to both increase appropriate behavior and decrease inappropriate behavior.

A second group of participants were taught the same information via required reading and a didactic lecture format delivered in video format. In the didactic lecture group, optional support materials in the form of 20 flashcards with correct answers on one side were provided for participants. Also, participants in the didactic lecture group were able to ask questions about the material and received further instruction from the experimenters. For the computer training group, Wolf and Slocum developed a computer-based training that included a voice over presentation and animations that demonstrated concepts. The computer-based training included 80 practice trials where participants were asked the same two questions regarding slope and level that were presented in the pre-test condition. After responding to these active response prompts, participants received computer generated feedback that was either supportive (i.e., indicating that the answer was correct), or corrective (i.e., indicating that the response was incorrect).

The results of the study indicated that there was relatively little change in participant scores in the control group. The groups exposed to didactic lecture and computer-based instruction demonstrated much higher post-test scores when compared to their pre-test baseline. Although there were increases in participant performance for the two training groups, investigators noted that there was still significant variability in performance.

O'Grady, Reeve, Reeve, Vladescu, and Lake (2018) explored using computer-based instruction to train visual analysis skills. The investigators trained 20 participants, consisting of undergraduate, graduate, and post-graduate students, in the visual analysis of baseline-treatment graphs. The researchers used a multiple baseline across responses design to assess intervention effects which consisted of baseline and treatment phases. In the baseline condition, researchers asked participants to analyze 10 hypothetical baseline-intervention data and answer questions regarding the level, trend, and variability of the dataset, as well as the overall effect of the intervention. In the intervention phase of the experiment the researchers asked participants to progress through a computer-based training that taught visual analysis skills. The training included active responses prompted by the display of sample graphs and a question that gaged participant understanding of the material. Scoring above 90% correct on active response questions resulted in participants progressing to subsequent training modules. Failing to achieve the performance criterion resulted in the computer routing participants back to the beginning of the module to progress through content again. Following training, the researchers assessed generalization by asking participants to rate intervention effects of AB graphs displayed on printed graphs. Maintenance was assessed at one day, one week, two-weeks, and one month after participant exposure to the computer-based training.

Participants in this study all exhibited performance below a 70% accuracy criterion prior to intervention and performance above the 70% criterion after participating in the compute-based training modules. For most participants, performance sustained across generalization and maintenance probes. Only two participants exhibited a slight decrease in the trend of performance during generalization probes. Participants also reported the training as very acceptable in terms of intervention effects and intervention acceptability. Investigators reported that this study assessed the feasibility of training individuals on visual analysis in a more complex format by assessing participant performance on discriminations of level, trend, variability, and overall treatment effects. Also, investigators discussed that the intervention was wholly automated, requiring almost no interaction with investigators which may have implications in producing more effective training strategies for behavior analytic organizations that require clinicians to have a strong understanding of visual analysis techniques.

Other applications of computer-based trainings have used different teaching procedures in order to develop skills in target populations. For instance, Albright, Schnell, et al., (2016), used an equivalence based instructional technique delivered via computerized training to teach the functions of behavior to eleven graduate students studying applied behavior analysis. Each participant was exposed to four different classes of stimuli which could give an indication of function of a hypothetical problem behavior. These classes of stimuli were labels of the four different functions of problem behavior, descriptions of antecedent conditions in which the problem behaviors were likely to occur, functional analysis graphs, and vignettes of one occurrence of problem behavior with a brief description of the consequence. All stimuli used in the study were hypothetical and generated by the research team.

Due to the complexity of the training task, there were a number of conditions utilized in the study. First, students were exposed to an oral pretest. In the oral pretest, participants were exposed to the description, graph, and vignette, then asked to identify a function. Participants were asked to repeat this process over three trials for each function, representing 12 trials of oral pretest. In the subsequent phase of the experiment, participants were asked to complete a multiple-choice written pretest. Students were allowed 30 minutes to complete a 48-question test where each of the possible stimulus relations was presented and participants were required to read the stem and identify the corresponding equivalent stimulus from a list of one key and three distractor stimuli. After both the oral and written pretests, the participants were asked to participate in a computer-based pretest that assessed participants on all combinations of equivalence relations. For example, participants were tested on label to description, graph to description, vignette to label, etc. Following all of the pretests, participants engaged in a computer-based training that explicitly taught three specific equivalence relations: 1.) label to description, 2.) label to graph, and 3.) description to vignette. Participants were then tested on derived relations, meaning, relations that were not directly trained in the computer-based training sequence. These tests occurred between the training of each of the three direct trainings on equivalence relations. To conclude the study, the participants were exposed to three posttests and three two-week maintenance posttests, oral, written, and computer-based that were structured identically to the three pretests.

The findings from the study indicate that the computer-based training was effective in teaching symmetric and equivalence relations between all stimuli. All participants scored significantly higher on posttests and maintenance phases after exposure to the computer-based training that targeted equivalence relations. There was relatively little difference between scores of symmetric and equivalence relations in posttest scores of the participants. In this study, investigators also assessed social validity of the training technique which scored highly acceptable across all participants. This study replicated previous findings that indicated computer-based instruction is effective in teaching complex discrimination skills and extended the literature base by demonstrating that this method of instruction can also produce derived stimulus relations in a graduate student population.

In 2018, Schnell et al., investigated the utility of using a computer-based training to teach 20 graduate students to make procedural modifications to standard functional analyses. The investigators in this study used a multiple baseline across participants design with pre and posttest measures in order to assess competency on a 70-item multiple-choice examination. The multiple-choice examination consisted of 10 questions about reinforcement contingencies present in each condition of the standard functional analysis procedure. It also included 30 case scenarios with two questions in relation to each case scenario that assessed participant understanding of appropriate functional analysis modifications. The multiple baseline design consisted of participant dyads where one participant entered the intervention phase of the experiment after exposure to a second pretest that was identical to the first.

The computer-based training required participants to progress through a number of training modules that presented content and concluded with a 10-15 multiple choice competency check. Failure to achieve a performance criterion of 100% correct on the competency check resulted in participants repeating the module. The posttest items were identical to those presented on the pretest. The item stems and corresponding keys and distractors presented in random order. Once participants completed the computerized training, they were exposed to a novel case condition and a maintenance check. The novel case condition involved the investigators presenting 10 case scenarios and hypothetical functional analysis graphs with which the participants had no prior experience. The participants were then asked to answer two multiple-choice questions regarding appropriate procedural modifications for each case scenario. The maintenance condition was conducted two weeks after the computer-based training and involved the participants answering multiple-choice questions in relation to all cases and reinforcement contingency questions that had been previously asked throughout the study.

All participants demonstrated an increase in accuracy in posttest scores as compared to pretest scores. Some participants exhibited a greater degree of progress than others. Meaning, some participants exhibited higher posttest score increases than other participants. This may be due to the fact that some participants entered the intervention phase of the experiment with performance scores close to 80%, whereas others entered that phase with scores as low as 41%. The investigators discussed that the training took very little time compared to traditional methods of training these skills however, there was no empirical analysis of the actual amount of time saved. One aspect of the study that warrants consideration is the fact that assessments of the primary dependent variable were limited to responses on multiple-choice test questions. That is, there was no examination of participant performance in real-life scenarios. There is a possibility that the skill of identifying appropriate procedural variations in vivo is different than the ability to discriminate between appropriate responses on a multiple-choice examination, therefore, it remains to be seen if the skills would have generalized to the natural setting.

Traditionally, training of functional assessment techniques is conducted in-person (McCahill et al., 2014); however, researchers have applied computer-based instruction to teach descriptive assessment strategies, in particular, the discrimination of antecedent and consequences (Scott et al., 2018). In that study, investigators used a multiple baseline design across participants to assess the impact of computer-based training on the discrimination of antecedent and consequence variables. In experiment 1, participants consisted of 21 teachers and 18 paraprofessionals employed in school districts. Participants had varying levels of experience in terms of years and student population. The dependent measure was the detection of programmed antecedents and consequences delivered in video format. Meaning, participants viewed videos of a hypothetical scenario and identified which stimuli they considered to be antecedents or consequences.

In baseline, researchers provided participants with brief instructions to watch a video and identify events that occurred before and after the problem behavior scenario. Investigators then calculated the percentage of correct antecedents and consequences identified. The investigators used a secondary dependent measure of participant prevalence of falsely positives (i.e., identifying antecedent and consequence variables that were not present or relevant). In each session, participants had the opportunity to score 11 antecedents and 11 consequences present in each video. After baseline, researchers asked participants to participate in a computer-based training focusing on teaching participants to discriminate antecedents and consequences. The computer-based training consisted of a voice-over presentation and opportunities to practice identifying antecedents and consequences presented in video format. The training video consisted of three distinct sections: 1) single exemplar training, 2) multiple exemplar training, and 3) multiple exemplar training with simultaneous events. The single exemplar training section included examples of an antecedent and consequence for one of the three social functions. The multiple exemplar portion of the training video included multiple examples of antecedents and consequences across the social functions of problem behavior. Finally, the multiple exemplar with simultaneous events section included examples of antecedents and consequences that occur at the same point in time across at least two social functions. Investigators assessed participant performance after the conclusion of each section of the video presentation. Results of Experiment 1 indicate that participant performance increased after each section of the video. However, investigators found that some participants exhibited significantly more false positives in assessing multiple exemplar situations with simultaneous events. In all, there were significant increases in participant performance compared to baseline.

Study 2 consisted of 11 teachers and 9 paraprofessionals. Investigators attempted to reduce the prevalence of false positives in participant performance by redesigning the training video into two sections. The first was similar to the single exemplar training section in experiment 1; however, the researchers included more discussion of the occurrence of simultaneous events and practice opportunities to aid in discrimination of relevant antecedents. After this condition, participants were exposed to a section identical to the multiple exemplar with simultaneous events video from Experiment 1, but with more examples. In Experiment 2, investigators found that explicit training on simultaneous events increased participant performance in accurately identifying antecedent and consequence events, as well as reducing identification of false positives in the mean score. All participants still identified false positives but, to a lesser degree in assessment scenarios.

Applications of Computer-based Training to Complex Behavior Chains

There is likely a difference between exhibiting a single physical response with accuracy and exhibiting a series of more complex responses. The training of these different types of complex responses may require different approaches to reach optimal outcomes in research participants. The following section focuses on research using computer-based instruction to teach or expedite the teaching of complex behavior chains that were overt and physical in nature.

Researchers have used computer-based instruction to investigate the impact of teaching discrete trial and backward chaining skills to four undergraduate psychology students working with individuals with intellectual disabilities (Nosik & Williams, 2011). Nosik and Williams used a computer-based instructional program with modeling to teach the initial skills required to accurately engage in discrete trial teaching and backward chaining in a multiple baseline design across participants design. The program was designed to assess knowledge of the two response repertoires. Participants were also given written feedback based on their performance post-computer-based instruction.

The computer-based training included the typical steps found in BST, with slight modifications. First, a skill was described, then modelled, then each participant's performance on discrete trial and backward chaining tasks was quantified based on a task analysis. After exposure to the computer-based instruction, failure to perform the target task with 100% accuracy resulted in exposure to a written feedback condition. The written feedback condition consisted of the investigators demonstrating four scenarios of the target skills which were recorded and displayed for each participant in video format. One of the demonstrations was an accurate demonstration of discrete trial teaching and backward chaining, and the other three demonstrations were inaccurate demonstrations of the target skills. The participant was asked to score the accuracy of each demonstration and at the end of the video demonstrations. Participants were then shown an accurately scored checklist of that particular demonstration. If participant performance still did not reach the 100% accuracy criterion, participants were exposed to a condition of observed feedback. The observed feedback condition consisted of the participants engaging in the same procedures as the written feedback condition with the exception of an added requirement that the participant watch a subsequent video models receiving performance feedback on the inaccuracies of their performance. Because this investigation examined the effectiveness of different components of the interventions, the investigators asked all participants to participate in all three conditions. After exposure to all three conditions, all participants demonstrated a significant increase in both targeted skills. There was also an indication that performance could maintain at an appropriate standard up to six weeks after the last condition of intervention.

Nosik et al. (2013), subsequently conducted a comparison of computer-based instruction and live BST to teach discrete-trial instruction for new front-line staff who worked with adults with disabilities. Six participants were split into two groups and each group was assessed using a multiple baseline design across participants. One group participated in traditional BST (delivered by a trainer) and the other group participated in a computer-based instructional program. The computer-based instructional program was developed similarly to the 2011 study, in that, it consisted of an instructional presentation with voiceover, models of accurate and inaccurate exhibition of the target skill, and feedback. The feedback component required the participants to score modeled scenario fidelity with a checklist that was provided by researchers, the participants were then shown an accurately completed performance checklist for each model they viewed. Participants in the BST sequence received instruction, modeling, rehearsal, and feedback. Each experimental group received instruction on the delivery of discrete trial instruction for a gross motor task. Investigators found that the computer-based instruction produced a large increase in the accuracy of the target skills; however, it did not produce performance increases as significant as those produced by BST. Another finding from the study that may be somewhat concerning is that the participants in the computerized training demonstrated significant performance deterioration during maintenance checks. Researchers indicated that BST lasted approximately three times longer than exposure to the computerized training. This dosage difference between training formats may have been a confounding variable in the study.

Pollard et al., (2014) conducted a similar follow-up study investigating a computer-based instruction to train discrete trial teaching procedures the following year. This computer-based training included a voice over presentation with competency checks embedded throughout. The computer-based instruction included open ended questions on some slides, if the questions were answered correctly, the participants were allowed to advance to subsequent content. Incorrect responding resulted in participants repeating that segment of the computer-based instruction until the open-ended question was answered correctly. There were also segments of the training where instruction was paused, and participants were prompted to practice certain skills that had been modeled in the modules. The investigation used a pre- and post-test competency assessment as a dependent variable. There was an item bank consisting of 20 test questions and 10 items were randomly selected by the computerized instruction to develop the pre- and post-tests. After participants participated in the computer-based training they were asked to demonstrate the skill with an adult model. If the participants reached a predetermined accuracy criterion, the participants were then asked to implement the discrete trial teaching procedures with a child with autism. At this point, if performance did not reach the accuracy criterion performance feedback was delivered. The experiment used a multiple baseline design across participants to assess the effects of the intervention.

Results indicated that all of the participants of the study exhibited increased accuracy as they progressed through the computer-based instruction. Only one of four participant required performance feedback. Regarding the pre- and post-test scores, all participants exhibited higher scores on the post-test after receiving the computer-based training. Although there was a significant increase in performance immediately after the delivery of the performance feedback, the performance of two participants deteriorated as they progressed to the step requiring demonstration of the discrete trial teaching procedures with children with autism.

In 2016, a replication and extension Pollard et al. (2014) was conducted with undergraduate students in Brazil (Higbee et al., 2016). This series of two experiments used a similar method to the previous study conducted by Pollard et al., in that, it involved a voice over lecture with active student responding in the form of open-ended questions. The computer-based was developed in a number of modules that targeted discrete trail teaching skills. Each study used a multiple baseline design across participants in order to assess intervention effects.

Experiment 1 targeted undergraduate students in Brazil who had no prior training in discrete trial teaching. As participants progressed through the computer-based training, if active responses were incorrect, participants were required to return to previous material for review. If the participants responded accurately to active responding prompts, they were allowed to progress through the material. Participant discrete trial instruction performance was scored via a fidelity checklist outlining the steps involved in demonstrating accurate discrete trial instruction steps. At first, researchers asked participants to demonstrate discrete trial instruction in a roleplay scenario until performance reached a predetermined criterion. After participants met that criterion, they were asked to demonstrate the skill with children with autism. If participants did not exhibit accurate performance on the discrete trial instruction tasks with high fidelity, performance feedback was provided by investigators. In Experiment 1, Computer-based training produced an increase in accuracy of responding on a discrete trail instruction task for all participants. However, the computer-based training did not produce mastery of the skill. Application of performance feedback was necessary to increase accuracy of the target skill to levels deemed acceptable in a clinical setting. Only two participants in the study met the acceptable performance standards without receiving feedback.

In Experiment 2, the procedures were replicated with four special education teachers who worked at an institution that served children with significant disabilities. This second study replicated the method and procedures from (Pollard et al., 2014) and extended it by including a phase that assessed the maintenance of the discrete trial instruction skills. In addition, in the second study participants were not required to first implement the discrete trial skills in a role play scenario. Results of Experiment 2 were similar to Experiment 1, all participants exhibited an increase in target responding and two of four participants needed individual feedback sessions in order to reach the performance criterion. In the maintenance phase of Experiment 2, three out of four participants maintained performance after a one month period. For participant whose performance deteriorated, it did so significantly. However, that performance was recovered after performance feedback was delivered by experimenters.

Participants in Experiment 1 averaged 271 minutes of exposure to the computer-based instruction. The participants in Experiment 2 averaged 482 minutes of exposure to the training. Because of the slight differences in performance between participants in each study, it is important to note two considerations. First, the participants in study one and two had no history with discrete trial instruction, however, the participants in study two did work in a facility that served children with autism spectrum disorder and other significant disabilities. Second, there were significant differences in dosage of intervention between the two subject populations.

In a more recent application of computer-based instruction, researchers used a computer-based to teach parents to implement photographic activity schedules with children with autism spectrum disorder (Gerencser, et al., 2017). The utility of photographic activity schedules is significant in applied behavior analysis as it has been used to teach independence in complex activities (Betz, et al., 2008; Brodhead, et al., 2018). However, most of the studies that previously investigated the use of photographic activity schedules trained implementers in-person. This study included three parents with little or no experience implementing photographic activity schedules. Intervention effects were assessed using a multiple baseline design across participants. The investigators used computer-based training that consisted of voice-over presentations, models of appropriate implementation of photographic activity schedules and active responding to prompts embedded throughout the presentation to train the participants.

Similar to previous studies, the primary dependent measure consisted of accurate implementation of all steps of the activity schedule procedures. In baseline, parents were asked to implement the picture activity schedule with a research confederate. Baseline also used a brief probe where the participants were asked to implement procedures with a child. After participation in the computer-based training module, researchers again asked participants to implement the activity schedule protocol with a research confederate. Once participants reached a predetermined performance criterion, researchers asked them to implement the activity schedule procedure with the child. At this point, child participant adherence to the activity schedule procedure was measured as a secondary dependent variable. After children achieved accurate performance with the activity schedule procedure, maintenance of both parent implementation and child performance was measured in three sessions, two weeks after.

Results indicated that the computer-based teaching procedure effectively increased participants' accurate implementation of the activity schedule intervention with both research confederates and child participants. Parents maintained performance in the maintenance phase of the experiment as well. This study extended findings from the previous line of research indicating that the use of computer-based training is effective in parent populations. The authors also found a significant time savings when comparing activity schedule training via computer-based instruction to previous studies that used in-person training. The approximate time savings was 50-87 hours. Although there was no direct cost comparison between this study and previous studies that trained parents to implement activity schedules, one can assume that the cost of training multiple participants is greatly reduced due to the difference in the number of training hours that are required to bring parent performance to acceptable levels of implementation accuracy. However, previous studies have reported significant time investments by researchers in the development of computer-based trainings. Investigators did not report the time it took to develop the training but indicated that initial time investment could reduce the estimated time savings discussed above.

As stated previously, the training of more complex skills in a cost efficient manner could be very useful in organizational settings due to the potential cost savings. In a recent investigation, researchers trained supervisors to appropriately deliver performance feedback (Shuler & Carroll, 2019). The investigators used a multiple baseline design across participants to assess the intervention effects of a computer-based training to teach four supervisors in a university based autism clinic to appropriately deliver feedback. Investigators identified eight critical component behaviors that comprise effective feedback delivery. The primary dependent measure was the percentage of occurrence of these critical feedback behaviors. The experimenters included a pre-experimental condition where supervisors were trained on collecting fidelity data for a guided compliance procedure that would be used for later performance feedback. All supervisors left the pre-experimental condition after their agreement scores between participant and experimenter reached 90%.

Baseline performance was assessed by asking participants to score fidelity on a confederate subordinate's performance with the guided compliance task. The supervisors were then instructed to deliver performance feedback based on the confederate subordinate's performance. Supervisors received no feedback on their performance of feedback delivery. The following condition included a training program that used video modeling to teach the eight appropriate feedback delivery skills. The video modeling section was delivered via computer and included a series of exemplars of the component with voice over descriptions. Immediately after viewing the video, investigators asked the participants to deliver feedback in a simulated scenario. If participants did not achieve an 80% minimum on seven out of eight target skills, they were given further training via video modeling. Between one and four days after participants reached the mastery criterion, investigators measured the accuracy of feedback delivery in a post-training assessment phase. Throughout the post-training assessment, researchers probed participants' performance of feedback delivery for three sessions with a two novel behavior analytic tasks and with an actual subordinate. In this condition, the skills that were targeted were discrete trial instruction and mand training. After the post-training assessment, investigators used a follow-up probe approximately one month after the conclusion of the video modeling training.

Results indicated that the implementation of video model training increased the accuracy of appropriate feedback delivery behaviors in all participants except one. For that participant, video modelling and a tailored training based on the components of BST was needed to produce performance increases similar to other participants. All participants reached at least 80% accuracy exhibiting accurate feedback delivery skills in the post-training phase of the experiment. However, performance of each participant deteriorated when they were asked to deliver feedback regarding discrete trial procedures and mand training. Only one participant's performance deteriorated when delivering feedback to an actual subordinate. On average, participants agreed that the acceptability of the video modelling intervention was high. This study provides insight into methods that may be used to train supervisors to implement feedback in an appropriate manner. However, due to the performance deterioration in the novel behavior analytic procedure probes, it may be important to identify a strategy that would produce generalization of feedback delivery across contexts.

The last study of importance was conducted by Ehrlich et al. (2020) who investigated the impact of BST on the appropriate reception of feedback skills of three participants. Participants in this study were individuals who worked in a customer service setting. They ranged from 23 to 27 years of age and all had worked in the setting for at least two months. Two dependent variables were assessed throughout the study. The primary dependent variable was the exhibition of appropriate feedback reception skills. The investigators reviewed popular content in the management and business fields to identify a list of relevant feedback reception skills. The investigators then synthesized the findings from the literature review with six phone interviews conducted with senior-level personnel in the field of behavior analysis to derive a list of skills which became the primary dependent measure. This primary dependent measure consisted of eight component skills that composed appropriate reception of feedback. Those component skills were as follows: preparation, eye contact, follow-up questions, acknowledging mistakes, active listening, commitment to behavior change, appreciative statements, and overall demeanor. The secondary dependent measure was accuracy of performance on a job-related email task.

Prior to the study, all participants received didactic training regarding the accurate performance of interacting with customers via email. In baseline all participants were given feedback on their email performance two to three times per week. In each session, either the primary researcher or a research assistant delivered structured performance feedback. The reasoning for structuring the feedback was twofold. First, structuring feedback reduced the likelihood of performance variability due to significant differences in feedback structure. Second, structuring of feedback created opportunities for participants in this investigation to exhibit appropriate reception of feedback skills. For instance, if there was no pause after the delivery of a vague feedback statement, participants would not have an opportunity to ask a follow-up question in order to clarify the feedback statement. After baseline sessions, each participant was exposed to BST which targeted the specific skills associated with appropriate reception of feedback.

The BST consisted of a PowerPoint presentation that discussed the purpose of the skill and a description of how to perform each component skill. Participants were then given seven video models of each component skill that were modeled with varying levels of accuracy. At this stage, investigators asked participants to score the accuracy of each video model with a task analysis of the component skills. Investigators delivered feedback based on participant errors. If errors were made in the scoring of videos, participants watched and scored the video model until 100% accuracy was achieved. Investigators then asked participants to engage in role-play scenarios where the participant was required to exhibit the appropriate reception of feedback skills reviewed in the earlier stages of BST. One difference between this stage and traditional BST is that the participants did not need to achieve a predetermined performance criterion. Instead, investigators delivered further feedback on any performance deficits and allowed for participants to ask follow-up questions. For any performance deficits following BST, further feedback was provided regarding how a participant could demonstrate the skills with perfect accuracy. Following the post-training phase of the experiment, a two-week follow up probe was conducted to determine the extent of performance maintenance.

All participants in the study exhibited an increase in the target skills. In terms of the size of effect, participants exhibited a 40% to 150% increase in performance accuracy from baseline to post-training. For two of the three participants, performance maintained throughout post-training and follow-up phases of the experiment. However, it is important to note that none of the participants in the experiment maintained 100% correct performance throughout the study. There was only one participant that performed at 100% for one session post-training. Investigators posit that this may have occurred due to the counterintuitive nature of some of the feedback reception skills. For instance, with shorter feedback sessions of 2-4 minutes, it is unlikely that the feedback will be so intricate a participant will need to take notes to remember the specifics of the feedback. Also, there may be some colloquial differences between what was initially defined as an appreciative statement and what was exhibited by participants at the end of feedback sessions. For instance, some participants ended the feedback session with a departing statement that was neutral in nature and did not contain an appreciative element. The authors suggested that those pursuing this line of research in the future should attempt to refine the behavioral criteria of appropriate feedback reception behaviors.

Regarding computer-based trainings, there have been a number of demonstrations indicating this medium of delivery can produce increases in the accuracy of performance for a variety of participants. In review of the above studies, it is important to note that there are two main types of skills which are investigated, skills that are overt behavior chains that must be demonstrated in a certain order, and discrimination skills where individuals must make fine discriminations about the current environment. It seems that the target skills are a major consideration in the development of the structure and active response opportunities of computer-based trainings. For instance, those studies investigating the training of behaviors or behavior chains requiring an overt demonstration in order to gage accuracy, the computer-based trainings were typically developed based on the basic structure of BST. That is, the studies often included extensive video modeling and some form of feedback.

For skills that require individuals to make complex discriminations based on sometimes subtle aspects of the environment, computer-based trainings often involved comprehension checks, multiple exemplar training, and opportunities to practice making the target discriminations. Therefore, the computer-based training should include descriptions of the target responses, a rationale for the importance of target responses, multiple exemplars of the target responses, extensive modeling, discrimination of accurate and inaccurate instances of target responses, and some embedded feedback in the form of discriminating correct and incorrect responses.

Chapter III

Method

Experimental Design

The experimenters used a non-concurrent multiple baseline across participants design to assess the impact of the ICT on target feedback reception skills and primary job task performance. The experiment consisted of three phases, baseline, post-training, and follow-up.

Participants

Participants were recruited via a flier posted in public areas of the office building at an agency in the Intermountain West. The flier briefly described the study and directed interested individuals to email the primary researcher about possible participation. Four female individuals, one manager and three customer service specialists contacted the researcher expressing interest in the study. Participants were recruited into the study provided they held positions involving direct customer service but were excluded if they held management-level positions. Therefore, one interested individual was excluded from participating because she did not meet entrance criteria regarding her position level. Other inclusion criteria included that participants must have received regular performance feedback in the past, and their performance on the primary job task must not have been at the desired level of accuracy at the time of entry into the study (performance level was confirmed in the first baseline session).

Once accepted into the study, participants were exited from the study if they exhibited feedback reception performance above 70% in baseline or exhibited performance on their primary job task at above 80% in baseline. No participants were exited from the study. The participants ranged from 39-59 years of age. All participants worked in customer service roles for at least two months prior to participation in the study. Participants completed a standardized, formal onboarding process that included job-specific training at least six weeks prior to participation in the study. Participants reported having no formal training in feedback reception skills prior to beginning the study. Participants had a range of experience in their role at the current organization or a similar role at other organizations. Experience in a customer service role ranged from two months to 10 years across participants.

In addition to the above three participants, one manager was recruited into the study. The manager was 36 years of age at the time of participation. The manager had four years of experience working in a leadership role. The role of the manager was to evaluate the acceptability and validity of performance change in the participant from baseline to post-training. The manager did not serve as a supervisor for any other participant in the study.

Materials

The researchers used the latest version of Moodle, an open-source online learning management system, to develop the computer-based training program. Moodle allowed for researchers to upload PowerPoints, use voice-over recording to develop a presentation, and develop interactive activities targeting participant understanding. Researchers also used paper data sheets as well as electronic data collection systems in Microsoft Excel™ to collect data on the dependent measures.

All sessions were video-recorded using a USB camera connected to a computer. The video camera was placed in a corner of the room where feedback is delivered on a camera stand approximately 4 feet tall. Due to some work-setting changes that occurred shortly after beginning the study and were beyond the control of the researchers, participants used their work computers and video conference software to participate in research sessions. When participants used video conference software to participate in the study, sessions were recorded directly from the video conference platform. Participant work computers had onboard wireless internet capability, built-in microphones, and web cameras. In order to collect social validity data, two surveys were created in an online survey platform, Qualtrics. The research team used Box.com to transfer customer service participant job products and videos to the manager participant.

Setting

The initial setting was a private office in the building. The office's approximate dimensions will be 9 feet by 12 feet. The office was furnished with two desks and three chairs. One desk functioned as a monitor stand and small workstation; the other desk functioned as a collaborative workspace. Two chairs were placed on either side of the workspace so the researchers and participants would face each other. The office had a door that remained closed for the duration of each feedback session.

However, shortly after beginning the study, the company implemented mandated work from home conditions related to the COVID-19 pandemic for all staff. At that point, the experiment transitioned to a videoconference setting for all remaining sessions. The videoconference platform was GoToMeeting, an online videoconferencing software that allows for face-to-face meetings and recording of those meetings.

Social validity questionnaires for customer service participants were sent to each participant via email with a link to the anonymous social validity questionnaire. The surveys were completed from the participant's work computer in their homes. For the manager-completed social validity, the manager received all products electronically. The manager participant scored these products via online survey from their own home.

Dependent Variables and Measurement

The primary dependent measure consisted of six component behaviors related to the appropriate reception of feedback. These responses were derived from the study conducted, and the limitations discussed, by Ehrlich et al. (2020). Those responses include eye contact, follow-up questions, acknowledges mistakes, active listening, commitment to behavior change statement, overall demeanor.

Eye contact is defined as maintaining appropriate eye contact or orientation toward the manager who is delivering the feedback. Follow-up question was defined as the employee asking a specific question for more information when given only evaluative or objective feedback. Active listening was defined as the employee emitting vocalizations such as, "yes," "ok," "ahuh," or other vocalizations indicating they were attending to feedback. Commitment to change was defined as the participant making a vocal statement indicating how their behavior will change in order to perform the target task more accurately. Overall demeanor was defined as speaking in a friendly tone with an appropriate facial expression and attentive posture. These six component behaviors were assessed as the researcher delivered feedback to participants. The researcher delivered twice-weekly post-session feedback on the participant's emailing behavior (a vital task for the particular job position).

Because the authors in the Ehrlich et al. (2020) study indicated that two target responses, preparation, and appreciative statements rarely occurred in the post-training phase of the experiment. The authors suggested that the natural contingencies in the environment may not support these two response classes once acquired. In addition, it may be that these two responses may not be vital to appropriate reception of feedback or are subsumed by other skills present in the above target responses. Therefore, the researchers in the present study decided to omit them.

The secondary dependent measure was performance on a primary job task. For two of three participants, the primary job task included performance on an email task. For the third participant we selected performance on a document processing task. The participants in this study had formal training on policies and procedures surrounding email behavior and document processing as part of the company onboarding process. Performance around the primary job task served as the basis for researcher-delivered feedback. Primary job task performance was task analyzed and performance was monitored via permanent product. All employee interactions with customers were stored in an omnichannel support system or customer relationship management database which allowed managers and researchers to review at any time.

Participant email products were acquired by using this system to view permanent products from the participants historical email archive. For documentation processing data collection, all data were collected from an online customer relationship management database where documents were stored along with processing notes. In order to maintain confidentiality, all products scored for the secondary dependent measure were copied from the research site's databases and saved in individual participant files in a Utah State University secure online storage system.

All sessions of feedback were video-recorded for future data collection. Each video was scored by rating each of the behaviors outlined in Table 1. Table 1 is modified from Ehrlich et al., (2020). For scoring, each response was rated by the primary observer and be assigned either 0, 1 or 2 point, where 2 points exemplifies perfect execution of that target response.

The secondary dependent variable was measured via task analysis of the primary job task (email behavior for participants 1 and 2, and on an email task and document processing task for participant 3) based on the criteria set forth by the managers and trainers in the customer service department and performance accuracy was calculated as percentage correct. For Participant 3, an 8-item task analysis was also used to determine if an error was made in a document processed by the participant. If an error was discovered, the entire document was considered incorrect. This process was repeated across 10 randomly selected documents. The number of documents without errors was then divided by the number of total documents resulting in a percentage of documents scored correctly measure.

If participants would have exhibited a high degree of accuracy in the email task before or after participation in the computer-based training, it may have impacted the extent to which feedback could be delivered. If that did occur, researchers would have identified a novel task that was part of the primary job function of the participant and used that as the secondary dependent variable for the remainder of the study. However, participant scores in baseline and post-training never met the criterion above and it was not necessary to transition to a novel task.

Social Validity

Three social validity measures were used. The first measure assessed the appropriateness of the intervention from the participant perspective. Participants were asked to respond to each item on the social validity measure via an anonymous online survey platform. The researcher instructed the participants to respond to the social validity questionnaire by stating: “Please rate your level of agreement with the following statements." Each item was scored via a 5-point Likert-scale with the response options, strongly disagree, disagree, neither agree nor disagree, agree, strongly agree. The five items which participants were asked to respond to were as follows: 1) I found the computer-based training on feedback reception skills acceptable, 2) The skills taught in the computer-based training are appropriate, 3) Participating in the computer-based training has changed the way I receive performance feedback, 4) I feel my behavior has changed a lot since completing the computer-based training, 5) I would feel comfortable recommending the computer-based training to others. All social validity measures were distributed to participants after the post-training phase of the experiment. All participant answers remained anonymous.

The second social validity measure consisted of a novel manager rating performance change acceptability. Three primary job products were randomly selected from baseline and intervention phases and the novel manager was asked to rate the quality of the task samples based on the task analysis found in Appendix C. The job products and videos were renamed and delivered to the manager in a random order to ensure the manager remained blind to the participant’s identity and to phase of the study from which each video and job product was obtained. The manager was asked to score job products from three randomly selected sessions from baseline and post-training.

Because participant 3's primary job task required extensive training in order to be accurately scored, these data were only collected for participant 1 and 2. The manager was given the following instruction, "Please rate the email on the following categories," and asked to rate 1) the introduction and closing of the email, 2) the thoroughness and problem solving of the email, 3) the helpfulness of the email, and 4) the language and grammar of the email. All items used a 3-point Likert scale with the response options, inappropriate, appropriate, and exemplary.

The third aspect of social validity required the novel manager to rate videos of baseline and post-training performance. These ratings addressed the acceptability of participant and manager interaction during feedback sessions. The manager was asked 1) how appropriate was the feedback session?, 2) to what extent do you feel the participant exhibited appropriate behavior during the feedback session?, and 3) how acceptable was the interaction between the feedback provider and the feedback recipient? All ratings used a 5-point Likert scale with the response options very inappropriate, somewhat appropriate, neutral, appropriate, and very appropriate.

Interobserver Agreement

Data for calculating interobserver agreement (IOA) data were collected for both the primary and secondary dependent variables across all participants and phases for a minimum of 30% of sessions. An agreement was scored when the primary and secondary observer recorded the same score for a single target behavior. Therefore, there could be a total of six agreements per session on the primary dependent variable. For the secondary dependent variable, there were between 5 and 10 total agreements per session due to the difference between email scoring and document processing scoring. The total number of agreements per session was then divided by the total number of opportunities the participant had to exhibit the target skills that session. This produced a percentage agreement per session. Average agreement is reported for each participant independently across all phases of the experiment.

For Participant 1, IOA data were obtained for 44% of total sessions, 33% of baseline, and 50% of post-training and follow-up phases. The IOA scores for Participant 1 were 92% on feedback reception skills and 87% on email accuracy. For Participant 2, IOA data were obtained for 41% of all sessions, 40% of baseline, 33% of post-training, and 50% of the follow-up phase. The IOA scores for Participant 2 were 92% for feedback reception skills and 93% for email accuracy. For Participant 3, IOA data were obtained for 48% of total sessions, 43% of baseline and 50% of post-training and follow-up. The IOA scores for Participant three were 97% for feedback reception skills and 100% for documentation processing. The most common disagreements for feedback reception skills were acknowledging mistakes and active listening. The most common disagreements for the primary job task were on the items thoroughness and problem solving, timeliness, and helpfulness.

Treatment Integrity

Investigators gathered data to measure two aspects of treatment integrity across all participants and phases of the study for a minimum of 30% of sessions. First, data was collected on researcher delivered feedback in order to ensure that researchers maintained high quality feedback delivery throughout the study. The second aspect of treatment integrity that was measured is the application of computer-based training. The treatment integrity scoring sheet for researcher delivered feedback can be found in appendix D. A researcher observed or offered live technical support to participants progressing through the computer-based training (CBT) in order to make sure that the computer-based training ran as intended. If participant performance did not change, researchers tracked the appropriate application of CBT-b (CBT brief) and BST.

In order to measure the appropriate application of training sequences, a task analysis was used outlining all appropriate actions in terms of exposing participants to training based on participant performance. For example, if a participant performed poorly, in terms of exhibiting appropriate feedback reception skills, for at least two sessions following participation in the full computer-based training (CBT-f), then the participant would have been exposed to the CBT-b. None of the participants in the study required supplemental training to demonstrate appropriate feedback reception skills.

Treatment fidelity data were collected for all participants across all phases for a minimum of 30% of sessions in each phase. For all participants, the computer based training functioned as intended, yielding a treatment fidelity score of 100%. Regarding the treatment fidelity of feedback sessions for Participant 1, data were obtained for 44% of total sessions, 33% of baseline, and 50% of post-training and follow-up phases. The treatment fidelity score for feedback delivery for Participant 1 was 100%. For participant 2, treatment fidelity data were obtained for 41% of all sessions, 40% of baseline, 33% of post-training, and 50% of the follow-up phase. The treatment fidelity score for feedback delivery for Participant 2 was 97%. For Participant 3, treatment fidelity data were obtained for 48% of total sessions, 43% of baseline and 50% of post-training and follow-up. The treatment fidelity score for feedback delivery for Participant 3 was 98%. The most frequent errors made by the implementer were failure to deliver specific positive feedback on a previous job product (item 2) and failure to ask the participant if they could follow the recommendations provided if the participant failed to exhibit appropriate commitment to behavior change (item 9).

Procedures

Baseline. The participants received feedback from the experimenter based on task performance surrounding the primary job task. Three participant primary job task products were reviewed twice weekly and feedback was delivered based on errors identified in those primary job tasks. The primary researcher scored both appropriateness of feedback reception and primary job task accuracy. Participants continued in the baseline phase until each participant demonstrated stable responding or a downward trend in accuracy of responding on appropriate reception skills. If participants scored above 80% correct on the appropriate reception of feedback in baseline, the participant would have been discharged from the study. When a participant transitioned between any phase of the experiment, all other participants remained in their current phase to ensure that both email behavior and feedback reception remained stable. After 2-3 sessions of stable performance, the next participant was transitioned into the subsequent phase of the experiment.

Feedback delivery was structured so the feedback could be delivered in 3-5 minute sessions at least twice weekly. Because some of the primary target responses required an opportunity to ask a question about their performance, the researcher delivered feedback about at least one aspect of participant performance in a vague manner. For example, simply stating the percentage score of correct steps achieved on the email task analysis without providing an indication of which steps were performed inaccurately. This allowed the participant an opportunity to ask a follow-up question about their performance. All feedback sessions were structured in a manner that allowed for at least one opportunity to exhibit each target skill in a single feedback session.

Computer-based training. A computer-based instruction (CBI) was developed with the purpose of teaching appropriate feedback reception skills to the customer service participants. The computerized training involved: 1) a description of the target skills and a rationale for why the feedback skill is important, 2) video models of the target skills, 3) discrimination activities, 4) and feedback based on the correct or incorrect discrimination of each component skill of feedback reception. The computerized training had two versions: 1) a full version (CBI-f) consisting of approximately 90 minutes of instruction and interactive training and 2) a brief version (CBI-b) consisting of approximately 15 minutes of review and interactive training.

The description component of CBI-f included of a voice-over presentation with a description of each component skill of feedback reception. After the description of each component skill, a rationale was provided for each component skill. Also, a brief, accurate demonstration of each skill was provided via video model. After the conclusion of this stage of the training, participants were asked to discriminate between accurate and inaccurate performance of each component skill.

In order to increase the likelihood that participants could exhibit the skills upon the conclusion of CBI-f, participants were taught to discriminate between all skills. The participants were shown 12 video models of a feedback interaction where the role player demonstrated each feedback reception skill with varying levels of accuracy. Participants scored each component skill in terms of accuracy on a data collection sheet. After each attempt, participants were given feedback on their ability to discriminate between accurate and inaccurate exhibition of the target skills. Feedback was automated by displaying an accurately completed data collection sheet on-screen with supportive or corrective feedback for each component of the data collection sheet. This process was repeated until each participant scored all video models with 80% accuracy. If participants did not achieve the 80% performance criterion, participants were asked to view the video models again and participate in the discrimination task. This process was repeated until participants achieved the performance criterion. After meeting the performance criterion, participants transitioned to the post-training phase of the experiment. Although supplemental training materials were prepared if participant behavior did not respond to the initial computer-based training, no participant needed additional training in feedback reception skills.

Participant 1 completed the computer-based training in the presence of the primary researcher, however, the only assistance that was provided was technical in nature. For instance, the primary researcher provided instruction as to how to access and score the 12 practice videos. Participants 2 and 3 completed the computer-based training independently with online support from the primary researcher. No assistance from the primary researcher was necessary for participants 2 and 3.

Novel task probes. Originally researchers planned to use novel task probes to determine whether primary job task performance generalized across tasks. Unfortunately, the mandated move to work from home early in the study prevented the researchers from collecting these data as work duties shifted significantly. The researchers intended to collect probe data on phone performance, however, the company discontinued customer service phone support once employees moved to working from home. Due to the lack of phone support, novel task probes were unable to be collected for Participants 1 and 2. Participant 3 was recruited during the mandated work from home period. Researchers were unable to collect novel task probe data on this participant due to the limited access researchers had to that participant's data.

Follow-up. Maintenance sessions took place at 2-weeks and 4-weeks after participants had achieved the stability criterion established in the intervention phase of the experiment. In this phase of the experiment, no supplemental training was delivered. Researchers measured the primary and secondary dependent variables in the same manner as in baseline and intervention.

Duration measures for CBI. Training efficiency was gauged by calculating the number of in-person hours to complete a task or deliver a training. Therefore, the total hours of development and in-person time were tracked throughout the study. There are three main aspects of training time that were tracked. First, researchers tracked the total amount of time required to develop the computer-based training. Second, they tracked the total amount of time participants were exposed to the training, including all supplemental training. Lastly, the researcher derived the sum of total hours of training development and participant training time.

Error and acquisition analysis. Inspection of participant performance was conducted in order to determine if there were consistent errors within particular participants. Also, inspection of raw data occurred across participants in order to determine if systematic errors are exhibited across participants. Also, raw data were analyzed in order to determine if some feedback reception skills may have been more easily acquired than others.

Chapter IV

Results

Feedback Reception

All participants responded to the computer-based training with an increase in accuracy of appropriate feedback reception responses. A visual display of participant performance is shown in Figure 3. Participants required three to four sessions to achieve the mastery criterion of three consecutive sessions above 80%. Determinations regarding treatment effects were made using visual analysis, visual analysis with visual aids, and effect size indices which are described further below.

In baseline, participant 1 scored at a stable level of 45% accurate on feedback reception responses with no trend. After training, participant 1's responding in the initial session was 73%. Responding increased across the next two sessions to 91%, remaining stable for the next session. Participant 1 was exposed to a total of four post-training sessions. She met the mastery criterion of three consecutive sessions above 80% by the fourth post-training session. Responding in the 2-week follow-up session remained stable at 91% with a slight deterioration of performance at the 4-week follow-up session where she scored 81% accurate.

Participant 2 exhibited an initial increase in accurate appropriate feedback responses across the first three sessions of baseline with a subsequent deterioration in performance for the following two sessions. The level of responding in baseline averaged 58% accuracy with a lowest score of 45% and a highest score 73% accuracy. After training, participant 2 demonstrated an immediate increase in accuracy of feedback reception responses to 100%. Feedback responding accuracy declined slightly to 91% in the second session of post-training followed by a return to 100% accuracy in the third session. Participant 2 met the mastery criterion within three post-training sessions. In follow-up, participant 2's performance accuracy was 91% in the 2-week and 4-week follow-up sessions.

Participant 3 experienced seven baseline sessions, the most of the three participants. Participant 3 demonstrated relatively stable performance with low variability for the first three baseline sessions. In session four her performance accuracy increased slightly and stabilized by session six. Participant 3 averaged 56% accurate responding in baseline. Participant 3's accuracy in the first post-training session decreased significantly to 36%. Following that decrease, Participant 3's accuracy of feedback reception skills increased and remained high at 82%, 82%, and 91% in subsequent sessions with low variability and an increasing trend. In follow-up, participant 3 scored 82% in the 2-week session and 82% in the 4-week session.

Unbeknownst to the researchers, participant 3 received a one-on-one training on feedback reception skills independent of the research team. This exposure is indicated by a condition line between session three and four on her graphic display of performance. Implications of this exposure are covered in the discussion section. We do not have a definitive reason for why participant 3 was exposed to a feedback reception training by her manager, due to the need to protect her identity. We do know that she was the only staff member involved in the training. One can assume that exposure to the training by her manager was due to a performance deficit in that area. The specifics of that one-on one training session include: a) a 20 minute lecture and PowerPoint on the eight feedback reception skills targeted in Ehrlich et al. (2020), b) watching four video models of the component skills being demonstrated accurately, and c) a role-play activity where the participant and her manager role-played each skill and discussed the importance of those skills. In total, the one-on-one training lasted approximately 60 minutes. This training may have produced a slight increase in the accuracy of feedback responses, however, Participant 3's performance stabilized below the mastery criterion after this training was delivered. The major differences between the computer-based training and the reported structure of the in-person training are: 1) the computer based training included over four times the number of video models, 2) 12 of the 16 video models in the computer-based training required the participant to discriminate accurate responding, 3) there was no role-play activity in the computer-based training, 4) there was no mastery criteria for successful completion of the in-person training.

Primary Job Task

All participants responded to the computer-based training with an increase in appropriate feedback reception skill accuracy. A graphic display of participant data is depicted in Figure 3. Participants required three to four post-training sessions to achieve the mastery criterion of three consecutive sessions with accuracy above 80%. Also, participant performance remained above 80% in follow-up sessions.

Participant 1's performance on the primary job task deteriorated from 70% to 60% across baseline sessions with little variability in primary job task accuracy. Participant 1 averaged 64.6% job task accuracy in baseline. Following training, accurate performance increased to an average level of 79%. However, accuracy was somewhat variable throughout the post-training condition, ranging from 76% to 84%. In the follow-up phase of the experiment, participant 1 continued to exhibit slight increases in primary job task accuracy. Participant 1 exhibited 80% and 81% accuracy in the 2- and 4-week follow up sessions respectively.

Participant 2’s performance on the primary job task increased slightly in the baseline condition from 71% to 73%. There was slight variability in performance accuracy, with the lowest performance being 66% and the highest being 73%. Participant 2’s average level of performance accuracy on the primary job task in baseline was 70%. Participant 2 scored 76%, 80%, and 79% accuracy respectively in the three post-training sessions. In follow-up, participant 2’s job task accuracy continued to increase. At the 2-week follow-up, accuracy on the primary job task was 84%, and at the 4-week follow up session it was 92%.

Participant 3 exhibited fairly consistent levels of accuracy with no trend and slight variability on the primary job task in baseline. Her job task accuracy was at 70% for all baseline sessions, with the exception of sessions two and six which were 60% and 80% accuracy, respectively. Following training, participant 3’s performance scores increased to an average accuracy of 82%. However, the accuracy scores were moderately variable in the post-training phase with a low score of 70% and a high score of 90%. At the 2-week follow-up, accuracy on the primary job task was 90%, and at the 4-week follow-up session it was 80%.

Visual Aids and Statistical Analysis

To support the determination of whether the training produced a treatment effect on the primary and secondary DVs, several other analyses were conducted. We used the Conservative Dual-Criterion (CDC) method to project mean and regression lines to the post-training phase for each dependent measure of each participant in order to aid in visual analysis (Fisher et al., 2003). The CDC method also raises the mean and regression line by .25 standard deviations, which reduces the likelihood of type 1 errors or false positives. In addition to visual aids, a number of single-case effect size measures were used to aid in the analysis of data. The following effect-size indices were used: Tau-U, percentage of non-overlapping data (PND), Percentage of data exceeding the median (PEM), and improvement rate difference (IRD).

Each of these strategies have strengths and weaknesses. For instance, the CDC has been shown to increase the accuracy of visual analysis by decreasing the ratio of type 1 and type 2 errors in visual analysis (Fisher et al., 2003). In that same study, Fisher et al., found that the CDC model aided visual analysis performance similar to more complex statistical methods such as the general linear model and interrupted time series statistical methods. However, it is important to note that the use of the CDC did not eliminate type 1 errors but, reduced them to a greater extent than similar methods.

Regarding the effect-size indices used in the analysis, it was important to account for an upward trend in baseline for the primary job task in participants 2 and 3. Thus, the Tau-U effect size was used to determine if the change from baseline to post-training was acceptable (Parker et al., 2011). Tau-U is a superior method for controlling for an upward baseline trend than the split middle line (ECL) technique as Tau-U controls for monotonic trend where ECL controls for linear trend. Also, the ECL method uses percentage of data exceeding an extended mean where Tau-U uses a non-overlap after controlling for baseline trend. PND was used due to its straight-forward and intuitive nature. PND is also frequently used in the literature. This measure is derived from identifying the highest data point in baseline and calculating the percentage of data points in post-training that are above that point.

PEM is similar to PND; however, it uses the median instead of the highest point in baseline phase. Using the median value instead of the highest value in baseline as the median value may be a more accurate summary of baseline data than the highest value. IRD was the last effect size index that was used to calculate an effect. IRD is essentially the difference in improvement rates between baseline and post-training phases. However, IRD is still technically a non-overlap analysis which does not account for upward trend in baseline.

It is important to attend to the strengths and weaknesses of each effect size index when analyzing participant data. For instance, in cases where there is an upward trend in baseline for any dependent measure, Tau-U may provide the best non-overlap analysis, as it corrects for upward trends in baseline. Also, for those participants who exhibited one baseline datum that is higher than others, attending to the PEM may be more beneficial than PND. Also, for baseline data with a detectable upward trend and a continued upward trend in post-training, Tau-U may be most beneficial as PND and PEM may falsely indicate an effect. Follow-up data points were included in this analysis as they also came after the application of the one-time computer-based training. Scruggs and Mastropieri (1998), proposed a method for classifying the degree of effect based on non-overlap effect-size scores. They proposed that those interventions with effect sizes of over .90 were very effective, those between .7 and .89 as moderately effective, those between .5 and .69 as slightly effective, and those less than .5 as not effective. For Tau-U, scores lower than .20 are representative of a small change in the DV, scores between .20 and .60

are representative of a moderate change in the DV, scores between .60 and .80 are representative of a large change, and scores above .80 are representative of a very large change in the DV.

The effect size calculation for each participants' two dependent variables can be found in Table 6. Participant 1's scores for feedback reception are as follows: Tau-U, 1; PND, 1; PEM, 1; IRD, 1; CDC, 6/6 (See Appendix F). Participant 1's scores for primary job task are as follows: Tau-U, 1; PND, 1; PEM, 1; IRD, 1; CDC, 6/6 (See Appendix F). Participant 2's scores for feedback reception are as follows: Tau-U, 1; PND, 1; PEM, 1; IRD, 1; CDC, 5/5 (See Appendix G). Participant 2's scores for primary job task are as follows: Tau-U, .88; PND, 1; PEM, 1; IRD, 1; CDC, 5/5 (See Appendix G). Participant 3's scores for feedback reception are as follows: Tau-U, .52; PND, .83; PEM,.83; IRD, .84; CDC, 5/6 (See Appendix H). Participant 3's scores for primary job task are as follows: Tau-U, .61; PND, .5; PEM, .91; IRD, .69; CDC 4/6 (See Appendix H). Tau-U was the most conservative effect size index due to the prevalence of upward trends in baseline data, so we calculated an aggregated score across all participants for feedback responding (.83), primary job task (.84) and total (.83).

Overall Analysis of Effect

For Participant 1, the results of visual analysis, CDC analysis, and effect size indices all show a clear and immediate change in both dependent measures after the computer-based training was implemented. Thus, the computer-based training had an apparent treatment effect on feedback reception skills.

For participant 2, visual analysis results indicate a clear and immediate change of feedback reception skills after the application of computer-based training. Due to the presence of an upward trend in baseline, visual analysis of the effect of computer-based training on participant 2's primary job task is less clear. However, after application of the CDC and effect size indices, we found that 0 of the 5 data points in post-training overlapped with the regression line of the CDC. Also, due to the upward trend in baseline, the only applicable effect size index for primary job task is Tau-U. The Tau-U score for primary job task was .88. The non-overlap of the CDC and the .88 score for Tau-U provides sufficient evidence to claim the computer-based training appears to have had an effect on primary job task for participant 2.

For participant 3's feedback reception, the primary issue with claiming an effect is that there is a low initial datum (36%) as compared to the other data points in the post-training condition. However, the remaining data are well above baseline levels of performance. Although, we have no concrete explanation for initially low performance, we feel comfortable claiming that the computer-based training had an effect on feedback reception. For participant 3's primary job task, we find it difficult to claim the computer-based training had an effect on the primary job task. There is an upward trend in baseline, such that it does not allow the researchers to solely rely on visual analysis. The CDC analysis indicated that 2 of the 6 data in post-training overlapped with the regression line, which precludes us from claiming there is an effect. The standard for claiming an effect when using CDC for a 6 data point treatment condition is that all 6 data must be above the regression line. Also, the only applicable effect size index, Tau-U (.61), does not provide sufficient evidence to claim an effect. Thus, there is not sufficient evidence to claim that computer-based training had an effect on job task performance for participant 3.

Social Validity

Three social validity scores were conducted after the conclusion of the post-training phase. Participant responses to social validity measures can be found in Table 3. To analyze these data, two dimensions of the visual displays were analyzed. Each item had an odd number of response options with the middle value serving as a neutral point for ratings of inappropriateness and appropriateness. Then, the modal rating was identified in baseline. If there was a positive shift in the modal value for an item from baseline to intervention, we considered that change to be a shift in the appropriateness of that feedback interaction or job product. In instances where the modal value remained the same, the second dimension that was analyzed was a decrease in inappropriate ratings from baseline to post training.

For instance, the manager could have scored three interactions as somewhat appropriate, five interactions as appropriate, and three interactions as very appropriate in baseline. Then in post-training, the manager could have scored one interaction as somewhat appropriate, two interaction as neutral, five interactions as appropriate, and three interactions as very appropriate. This scenario would have resulted in no modal shift in our data. Thus, the decrease in interactions rated as inappropriate would indicate an overall shift in perceived appropriateness of those interactions. Although the number of response options and anchors changed based on whether the manager was scoring feedback interactions or primary job products, the same technique to determine change was used across all manager ratings. This strategy was repeated for each item the manager rated.

The first social validity measure assessed the social validity of the computer-based training with five items. When asked if participants would recommend the training to others, two participants agreed, and one strongly agreed. On the items asking about training acceptability and the appropriateness of the target skills, one participant strongly agreed, one participant agreed, and one participant neither agreed nor disagreed. Participants provided lower scores regarding their perceived change in behavior with two participants neither agreeing nor disagreeing, and one participant strongly agreeing. When asked if their behavior changed “a lot” after the computer-based training, one participant strongly agreed, one participant disagreed, one participant neither agreed nor disagreed.

The second social validity measure assessed the acceptability of change in feedback reception from a novel manager perspective. A visual display of baseline and post-training scores on these social validity measures can be found in Figure 4-6. Regarding scoring video products, the manager was first asked to score the acceptability of the feedback session. In baseline videos, the manager scored three videos as appropriate and six videos as very appropriate. In post-training videos, the manager scored one video as appropriate and eight videos as very appropriate, indicating a positive modal shift.

The manager was then asked to rate the appropriateness of participant behavior in feedback sessions. The manager scored baseline videos as one somewhat appropriate, one neutral, six appropriate, and one very appropriate. In post-training videos, the manager scored one video as neutral, four videos as appropriate, and four videos as very appropriate, indicating a positive shift from unimodal (appropriate) to bimodal (appropriate and very appropriate). In the final video-based social validity measure, the manager was asked to rate the acceptability of the feedback interaction. In baseline videos, the manager scored one video as somewhat appropriate, four videos as appropriate, and four videos as very appropriate, indicating a decrease in inappropriate ratings. In post-training videos, the manager scored five videos as appropriate and four videos as very appropriate. The manager's scores indicate that there was an overall increase in appropriateness across the feedback session, participant behavior, and feedback interaction after participants received feedback reception training.

The final social validity measure assessed the overall quality of the primary job product in both baseline and post-training. A visual display of manager scores for participant work products can be found in Figure 7. The manager provided four scores for 12 sets of emails across baseline and post-training. Meaning, the manager participant provided a total of 48 scores for baseline and post-training emails combined. When asked about the introduction and closing quality in baseline emails, the manager participant scored one as inappropriate, one email as appropriate, and four emails as exemplary. In post-training emails the manager scored one as appropriate, and five as exemplary, indicating a positive modal shift. When asked about the thoroughness and problem solving of emails in baseline, the manager scored two as inappropriate, two as appropriate, and two as exemplary. In post-training emails, the manager scored one as inappropriate, four as appropriate, and one as exemplary, indicating a decrease in inappropriate ratings. When asked about the helpfulness of emails in baseline, the manager scored two emails as inappropriate, one as appropriate, and three as exemplary. In post-training, the manager scored one as inappropriate, four as appropriate, and one as exemplary, indicating a decrease in inappropriate ratings. When asked about the language and grammar of emails in baseline, the manager scored one as inappropriate, four as appropriate, and one as inappropriate. In post-training, the manager scored one as appropriate and five as exemplary, indicating a positive modal shift. Overall, the manager scored job task products that were produced in the post-training phase of the study as more appropriate than those that were produced in baseline.

Training Cost Analysis

There are three main components of training cost effectiveness, initial investment, ongoing maintenance costs, and benefit. Initial investment is discussed below as the total amount of hours that were required to create the training. In this study, it took approximately 45 total hours to develop the computer based training. A complete breakdown of investment time can be found in Table 4. It is important to note that this number reflects the total time across both the training developer and those that served as the video models for practice components of the computer-based training. In order to determine an overall cost for the development of the training, an hourly rate of $30 per hour was used to derive a total development cost of $1,350 for the computer-based training. The hourly rate for computer-based training development is based on the average salary of $60,000 per year for eLearning developers (Glassdoor, 2020). If in-person trainings of a similar duration were to be provided, it would take approximately 30 deliveries of the training, to break even on the investment. This number only accounts for the time of the individual delivering the training. If the payment of a group of trainees is also calculated into the total cost of in-person delivery, the number of trainings needed to break even on the training investment could be much lower. For instance, if a group of

10 trainees were paid at $12 per hour, the average pay for customer service personnel at the research site, during the in-person training, the total cost of one training would be $225. If we use this group training cost to calculate the return on investment for the computer-based training, it would take approximately six in-person trainings to break even on the initial investment of developing a computer-based training.

Error and Acquisition Analysis

Error and acquisition analyses were conducted for all participants upon the conclusion of the follow-up phase of the experiment. On an individual level, most participants who failed to exhibit a specific target response in baseline improved the accuracy of that response in post-training. Individual participant error patterns can be found in Table 5. For all participants, the average score in baseline and post-training for eye contact and overall demeanor was 2. Meaning, there was no error made on either skill throughout the entire study. However, there were individual differences in the acquisition of target skills for participants.

The target responses were scored 0, 1, or 2, with the exception of commitment to behavior change which was scored either 0 or 1. For participant 1, follow-up questions were quickly acquired with a baseline average of 0 and a post-training average of 1.75. Participant 1 also acquired commitment to behavior change quickly with a baseline average of 0 and a post-training average of 1. For active listening, participant 1 averaged a score of 1 in baseline and 1.25 in post-training. For acknowledging mistakes, participant 1 averaged 0 in baseline and 1.25 in post-training. Based on a review of the data, the easiest skills to acquire for participant 1 were follow-up questions and commitment to behavior change. The most difficult skills for participant 1 to acquire were active listening and acknowledging mistakes.

For participant 2, commitment to behavior change was quickly acquired with a baseline average of 0 and a post-training average of 1. Asking a follow up question was also quickly acquired, with a baseline average of .40 and a post-training average of 2. For acknowledging mistakes, participant 2 averaged .40 in baseline and 1.67 in post-training. For active listening, participant 2 averaged 1.6 in baseline and 2 in post-training. For participant 2, commitment to behavior change and follow-up questions were the easiest of the skills to acquire. Acknowledging mistakes was the only feedback reception error for participant 2 in post-training.

For participant 3, acknowledging mistakes was quickly acquired with a baseline average of .43 and a post-training average of 1.50. For follow-up questions, participant 3 averaged .14 in baseline and .75 in post-training. For commitment to behavior change, participant 3 averaged .29 in baseline and .75 in post-training. Participant 3 was the only participant to exhibit skill deterioration on one component skill in post-training. Participant 3's active listening average score in baseline was 1.29, which dropped to 1.0 in post-training. It is also important to note that participant 3's average scores are much lower than others due to seven baseline sessions, four post-training sessions, and participant 3's worst performance score (36%) having occurred in post-training. Overall, it seems as though acknowledging mistakes was quickly acquired by participant 3 and commitment to behavior change and follow-up questions had the highest error rates.

In order to better summarize the overall difference across all participant scores in baseline and post-training, an average score across all participants was collected for each individual target response in baseline and post-training. These data are displayed in Figure 8. In baseline, the most common responses participants omitted were follow up questions, acknowledging mistakes, and commitment to behavior change. In baseline, participants never emitted appropriate eye contact and appropriate overall demeanor. After participating in the computer-based instruction, participants were more likely to exhibit follow-up questions, acknowledging mistakes, and commitment to behavior change. Again, participants rarely failed to engage in appropriate eye contact and overall demeanor.

Chapter V

Discussion

Implications

The present investigation demonstrates that exposure to the computer-based training produced an increase in the accuracy of feedback reception skills for all three participants. This is demonstrated by the clear and immediate change for all participants in their primary dependent measure following training in feedback reception. Both visual analysis with visual aids, and effect size indices, confirm this finding.

However, in participant 3, due to initially low performance in baseline, effect size scores indicate that the effect of the independent variable is debatable. When a regression line is used to show trend from baseline, these low data in the first three sessions of baseline produce a much higher baseline trend than what one might expect from visual analysis alone.

There was also a corresponding increase in accuracy on the primary job task in two of three participants. Both visual analysis with visual aids and effect size indices confirm this effect for participants 1 and 2. Although the increase in level of responding may be less than that seen in the primary dependent variable, an effect is still demonstrated for two of three participants. Regarding participant 3, there is no evidence to support that the independent variable had a similar effect on her primary job task performance. For instance, 2 of 6 data points are below the regression line populated by the CDC. Fisher et al. (2003), provided guidance for the number of post-training data points which would need to fall above the regression line. In order to conclude that there was a reliable treatment effect using the CDC, all 6 data points would have needed to fall above both the mean line and regression line. The Tau-U effect size index score for participant 3 was .61, although Tau-U is indicative of an overall change from baseline, it may not be representative of an experimental demonstration of effect. Although an averaged Tau-U score was reported across all participants for the job performance task (.84), these results must be tempered with differences in responding at an individual level. Considering this evidence, the study failed to produce three clear demonstrations of effect on the dependent measure of primary job task. Thus, we cannot claim a functional relation between computer-based and the primary job task.

Participants generally maintained accuracy above the mastery criterion in feedback reception skills into the follow-up phase of the experiment. This demonstration indicates that the computer-based training was effective at developing appropriate feedback reception skills, which may maintain for at least one month after training.

There was a corresponding increase between appropriate reception of feedback and job task performance for only two of three participants; however, the design of the study prevents confirmation of the hypothesized mechanisms responsible for those increases. We hypothesized that the increase in participant job task performance may have been due to appropriate feedback reception responses supporting the development of self-generated rules which guide future performance. However, the only evidence to suggest this may have occurred was an increase in both dependent measures in two of three participants, providing minimal indirect support for the hypothesis. The purpose of this study was to investigate the impact of a computer-based training on feedback reception skills. The research questions were not designed to investigate the hypothesized conceptual basis responsible for any effects. However, the inclusion of the conceptual analysis may provide a possible framework to support future researchers who are interested in similar topics.

Another important contribution is that a new response category for primary job performance was included in this study, demonstrating that this type of training may be used with individuals with a diverse range of job tasks. For instance, previous research on feedback reception skills focused solely on email interactions of participants. Although email interaction remained the focus for participants 1 and 2, participant 3's primary job task was a document processing task. This primary job task was thoroughly outlined and thus, did not necessitate social validation of behavior change from baseline to post-training.

One interesting finding from the acquisition and error analysis was that the participants in the current study always exhibited appropriate demeanor and eye contact. This may be attributed to hiring practices specific to the research site or individual histories of reinforcement associated with demeanor and eye contact in performance feedback meetings. This finding may suggest that the number of skills taught in feedback reception may be further limited as the current work environment naturally supports appropriate eye contact and overall demeanor. An alternative explanation may be that the culture in which this research project took place naturally supports these responses. However, future researchers may wish to probe the accuracy of eye contact and overall demeanor in potential participants as these responses could be supported by natural contingencies. It could be possible to teach only follow-up questions, acknowledging mistakes, and commitment to behavior change to produce significant change in the accuracy of feedback reception skills for those participants with high probe scores.

In the individual acquisition analysis, each participant was unique in their error rate regarding specific feedback reception skills. For participants 1 and 2, follow-up questions were associated with the lowest or second lowest error rate. This is likely due to the primary researcher providing a vague statement about performance at the beginning of each feedback session. This vague statement could be considered a more salient discriminative stimulus that evoked participants to emit a follow-up question. Active listening was associated with the highest error rate in post-training for participants 1 and 3. This could possibly have been an artefact of the videoconference delivery that was used throughout the majority of the investigation. When both participant and researcher spoke at the same time in the video conference, only one party's audio input would be active. This could have inadvertently shaped less accurate active listening as any participant vocalization during the feedback session may have interrupted the primary researcher's audio feed, resulting in a loss of valuable information. Although each exhibited different error rates associated with the target responses, all participants reached the mastery criteria within four sessions. This finding provides evidence in support of the generality of computer-based training being effective with individuals of diverse behavioral histories.

Due to the subjective nature of participant performance accuracy in both feedback reception skills and email performance, it was vital to conduct thorough social validity checks upon conclusion of the study. The participants, on average, found the training acceptable and indicated a likelihood of recommending the training to others, validating previous findings regarding the acceptability of computer-based trainings. Participants scored the acceptability of behavior change items lower than the acceptability of training items. It may be that the participants were not sensitive to the change in their own behavior. Participant reports regarding acceptability of behavior change could be related to the rationale provided for each component behavior in the computer based training or their ability to detect their own behavior change.

Future researchers may wish to provide a more in-depth rationale for these feedback responses or train participants to score the accuracy of their own feedback reception performance in order to better detect and changes after exposure to training. Another possible solution to the above issue may be to provide visual feedback of each participant's performance. Because participation in the study ranged from 6-10 weeks, participants may not have easily been able to compare current to past performance in feedback reception. Researchers could also follow a similar procedure to what was used with the manager participant in this investigation. The participants could watch baseline and post-training videos of themselves in order to better discriminate the degree of their own behavior change.

Overall, the social validity results from managers indicate that they identified a positive change from baseline to post-training in both feedback reception skills and email performance. Manager ratings of acceptability both for the recorded feedback interaction sessions and the primary job product indicates an increase in appropriateness in the post-training phase of the experiment. Although the degree of increase was modest, it is still an important finding. However, the use of a novel manager to score social validity of behavior change could be seen as a limitation and is discussed in the limitation section.

It is likely that the participants in this study were all performing at an acceptable level in both feedback reception and their primary job task prior to participation. There are two primary indicators that this may have been the case. Specifically the participant recruitment methods and inclusion criteria used in this study may not have been sensitive enough to capture those who were most in need of feedback reception training, and the participants' baseline levels were as low as one might expect if they performing well below acceptable levels. It may have been the case that the current performance management and quality assurance strategies at the research site promoted higher performance in feedback reception and job task performance on across all staff. Those employees who were unable to engage in appropriate feedback interactions or perform at an appropriate level at work may have been transitioned to different roles or had their employment terminated. It may be best to conceptualize the behavior change produced by the application of computer-based training as a way of enriching pre-established acceptable behaviors. For individuals classified as low performers or those with problematic workplace behavior, it is likely that feedback reception training alone would not produce a change in workplace interaction and job task performance that would be deemed acceptable by managers. When managers are attempting to remediate low workplace performance, it may be important to implement more intensive interventions initially to bring performance up to an acceptable level. Then, managers may consider providing feedback reception training to further improve performance. The strategies used in this study may be a way to produce change that is more desirable than the behavior that is maintained by the natural contingencies of the workplace setting.

Training costs are vital in organizations, as those costs may not be directly related to company income, especially for those in customer service roles. Many organizations wish to bring their new employees from onboarding to active work in the fewest possible days. In the analysis of costs associated with the computer-based training, it seems as though developing computer-based trainings would be a long-term investment for companies. For training skills that are relatively static, meaning, the skill is not impacted by process and system changes within a company, a computer-based training may be most appropriate. For skills such as the primary job tasks in this study, a computer based training may not be the best approach as it would need to be modified to align with systems and process changes, incurring additional costs.

Limitations

Although this study demonstrates a functional relationship for two of three participants between increased accuracy of feedback reception skills following a computer-based training, it is not without its limitations. The computer-based training was developed according to behavior-analytic research in the area of computer-based training. There are other fields that have investigated the development of computer-based trainings. For example, there have been a number of meta-analyses assessing the efficacy of computer-based instruction for a variety of content areas (McNeil & Nelson, 1991; Fletcher-Flinn & Gravatt, 1995; Bayraktar, 2001; Larwin & Larwin, 2011). It is possible that investigations in these fields have derived more efficient or effective ways in which to develop skills via computer-based training than those in applied behavior analysis.

None of the participants in this study served in a managerial role at the organization. It may be that individuals who have managerial experience may have developed more complex skillsets or have developed fluency in feedback reception responses. In order to better generalize from this line of research, future researchers should seek to include a more diverse participant base whose job duties are more complex.

In this study, no data were collected on change in manager feedback delivery rates. Although all feedback sessions in this study were conducted by the primary researcher, if participants generalized those skills to their manager-delivered feedback sessions, it may produce an increase in the rate of manager-delivered feedback. The reason behind the possible increase in manager feedback delivery rates is further discussed below.

A novel manager was used in this study to maintain confidentiality and mitigate any potential risk to the employment of participants. However, the use of a novel manager to score degree of behavior change may be a limitation in this study. It could be that the participants actual manager may have been better at discriminating the overall acceptability of behavior change due to 1) their overall familiarity with the job task, 2) expectation of employees who have that primary job task, and 3) their more extensive history in interacting with the participant in their own feedback sessions. Manager familiarity with the job task and a more in-depth understanding of staff expectations could possibly provide a more accurate appraisal of the change in quality of participant primary job task products as well. The history of interactions with participants in feedback scenarios may better position a manager to determine the degree of change associated with feedback reception skills. For instance, a manager with a three month history of delivering feedback to a specific participant may be more likely to identify differences in feedback reception skills than a manager who has watched three 5-minute videos of participant feedback sessions. Alternatively, one might hypothesize that the use of a novel manager is strength of this study. Because the manager had no history in evaluating the performance of the participants, it is possible that their assessment of performance was more objective.

Participants in this study were not observed in feedback sessions unrelated to the study. For example, participants receiving feedback from their managers around work performance. There is a possibility that all or none of the behavior change produced by the computer-based training generalized to other settings. It is possible that participants in this study effectively generalized the acquired skills to feedback sessions with their manager. Also, individuals may have multiple primary job tasks as part of their employment. Researchers were unable to collect probe data of other primary job tasks due to the conditions under which the study was conducted. There is a possibility that the feedback provided to participants could have supported rule generation which impacted multiple domains of job performance. For example, in participant 3, only one of many document types was used for their primary job task. It is possible that the rules generated from feedback sessions could have produced a corresponding change in all documentation processing. Future research concerning generalization is discussed below.

Suggestions for Future Research

The current study is an early exploration of a line of research that could produce significant impact on the fields of applied behavior analysis and organizational behavior management. Future researchers should explore functional relationships between specific feedback reception skills and performance on job tasks. Also, future researchers should analyze the differences between participant accuracy of feedback reception skills based on the type of job task on which the participant is receiving feedback.

The job performance task for participants in Ehrlich et al. (2020), and participants 1 and 2 in the current study, was an email task. Future research should seek to extend the findings of this research line to a variety of job tasks. Future researchers could either use a computer-based training or an in-person feedback reception training to assess the degree of change in job tasks other than email performance. Similarly, only customer service personnel were included in this study and Ehrlich et al. (2020). Future researchers should seek to extend the generality of this research line by providing feedback reception training to other roles commonly found in organizations. Such roles may include administrative personnel, front-line interventionists, or managerial staff.

Cost-benefit analyses are vital for determining the efficacy and acceptability of interventions that will be implemented in an organizational setting. These analyses should always be included in studies investigating organizational interventions. One avenue for future research to further explore is ways in which organizations can quantify the benefit to the organization after a training has occurred. Also, for organizations delivering frequent trainings on a particular topic, implementation fidelity should be measured over time to determine whether there is drift in the delivery of the training. If significant drift occurs, or if it is likely (e.g., different individuals delivering the training, long periods of time between delivering the training), computer-based training may be an effective way to remedy that issue.

All participants in the current study exhibited performance accuracy on their primary job task after feedback training. Although our hypothesis is that rules are likely generated from the feedback provided by the primary researcher, we have no direct support for this hypothesis. Future researchers may benefit in investigating the features of feedback which participants are likely to respond. For instance, feedback sessions that restate the consequences for making certain performance errors may be most likely to support pliance; whereas, feedback identifying a performance error and providing insight on how to increase accuracy may be more likely to support tracking.

According to Skinner (1953), the audience influences the speaker's future behavior. Future researchers should assess the long-term impacts of a universal training of this type on the overall contingencies that are present in the work environment. For instance, the increased accuracy in appropriate reception of feedback across most or all subordinates may increase the likelihood of a supervisor delivering performance feedback in the future. We hypothesize that increasing the acceptability of feedback interaction across all staff a manager oversees may increase the reinforcing value or decrease the punishing value of performance feedback delivery. In turn, managers may increase the rate in which they deliver performance feedback to staff.

Another possible avenue of research is to identify the crucial components of feedback reception training. Participant 3's incidental exposure to feedback reception training, although unfortunate, brings to light a larger question of the components of training responsible for behavior change. Future research could explore the impact of varying dosage of training components that produce the greatest change in behavior.

It is likely that, because this study targets all feedback reception skills at once, it is difficult to identify a functional relationship between a specific feedback reception response and work performance. However, this is one area for future researchers to explore. For instance, future researchers could train individual components of appropriate feedback reception and assess which component, when exhibited fluently, has the greatest impact on task performance.

Also, future researchers should consider analyzing the differences between participant accuracy of feedback reception skills based on the type of job task on which the participant is receiving feedback. There is a possibility that those job tasks which are more vital to maintaining employment may influence some dimension of feedback reception. Future researchers should assess the long-term impacts of a universal training of this type on the overall contingencies that are present in the work environment. For example, the increased accuracy in appropriate reception of feedback across most or all subordinates may increase the likelihood of a supervisor delivering performance feedback in the future.

Participants were not exposed to any generalization probes in this study. Future research should investigate the degree to which appropriate feedback reception occurs in different settings, across different managers, and across task types. It would be important for researchers and managers to understand if the behavior change produced in feedback reception are likely to generalize to novel environments and across multiple managers. If future research fails to find appropriate stimulus generalization, it may be important to embed instructional components that produce effective generalization of feedback reception.

The participants in this study all received feedback on a primary job task that may be considered low-stakes. That is, errors in low-stakes tasks were unlikely to result in serious consequences. Future researchers could investigate feedback reception related to higher-stakes job tasks. It could be that feedback related to more high-stakes job tasks may be received in a different manner than feedback related to low-stakes tasks.

This study provides further support for the use of computer-based trainings to develop complex skill repertoires in adult populations. Furthermore, it provides support that feedback reception skills are valued in organizations. There is some indication that the way in which individuals respond to feedback may impact their work performance. In conclusion, universal training of appropriate feedback reception skills could lead to both individual and organizational improvement.

References

Albright, L., Schnell, L., Reeve, K. F., & Sidener, T. M. (2016). Using stimulus equivalence-based instruction to teach graduate students in applied behavior analysis to interpret operant functions of behavior. *Journal of Behavioral Education*, *25*(3), 290–309. https://doi.org/10.1002/jaba.249

Algiraigri, A. H. (2014). Ten tips for receiving feedback effectively in clinical practice. *Medical Education Online*, *19*(1), 25141. https://doi.org/10.3402/meo.v19.25141

Alvero, A. M., Bucklin, B. R., & Austin, J. (2001). An objective review of the effectiveness and essential characteristics of performance feedback in organizational settings (1985-1998). *Journal of Organizational Behavior Management*, *21*(1), 3–29. https://doi.org/10.1300/J075v21n01_02

Azrin, N. H., & Nunn, R. G. (1973). Habit-reversal: A method of eliminating nervous habits and tics. *Behaviour Research and Therapy*, *11*(4), 619–628. https://doi.org/10.1016/0005-7967(73)90119-8

Baer, D. M., Wolf, M. M., & Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, *1*(1), 91–97. https://doi.org/10.1901/jaba.1968.1-91

Balcazar, F., Hopkins, B. L., & Suarez, Y. (1985). A critical, objective review of performance feedback. *Journal of Organizational Behavior Management*, *7*(3–4), 65–89. https://doi.org/10.1300/J075v07n03_05

Bayraktar, S. (2001). A meta-analysis of the effectiveness of computer-assisted instruction in science education. *Journal of Research on Technology in Education*, *34*(2), 173–188. https://doi.org/10.1080/15391523.2001.10782344

Betz, A., Higbee, T. S., & Reagon, K. A. (2008). Using joint activity schedules to promote peer engagement in preschoolers with autism. *Journal of Applied Behavior Analysis, 41*(2), 237–241. https://doi.org/10.1901/jaba.2008.41-237

Boyer, E., Miltenberger, R. G., Batsche, C., & Fogel, V. (2009). Video modeling by experts with video feedback to enhance gymnastics skiLLS. *Journal of Applied Behavior Analysis, 42*(4), 855–860. https://doi.org/10.1901/jaba.2009.42-855

Brodhead, M. T., Courtney, W. T., & Thaxton, J. R. (2018). Using activity schedules to promote varied application use in children with autism. *Journal of Applied Behavior Analysis*, *51*(1), 80–86. https://doi.org/10.1002/jaba.435

Buck, H. M. (2014). *The Efficacy of Behavior Skills Training: A Literature Review*. Southern Illinois University. Carbondale, Illinois. Retreived from: https://opensiuc.lib.siu.edu/gs_rp/563/

Carr, E. G., & Durand, V. M. (1985). Reducing behavior problems through functional communication training. *Journal of Applied Behavior Analysis*, *18*(2), 111–126. https://doi.org/10.1901/jaba.1985.18-111

Davis, S., Thomson, K., & Connolly, M. (2019). A component analysis of behavioral skills training with volunteers teaching motor skills to individuals with developmental disabilities. *Behavioral Interventions*, *0*(0). https://doi.org/10.1002/bin.1688

DiGennaro Reed, F. D., Hyman, S. R., & Hirst, J. M. (2011). Applications of technology to teachsocial skills to children with autism. Research in Autism Spectrum Disorders, 5, 1003-1010.doi:10.1016/j.rasd.2011.01.022

Drifke, M. A., Tiger, J. H., & Wierzba, B. C. (2017). Using behavioral skills training to teach parents to implement three-step prompting: A component analysis and generalization assessment. *Learning and Motivation*, *57*, 1–14. https://doi.org/10.1016/j.lmot.2016.12.001

Duncan, P. K., & Bruwelheide, L. R. (1985). Feedback: Use and possible behavioral functions. *Journal of Organizational Behavior Management*, *7*(3–4), 91–114. https://doi.org/10.1300/J075v07n03_06

Ehrlich, R. J., Nosik, M. R., Carr, J. E., & Wine, B. (2020). Teaching employees how to receive feedback: a preliminary investigation. *Journal of Organizational Behavior Management*, 1-11. https://doi.org/10.1080/01608061.2020.1746470

Erath, T. G., & DiGennaro Reed, F. D. (2019). A brief review of technology-based antecedent training procedures. *Journal of Applied Behavior Analysis*. https://doi.org/10.1002/jaba.633

Fisher, W. W., Kelley, M. E., & Lomas, J. E. (2003). Visual aids and structured criteria for improving visual inspection and interpretation of single-case designs. *Journal of applied behavior analysis*, *36*(3), 387-406.

Fletcher-Flinn, C. M., & Gravatt, B. (1995). The efficacy of computer assisted instruction (CAI): A meta-analysis. *Journal of Educational Computing Research*, *12*(3), 219–241. https://doi.org/10.2190/51D4-F6L3-JQHU-9M31

Foxx, R. M., & Azrin, N. H. (1973). Dry pants: A rapid method of toilet training children. *Behaviour Research and Therapy*, *11*(4), 435–442. https://doi.org/10.1016/0005-7967(73)90102-2

Gatheridge, B. J. (2004). Comparison of two programs to teach firearm injury prevention skills to 6- and 7-Year-old children. *PEDIATRICS*, *114*(3), 294–299. https://doi.org/10.1542/peds.2003-0635-L

Geiger, K. B., LeBlanc, L. A., Hubik, K., Jenkins, S. R., & Carr, J. E. (2018). Live training versus e-learning to teach implementation of listener response programs. *Journal of Applied Behavior Analysis*, *51*(2), 220–235. https://doi.org/10.1002/jaba.444

Gerencser, K. R., Higbee, T. S., Akers, J. S., & Contreras, B. P. (2017). Evaluation of interactive computerized training to teach parents to implement photographic activity schedules with children with autism spectrum disorder. *Journal of Applied Behavior Analysis*, *50*(3), 567–581. https://doi.org/10.1002/jaba.386

Glassdoor (2020, June 4). Salary: Elearning Developer. www.glassdoor.com. https://www.glassdoor.com/Salaries/elearning-developer-salary-SRCH_KO0,19.htm

Goomas, D. T. (2008). The effects of computerized auditory feedback on electronic article surveillance tag placement in an auto-parts distribution center. *Journal of Organizational Behavior Management*, *28*(3), 188–197. https://doi.org/10.1080/01608060802251080

Gravina, N., Villacorta, J., Albert, K., Clark, R., Curry, S., & Wilder, D. (2018). A literature review of organizational behavior management interventions in human service settings from 1990 to 2016. *Journal of Organizational Behavior Management*, *38*(2–3), 191–224. https://doi.org/10.1080/01608061.2018.1454872

Gunby, K. V., Carr, J. E., & Leblanc, L. A. (2010). Teaching abduction-prevention skills to children with autism. *Journal of Applied Behavior Analysis*, *43*(1), 107–112. https://doi.org/10.1901/jaba.2010.43-107

Higbee, T. S., Aporta, A. P., Resende, A., Nogueira, M., Goyos, C., & Pollard, J. S. (2016). Interactive computer training to teach discrete-trial instruction to undergraduates and special educators in Brazil: A replication and extension. *Journal of Applied Behavior Analysis*, *49*(4), 780–793. https://doi.org/10.1002/jaba.329

Ingvarsson, E. T., & Hanley, G. P. (2006). An evaluation of computer-based programmed instruction for promoting teachers' greetings of parents by name. *Journal of Applied Behavior Analysis*, *39*(2), 203–214. https://doi.org/10.1901/jaba.2006.18-05

Johnson, B. M., Miltenberger, R. G., Egemo-Helm, K., Jostad, C. M., Flessner, C., & Gatheridge, B. (2005). Evaluation of behavioral skills training for teaching abduction-prevention skills to young children. *Journal of Applied Behavior Analysis*, *38*(1), 67–78. https://doi.org/10.1901/jaba.2005.26-04

Johnson, D. A. (2013). A Component Analysis of the Impact of Evaluative and Objective Feedback on Performance. *Journal of Organizational Behavior Management*, *33*(2), 89–103. https://doi.org/10.1080/01608061.2013.785879

Jug, R., Jiang, X. "Sara," & Bean, S. M. (2019). Giving and receiving effective feedback: A review article and how-to guide. *Archives of Pathology & Laboratory Medicine*, *143*(2), 244–250. https://doi.org/10.5858/arpa.2018-0058-RA

Kowalsky, R., & Cohen, S. H. (1985). The effects of two types of automated feedback on the performance of a community mental health center staff. *Journal of Organizational Behavior Management*, *6*(3–4), 123–140. https://doi.org/10.1300/J075v06n03_09

LaBrot, Z. C., Radley, K. C., Dart, E., Moore, J., & Cavell, H. J. (2018). A component analysis of behavioral skills training for effective instruction delivery. *Journal of Family Psychotherapy*, *29*(2), 122–141. https://doi.org/10.1080/08975353.2017.1368813

Larwin, K., & Larwin, D. (2011). *A Meta-Analysis Examining the Impact of Computer-Assisted Instruction on Postsecondary Statistics Education: 40 Years of Research*. 27.

Mangiapanello, K. A., & Hemmes, N. S. (2015). An analysis of feedback from a behavior analytic perspective. *The Behavior Analyst*, *38*(1), 51–75. https://doi.org/10.1007/s40614-014-0026-x

McCahill, J., Healy, O., Lydon, S., & Ramey, D. (2014). Training educational staff in functional behavioral assessment: A systematic review. *Journal of Developmental and Physical Disabilities*, *26*(4), 479–505. https://doi.org/10.1007/s10882-014-9378-0

McNeil, B. J., & Nelson, K. R. (1991). Meta-analysis of interactive video instruction: A 10 year review of achievement effects. *Journal of Computer-Based Instruction*, *18*(1), 1–6.

Nosik, M. R., & Williams, W. L. (2011). Component evaluation of a computer based format for teaching discrete trial and backward chaining. *Research in Developmental Disabilities*, *32*(5), 1694–1702. https://doi.org/10.1016/j.ridd.2011.02.022

Nosik, M. R., Williams, W. L., Garrido, N., & Lee, S. (2013). Comparison of computer based instruction to behavior skills training for teaching staff implementation of discrete-trial instruction with an adult with autism. *Research in Developmental Disabilities*, *34*(1), 461–468. https://doi.org/10.1016/j.ridd.2012.08.011

O'Grady, A. C., Reeve, S. A., Reeve, K. F., Vladescu, J. C., & Lake, C. M. (Jostad). (2018). Evaluation of computer-based training to teach adults visual analysis skills of baseline-treatment graphs. *Behavior Analysis in Practice*, *11*(3), 254–266. https://doi.org/10.1007/s40617-018-0266-4

Parker, R. I., Vannest, K. J., & Davis, J. L. (2011). Effect size in single-case research: A review of nine nonoverlap techniques. *Behavior Modification*, *35*(4), 303-322.

Parsons, M. B., Rollyson, J. H., & Reid, D. H. (2012). Evidence-based staff training: A guide for practitioners. *Behavior Analysis in Practice*, *5*(2), 2–11. https://doi.org/10.1007/BF03391819

Peterson, N. (1982). Feedback is not a new principle of behavior. *The Behavior Analyst*, *5*(1), 101–102. https://doi.org/10.1007/BF03393144

Pollard, J. S., Higbee, T. S., Akers, J. S., & Brodhead, M. T. (2014). An evaluation of interactive computer training to teach instructors to implement discrete trials with children with autism. *Journal of Applied Behavior Analysis, 47*(4), 765–776. https://doi.org/10.1002/jaba.152

Sarokoff, R. A., & Sturmey, P. (2004). The effects of behavioral skills training on staff implementation of discrete-trial teachinG. *Journal of Applied Behavior Analysis*, *37*(4), 535–538. https://doi.org/10.1901/jaba.2004.37-535

Schnell, L. K., Sidener, T. M., DeBar, R. M., Vladescu, J. C., & Kahng, S. (2018). Effects of computer-based training on procedural modifications to standard functional analyses. *Journal of Applied Behavior Analysis*, *51*(1), 87–98. https://doi.org/10.1002/jaba.423

Scott, J., Lerman, D. C., & Luck, K. (2018). Computer-based training to detect antecedents and consequences of problem behavior. *Journal of Applied Behavior Analysis*, *51*(4), 784–801. https://doi.org/10.1002/jaba.495

Scruggs, T. E., & Mastropieri, M. A. (1998). Summarizing single-subject research: Issues and applications. *Behavior modification*, *22*(3), 221-242.

Shuler, N., & Carroll, R. A. (2019). Training supervisors to provide performance feedback using video modeling with voiceover instructions. *Behavior Analysis in Practice*, *12*(3), 576–591. https://doi.org/10.1007/s40617-018-00314-5

Skinner, B. F. (1953). *Science and human behavior*. Oxford, England: Macmillan.

Spradlin, J. E., & Rosenberg, S. (1964). Complexity of adult verbal behavior in a dyadic situation with retarded children. *The Journal of Abnormal and Social Psychology*, *68*(6), 694–698. https://doi.org/10.1037/h0044330

Stone, D., & Heen, S. (2015). *Thanks For The Feedback*. London: Viking.

Tudor, R. M. (1995). Isolating the effects of active responding in computer-based instruction. *Journal of Applied Behavior Analysis*, *28*(3), 343-344.

Vladescu, J. C., Carroll, R., Paden, A., & Kodak, T. M. (2012). The effects of video modeling with voiceover instruction on accurate implementation of discrete-trial instruction. *Journal of Applied Behavior Analysis*, *45*(2), 419–423. https://doi.org/10.1901/jaba.2012.45-419

Ward-Horner, J., & Sturmey, P. (2012). Component analysis of behavior skills training in functional analysis. *Behavioral Interventions*, *27*(2), 75–92. https://doi.org/10.1002/bin.1339

Wolfe, K., & Slocum, T. A. (2015). A comparison of two approaches to training visual analysis of AB graphs: Training visual analysis. *Journal of Applied Behavior Analysis*, *48*(2), 472–477. https://doi.org/10.1002/jaba.212

Yoder, D. E. (1970). The reinforcing properties of a television presented listener. *ASHA Monographs*, *14*, 10–18.

Zettle, R. D., & Hayes, S. C. (1982). Rule governed behavior: A potential theoretical framework for cognitive behavior therapy. In P. C. Kendall (Ed.), *Advances in cognitive behavioral research and therapy* (pp. 73-118). New York: Academic.

Table 1

Scoring and Operational Definitions of Target Responses

Point Value	Operational Definition
	Eye Contact
2	Employee maintains eye contact when listening to feedback.
1	Employee maintains eye contact only for one of the two portions of corrective feedback.
0	Employee does not maintain eye contact when listening to feedback.
	Follow-Up Questions
2	Employee asks specific question for more information when given evaluative-only or objective-only feedback.
1	Employee asks an unclear or unrelated follow-up question. Example: “You’ve been doing better in some areas with email.” “Cool! What about phone calls?”
0	Employee does not ask for clarification after getting vague feedback. Example: “Your emails could use a little improvement.” “Okay, I’ll try my best!” or no response.
	Acknowledges Mistakes
2	Employee summarizes the performance error. Example: “I see that I made a mistake in providing inaccurate information.”
1	Employee acknowledges making some general error.
0	Employee denies or tries to explain the mistake. Example: “I think this was just a database error,” or “You never told me I needed to do that.”
	Active Listening
2	Employee says, “Yes,” “ahuh,” “OK” or other contextual vocalizations that indicate attention.
1	Employee engages in only a few vocalizations indicating they are attending to what is being said
0	Employee does not engage in any vocalizations that indicate they are attending to the feedback.
	Commits to Behavior Change
1	Employee indicates they’ve accepted the feedback and indicate how they will remedy the issue in the future.
0	Employee only gives minimal or no indication they will use the feedback. Example: just says “okay,” or expresses lack of faith in solution.
	Overall Demeanor
2	Employee speaks in a friendly tone, smiles or expresses interest, and maintains upright, respectful posture.
1	Employee speaks in a neutral tone, maintains a neutral facial expression, and maintains upright, respectful posture.
0	Employee speaks in a resentful tone, frowns or scowls, crosses arms or slouches.

Note. Operational definitions and target response weighting modified from Ehrlich et al. (2020).

Table 2

Literature on Feedback Reception Skills

Reception Skills	Ehrlich et al.	Jug et al.,	Algaraigri
Listen to feedback/active listening	X		X
Express Gratitude/appreciative statement	X		X
Clarify Feedback/ask questions about general feedback/follow-up questions	X	X	X
Self-Assess		X	
Openly receive feedback/overall demeanor	X	X	
Connect with feedback deliverer		X	
Request feedback		X	
Be confident and take positive feedback wisely		X	
Control emotions	X	X	
Make an action plan/commit to behavior change	X	X	
Acknowledge the Generations		X	
Be ready/preparation	X	X	
Acknowledge mistakes	X		

Note. Comparison of overlap between articles which discuss feedback reception skills.

Table 3

Participant Social Validity Items and Ratings

I found the computer-based training on feedback reception skills acceptable.	**The skills taught in the computer-based training are appropriate.**	**Participating in the computer-based training has changed the way I receive performance feedback.**	**I feel my behavior has changed a lot since completing the computer-based training.**	**I would feel comfortable recommending the computer-based training to others.**
Strongly agree	Strongly agree	Strongly agree	Strongly agree	Strongly agree
Neither agree nor disagree	Neither agree nor disagree	Neither agree nor disagree	Neither agree nor disagree	Agree
Agree	Agree	Neither agree nor disagree	Disagree	Agree

Note. This table represents anonymized participant data regarding the social validity of the training. Participants on average scored in agreement that the training was acceptable. there was only one participant who indicated a disagreement regarding the acceptability of behavior change after training.

Table 4

Computer-based Training Development Investment Time by Role

	Primary Developer	**Video Models**	**Participants**
One-time Investment	39	2 (6)	0
Ongoing	1.5	0	1.5 - 2

Note. This table represents the total investment time for each of the individuals involved in the computer-based training. It also indicates the number of one-time investment hours and ongoing investment. It required 3 individuals to develop the video models at approximately 2 hours each. The total time investment for video model development is included in parentheses.

Table 5

Average Manager Score Per Participant in Baseline and Post-training on Email Performance

	Participant 1		**Participant 2**		**Participant 3**	
	Baseline	**Post-training**	**Baseline**	**Post-training**	**Baseline**	**Post-training**
Eye Contact	2	2	2	2	2	2
Follow-up question	0	1.75	0.40	2	0.14	0.75
Acknowledging Mistakes	0	1.25	0.40	1.67	0.43	1.50
Active Listening	1	1.25	1.60	2	1.29	1
Commitment to Behavior Change	0	1	0	1	0.29	0.75
Overall Demeanor	2	2	2	2	2	2

Note. This table represents the average score in baseline and post-training for each target response across participants. These average scores provide insight into the acquisition and the error rate of individual skills in baseline and post-training.

Table 6

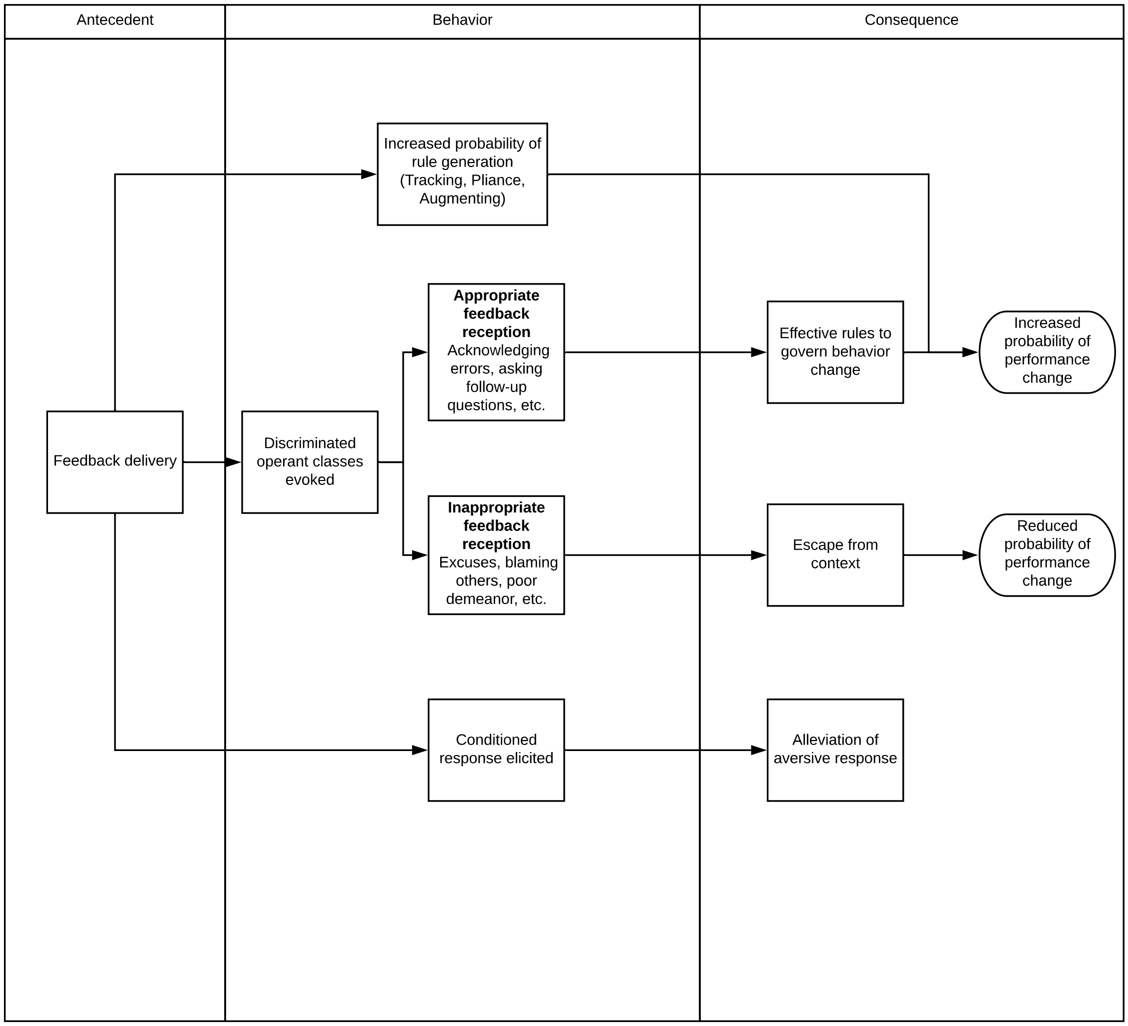
Effect Size Indices

	Tau-U	PND	PEM	IRD	CDC
Participant 1 Feedback Reception	1	1	1	1	6/6
Participant 1 Primary Job Task	1	1	1	1	6/6
Participant 2 Feedback Reception	1	1	1	1	5/5
Participant 2 Primary Job Task	.88	1	1	1	5/5
Participant 3 Feedback Reception	.52	.83	.83	.84	5/6
Participant 3 Primary Job Task	.61	.5	.91	.69	4/6
Average for Feedback Reception	.83	.94	.94	.95	-
Average for Primary Job Task	.84	.83	.97	.90	-
Average Across all Dependent Measures	.83	.88	.95	.92	-

Note. The above table outlines effect size indices and CDC scores for each dependent measure across all participants. The effect size indices are then aggregated across each dependent measure and The Effect size indices are as follows

Figure 1

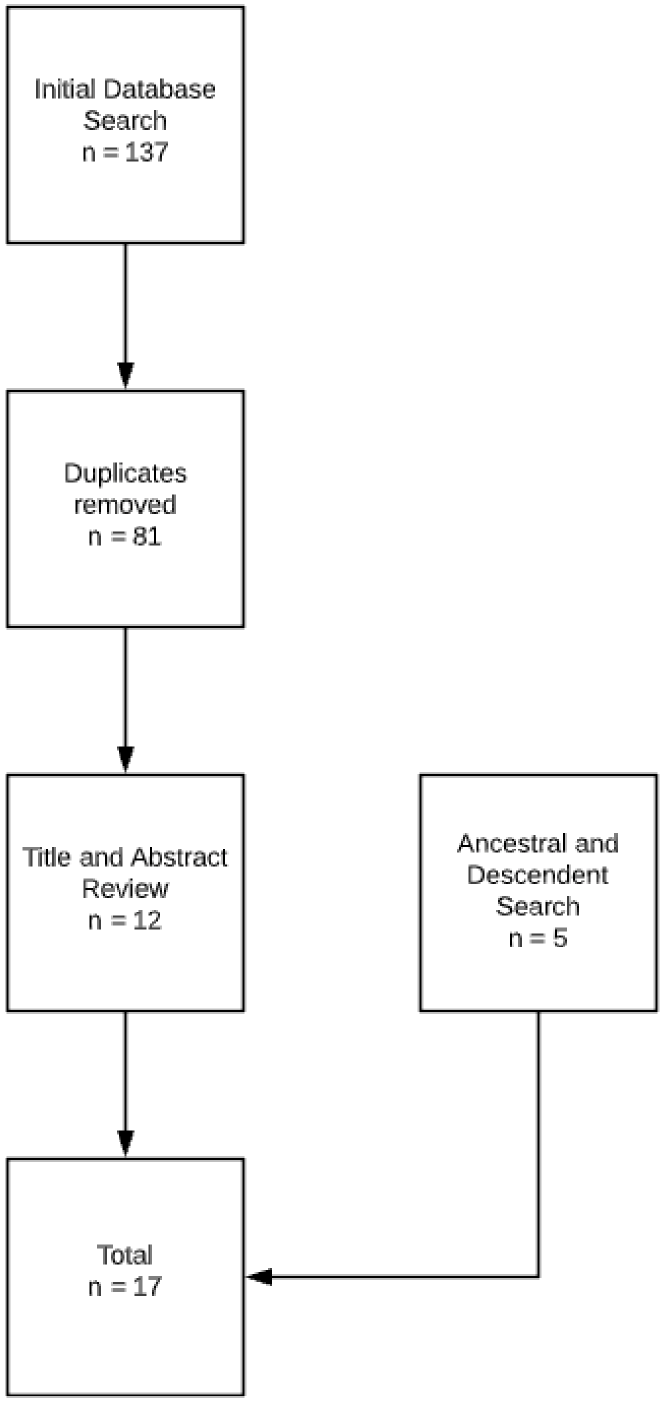
Conceptual Analysis of Feedback Reception and Performance Change



Note. This flow chart represents the hypothesized function of appropriate feedback reception in supporting performance change. The figure also outlines how inappropriate feedback reception may function as a barrier to performance change.

Figure 2

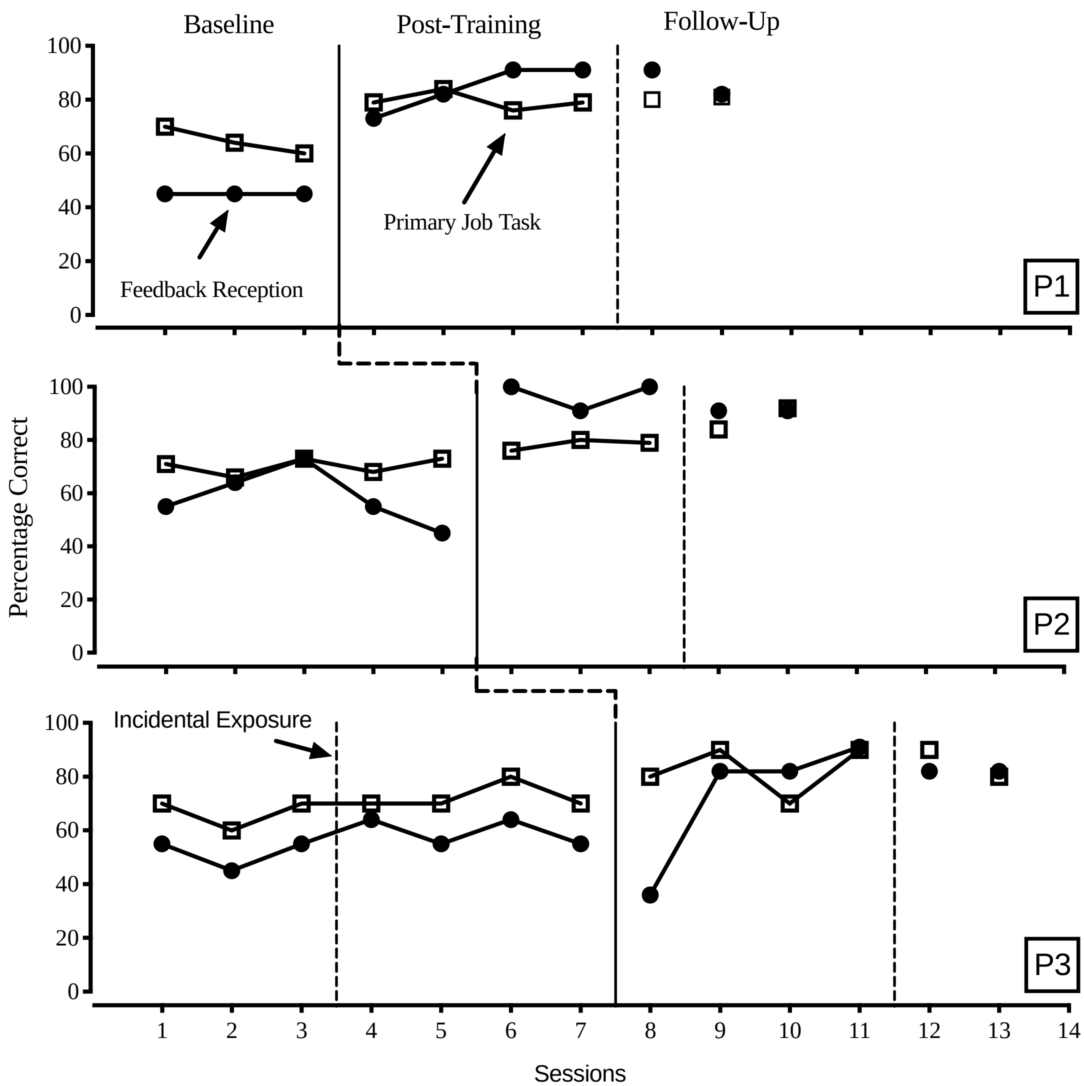
Literature Search Process



Note. Article selection flow chart for literature review.

Figure 3

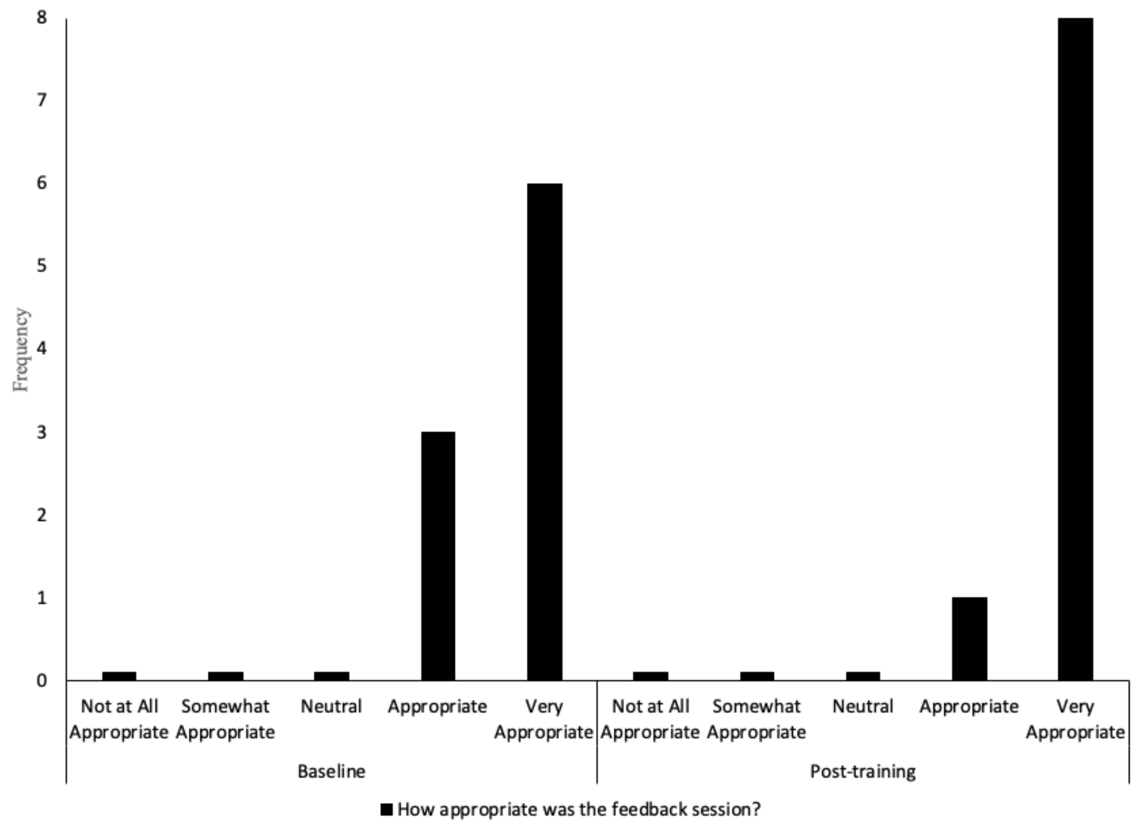
Using Computer-based Training to Teach Feedback Reception Skills



Note. This figure represents accuracy of feedback reception skills (closed circles) and primary job task performance (open squares) for participants 1, 2, and 3. The first condition line in participant 3's graph indicates the point at which the participant was incidentally exposed to a feedback reception skills training by her manager.

Figure 4

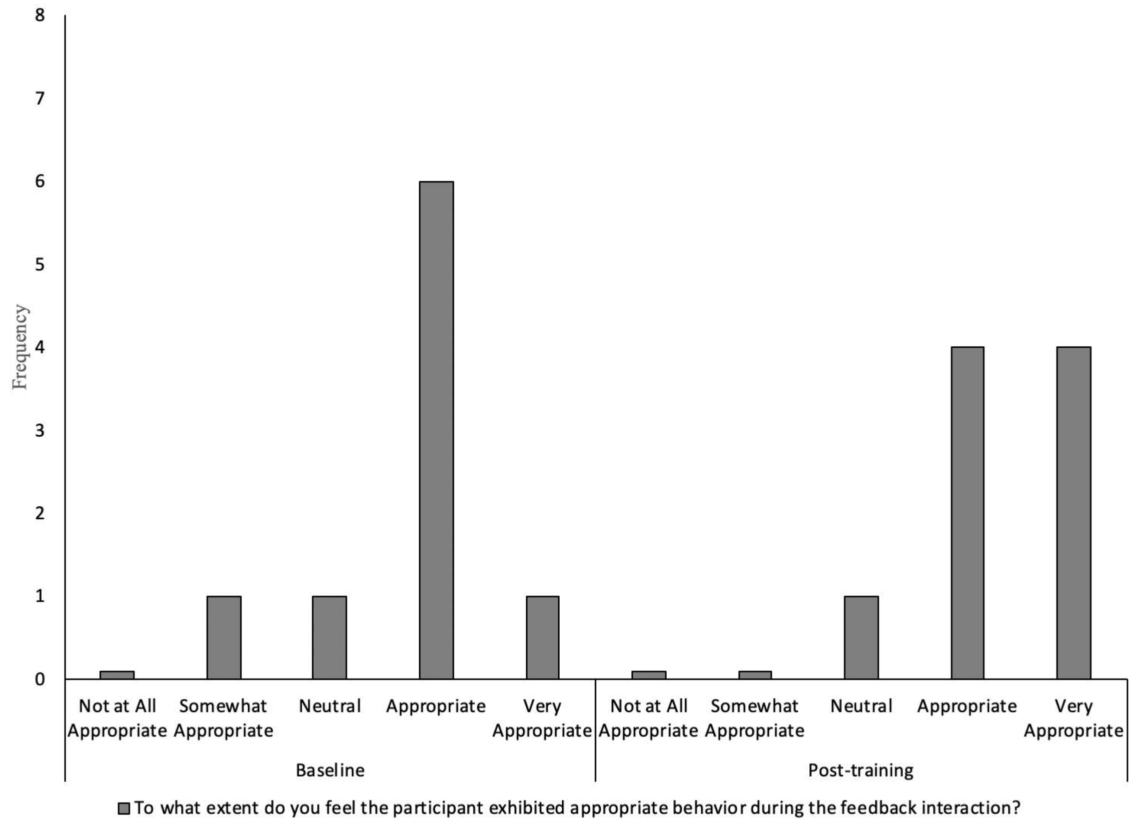
Manager Rating of Feedback Session Appropriateness



Note. Figure 4 displays the manager score for feedback session appropriateness.

Figure 5

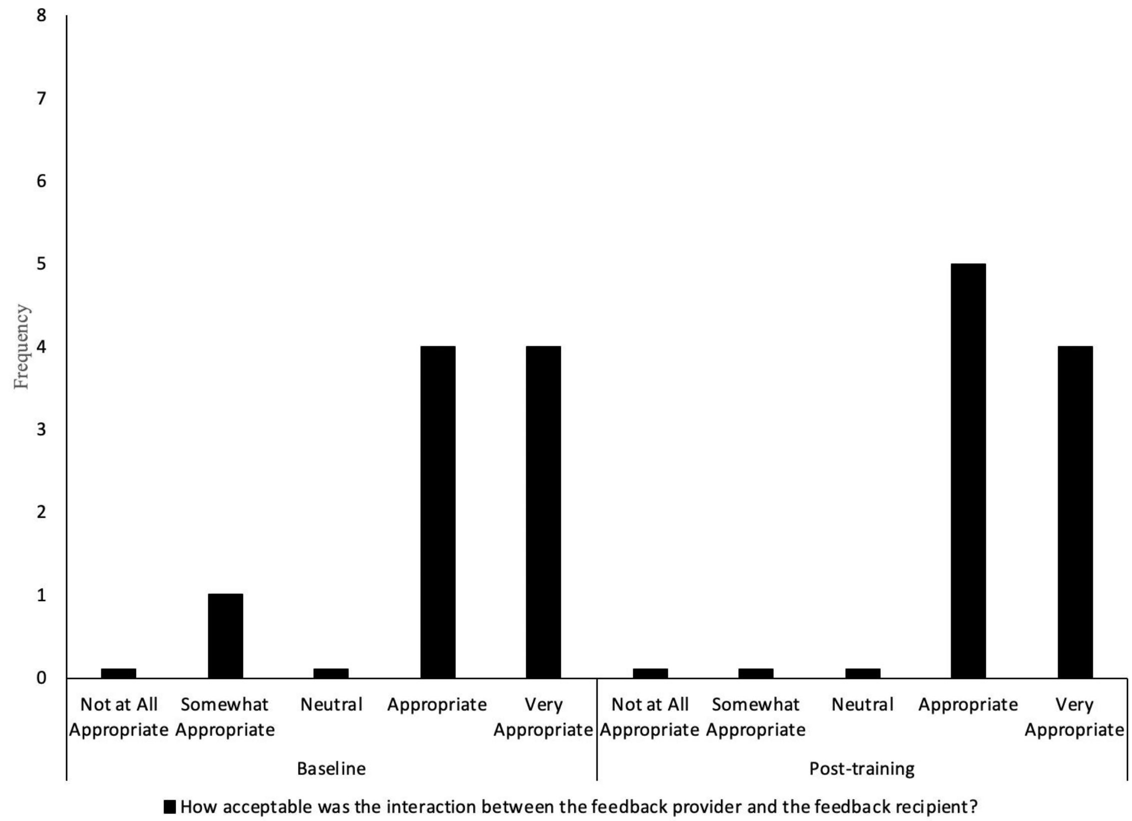
Manager Rating of Participant Behavior in Feedback Session



Note. This figure represents the manager ratings for participant behavior in baseline and post-training feedback sessions.

Figure 6

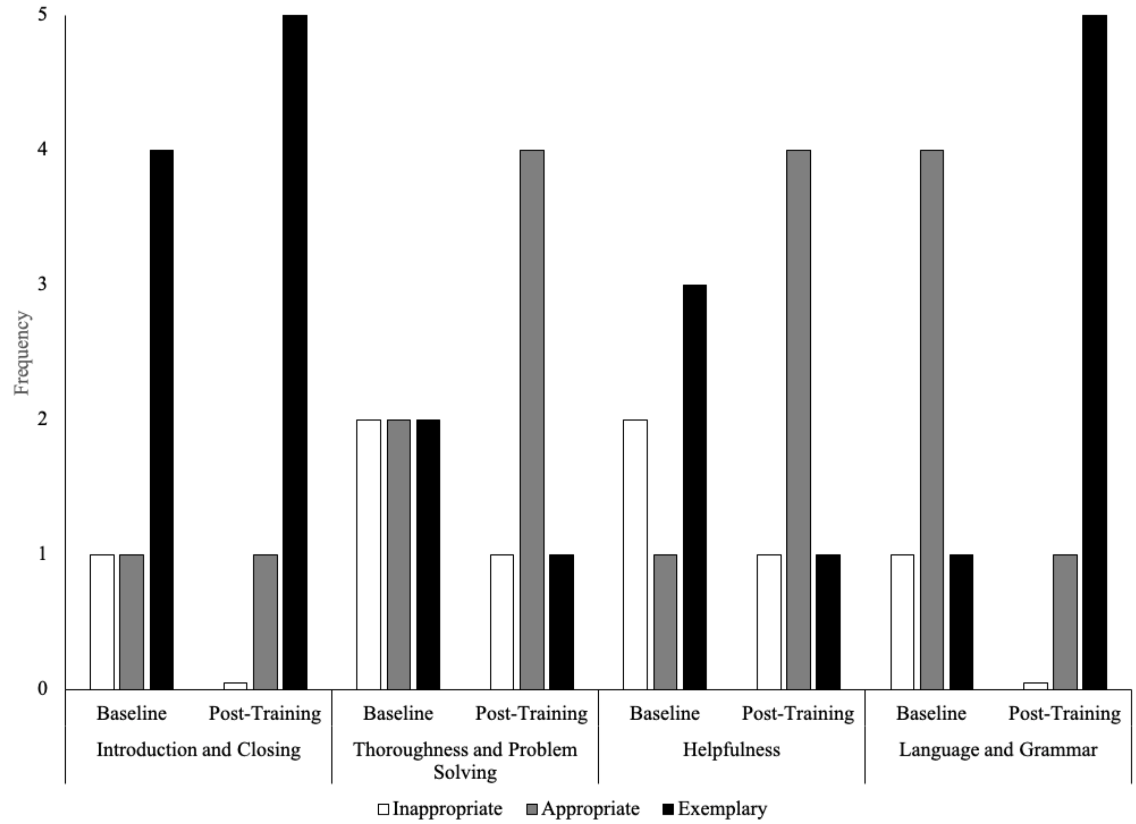
Manager Rating of Feedback Interaction



Note. This figure represents the manager ratings from the acceptability of interaction between feedback provider and feedback recipient across baseline and post-training.

Figure 7

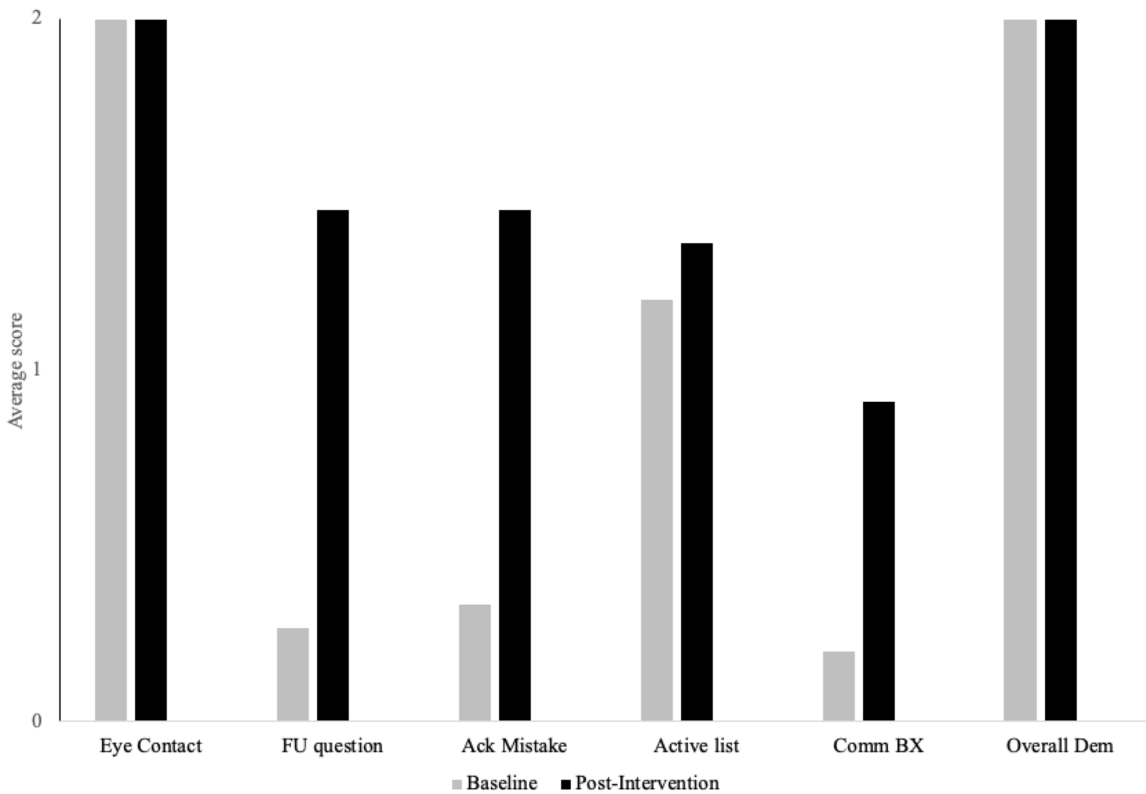
Manager Rating of Primary Job Task



Note. This figure displays the frequency of email components that were scored as inappropriate, appropriate, or exemplary by the manager participant across baseline and post-training phases.

Figure 8

Error and Acquisition Analysis



Note. This figure displays the average difference between baseline and post-training scores for all participants across eye contact, follow-up questions, acknowledging mistakes, active listening, commitment to behavior change, and overall demeanor.

Appendix A.

Feedback Delivery Task Analysis

1. Greet employee and make friendly inquiry or statement unrelated to work.
2. Give some specific positive feedback on a recent email
3. Make a vague statement about a performance mistake followed by a 1-3 second pause with neutral facial expression and slight posture change to allow time for follow-up question.
    a. The formatting of your email was a little inconsistent with the organization's guidelines.
    b. You made a couple of small grammar errors in your email.
    c. Some of the information you provided a customer was inaccurate.
    d. The language you used in your email was a little loose.
    e. The tone your writing conveyed was a little problematic.
4. If question is asked, explain the mistake. If question is not asked, move on to suggested correction.
5. Suggest a correction for the error, providing more information about the mistake if no question was asked. Ask employee if the suggestion is clear/makes sense. ("Okay?" "Does that make sense?")
6. If commitment is not indicated, inquire if suggestion can be implemented feasibly. ("Can you do this?" "Sound good?")
7. Friendly closing statement, such as "well, that's everything. Thanks for your time."

Note. From "How to Receive Feedback: A Preliminary Investigation" by Ehrlich, R., Nosik, M. R., Carr, J. E., & Wine, B. (2020). Journal of Organizational Behavior Management.

Appendix B.

Primary DV Data Collection Sheet

Name __________Date _______Primary obs. _____ Secondary obs._____ Task_____

Instructions: Circle the score under the response definition

Eye Contact

Employee does not maintain eye contact when listening to feedback.	Employee maintains eye contact only for one of the two portions of corrective feedback.	Employee maintains eye contact when listening to feedback.
0	1	2

Follow-up Question

Employee does not ask for clarification after getting vague feedback. Example: "Your emails could use a little improvement." "Okay, I'll try my best!" or no response.	Employee asks an unclear or unrelated follow-up question. Example: "You've been doing better in some areas with email." "Cool! What about phone calls?"	Employee asks specific question for more information when given evaluative-only or objective-only feedback.
0	1	2

Acknowledges Mistakes

Employee denies or tries to explain the mistake. Example: "I think this was just a database error," or "You never told me I needed to do that."	Employee acknowledges making some general error.	Employee summarizes the performance error. Example: "I see that I made a mistake in providing inaccurate information."
0	1	2

Active Listening

Employee does not engage in any vocalizations that indicate they are attending to the feedback.	Employee engages in only a few vocalizations indicating they are attending to what is being said.	Employee says, "Yes," "ahuh," "OK" or other contextual vocalizations that indicate attention.
0	1	2

Commits to Behavior Change

Employee only gives minimal or no indication they will use the feedback to remedy the performance error	Employee indicates they've accepted the feedback and indicate how they will remedy the issue in the future.
0	1

Overall Demeanor

Employee speaks in a resentful tone, frowns or scowls, crosses arms or slouches.	Employee speaks in a neutral tone, maintains a neutral facial expression, and maintains upright, respectful posture.	Employee speaks in a friendly tone, smiles or expresses interest, and maintains upright, respectful posture.
0	1	2

Appendix C.

Secondary DV Email Data Collection Sheet

Participant Name____________________________ **Date of review:**
Date email received:
Primary obs.: ________________ Secondary obs. _______ **Date email replied:**

Source and Subject:
Email Topic:
Email Components:

Composition

0		No salutation or closing, signature not included, inappropriate font
1		No closing statement and/or no salutation, no signature and/or inappropriate font used
2		
3		Salutation and closing statement, name but no organization signature or some formatting inconsistencies
4		
5		Salutation and closing statement, organization signature included, appropriate font used, no formatting issues

Problem Solving & Thoroughness

0		Provided incorrect information or inappropriately redirected or escalated
1		Provided information but did not answer the entire questions
2		
3		Provided the correct information for the question but nothing further
4		Provided information tailored to the customer's problem, and provided alternative solutions
5		Anticipated follow-up questions and answered those as well

Timeliness

0		Email was answered more than 3 days after it was received
1		
2		Email was answered within 3 days of receipt
3		Email was answered in 24-48 hours
4		
5		Email was answered in less than 24 hours

Soft Skills:
Helpfulness

0		Problematic: AA used blaming statements or words and punctuation conveyed inappropriate tone
1		Unhelpful: Directed customer website with no further guidance or suggestions, no offer for additional assistance
2		
3		Just Adequate: Just provided information necessary, did not provide alternative solutions, answered the question as a whole but not the specifics that also may apply
4		
5		Helpful: Email conveyed empathy, took ownership of answering the customer's question and guiding them through how to get this information in the future, provided enough detail in their response to completely answer the specific question that was asked.

"You should have…" "You failed to…" "You must…"

Personalized closers: “good luck with the exam” “I wish you the best in developing your training.”

Language and grammar

0		Used inaccurate language or punctuation that could lead to confusion or misinterpretation
1		Incorrect terminology overall responding that doesn’t convey understanding the question and confidence to the customer in the answer, spelling, grammar, or punctuation issues are present
2		
3		Overall appropriate language; could be clearer; some incorrect punctuation or lack of punctuation; some slang is used
4		
5		Explicit terminology that conveys what is meant and utilizes examples to convey the meaning when needed, does not use slang, grammar and punctuation are flawless

- Written using correct language and grammar
- Used autoclitics to modify language that might be harsh

Note. The scoring rubric for email performance was borrowed from the organizational setting and anonymized.

Secondary DV Documentation Processing Data Collection Sheet

Competency Assessment		
Assessment lists applicant’s name	☐	☐
Dated within 90 days of payment Date: ____________	☐	☐
Dated on or after end date of training	☐	☐
Responsible Assessor signed	☐	☐
Responsible Assessor is a qualified supervisor ☐ Is certified (BCaBA, BCBA, or BCBA-D) ☐ Completed 8-hour supervision training (before administering CA)	☐	☐
All tasks initialed	☐	☐
All assessment type checked off	☐	☐
Three of tasks 6-15 completed with a client	☐	☐

Note. The scoring rubric for documentation processing performance was borrowed from the organizational setting and anonymized.

Appendix D.

Treatment Fidelity Scoring Form

Participant Name___________________________ Date___________
Primary obs.: ________________ Secondary obs. __________________

#	Step	Correct/Incorrect
1	Greet employee and make friendly inquiry or statement unrelated to work.	Y / N
2	Give some specific positive feedback on a recent email	Y / N
3	Make a vague statement about a performance mistake.	Y / N
4	Follow vague statement with a 1-3 second pause with neutral facial expression and slight posture change to allow time for follow-up question.	Y / N
5	If question is asked, explain the mistake. If question is not asked, move on to explaining the error.	Y / N / NA
6	Accurately identify error ○ You made a couple of small grammar errors in your email. ○ Some of the information you provided a customer was inaccurate. ○ The formatting of your email was a little inconsistent with the organization's guidelines. ○ The language you used in your email was a little loose. ○ The tone your writing conveyed was a little problematic.	Y / N
7	If the participant nominates a correction, make a supporting statement.	Y / N / NA
8	If participant does not nominate a corrective action. Suggest a correction for the error, providing more information about the mistake if no question was asked. Ask employee if the suggestion is clear/makes sense. ("Okay?" "Does that make sense?")	Y / N / NA
9	If commitment is not indicated, inquire if suggestion can be implemented feasibly. ("Can you do this?" "Sound good?")	Y / N / NA
10	Friendly closing statement, such as "well, that's everything. Thanks for your time."	Y / N

Appendix E.

Computer-Based Training Outline

The following document outlines training activities that will be delivered via computer. All activities will be used across all target responses individually.

CBT-f

- Introduction
    - Discussion of the importance of target skills with video examples
    - In-depth description of target skills
    - Description of why target skills are important
- Modeling
    - Two video models of correct exhibitions of each target skill
- Discrimination and feedback
    - 6 videos of each target response exhibited accurately
    - 6 videos of each target skill exhibited inaccurately
    - Participants score accuracy on treatment fidelity sheet (Appendix D)
    - Feedback: Completed accurate treatment fidelity sheet displayed on screen following video for comparison
    - Participant scores will be collected and evaluated for mastery
- Conclusion
    - Reiteration of importance of target skills and rationale
    - Conclusion of training after performance criterion is achieved

CBT-b

- Introduction
    - Description of only one target skill

- Discrimination and feedback
    - 3-4 videos of each target response exhibited accurately
    - 3-4 videos of each target skill exhibited inaccurately
    - Participants score accuracy on treatment fidelity sheet (Appendix D)
    - Feedback: Completed accurate treatment fidelity sheet displayed on screen following video for comparison
    - Participant scores will be collected and evaluated for mastery
- Conclusion
    - Reiteration of importance of target skills and rationale
    - Conclusion of training after performance criterion is achieved

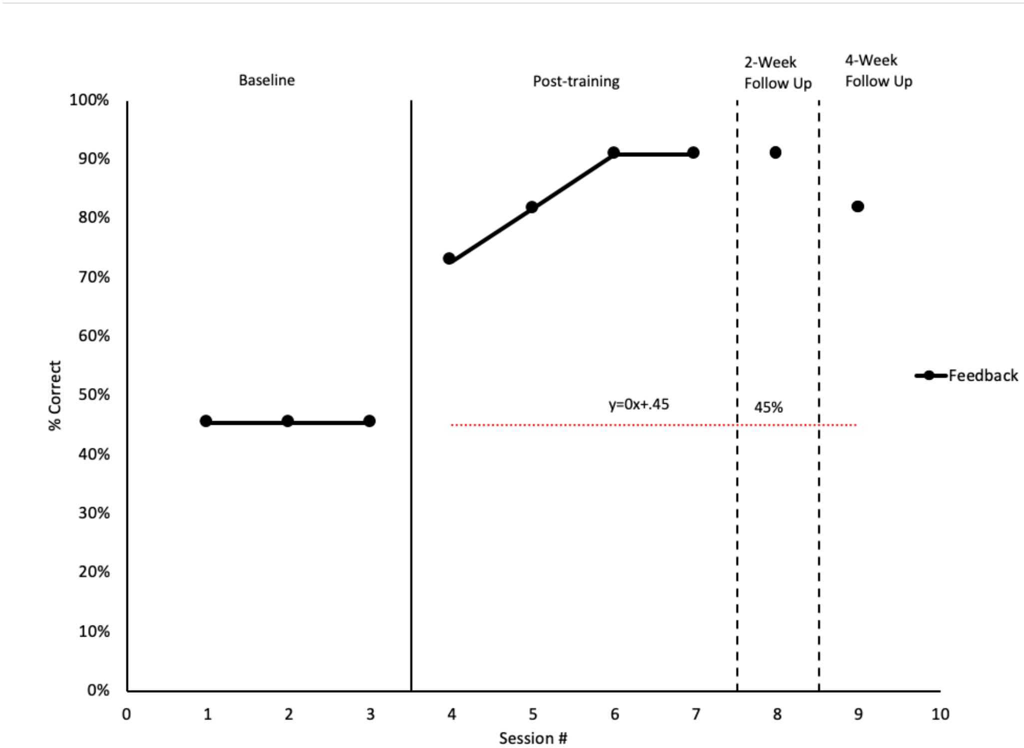
BST

- Introduction
    - Discussion of the importance of target skills
    - In-depth description of target skills
    - Description of why target skills are important
- Modeling
    - Two video models of correct exhibitions of each target skill
- Practice and feedback
    - Participants role play a situation where they would receive feedback from a supervisor
    - Participant accuracy scored by observer
    - Performance feedback delivered based on participant performance
- Conclusion

- Reiteration of importance of target skills and rationale
- Conclusion of training after performance criterion is achieved

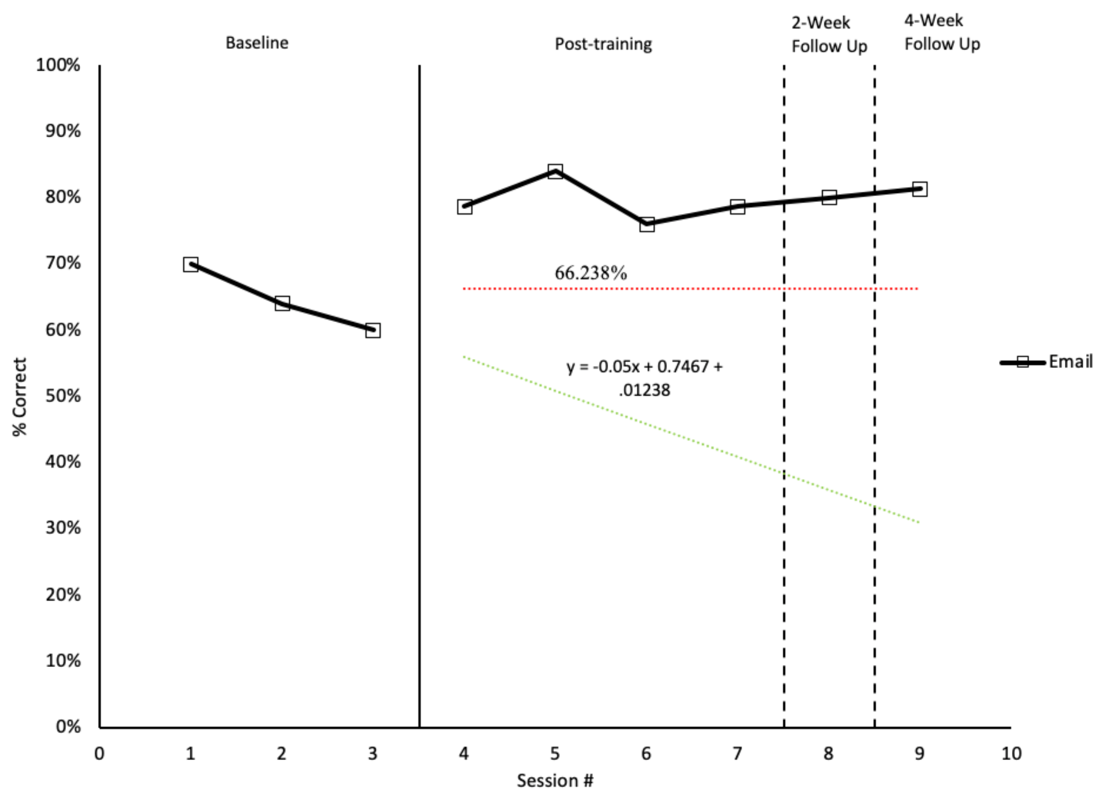
Appendix F. Further Analysis of Participant 1 Dependent Measures

Participant 1. Feedback Reception



Tau-U	PND	PEM	IRD
1.0	1.0	1.0	1.0

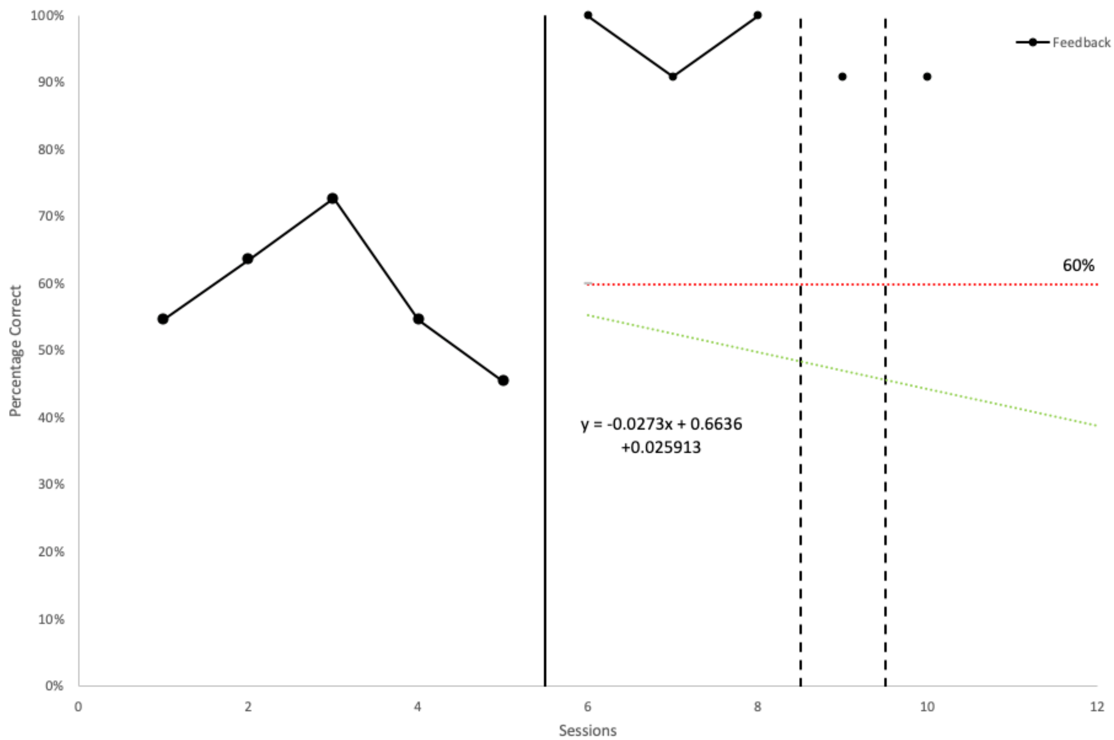
Participant 1. Primary Job Task



Tau-U	PND	PEM	IRD
1.0	1.0	1.0	1.0

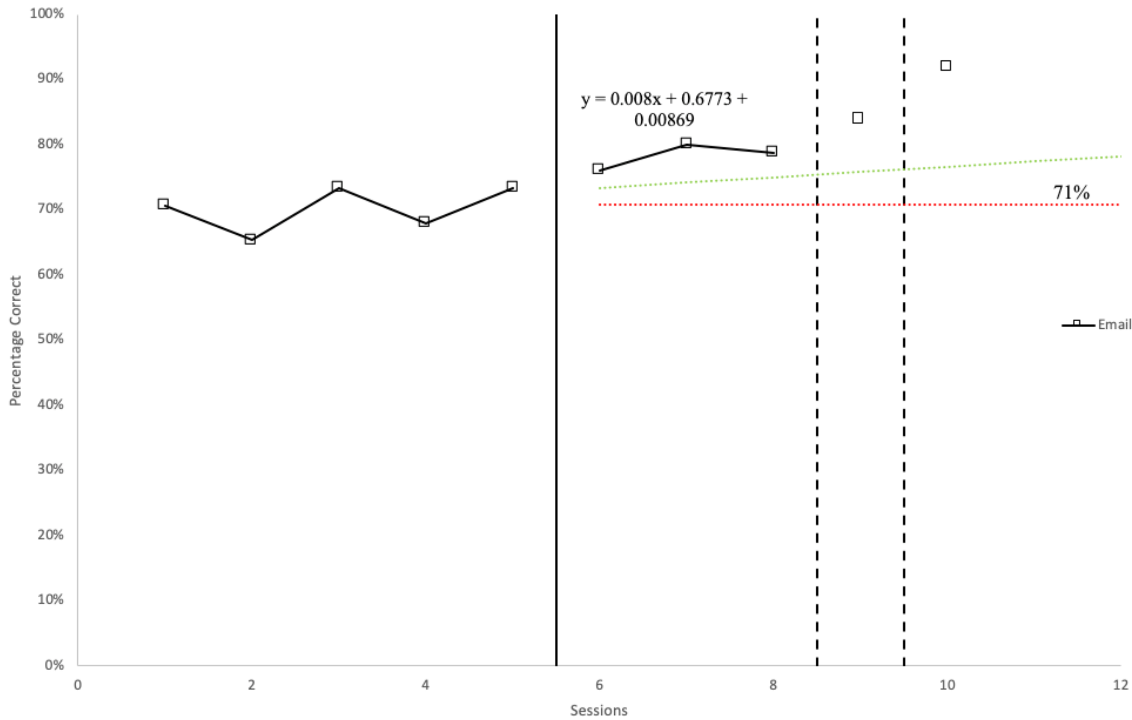
Appendix G. Further Analysis of Participant 2 Dependent Measures

Participant 2. Feedback Reception



Tau-U	PND	PEM	IRD
1.0	1.0	1.0	1.0

Participant 2. Primary Job Task

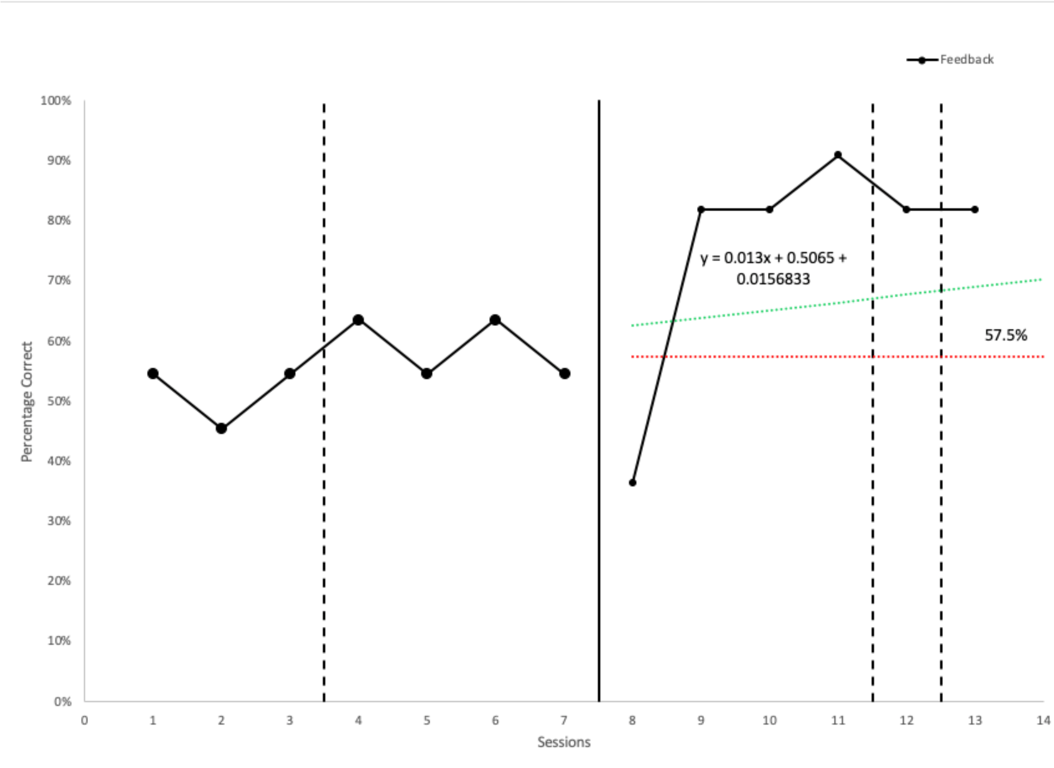


Tau-U	**PND**	**PEM**	**IRD**
.88	**1.0**	**1.0**	**1.0**

Note: The above figures include the application of the conservative dual-criterion method where a mean line (red) and regression line (green) plus .25 standard deviations are populated to aid in visual analysis. In the tables below each graph, the scores for each of the following single-case effect size measures are displayed: Tau-u, Percentage of non-overlapping data (PND), percentage of data exceeding the median (PEM), and improvement rate difference (IRD). It is important to note that the Tau-u accounts for baseline trend.

Appendix H. Further Analysis of Participant 3 Dependent Measures

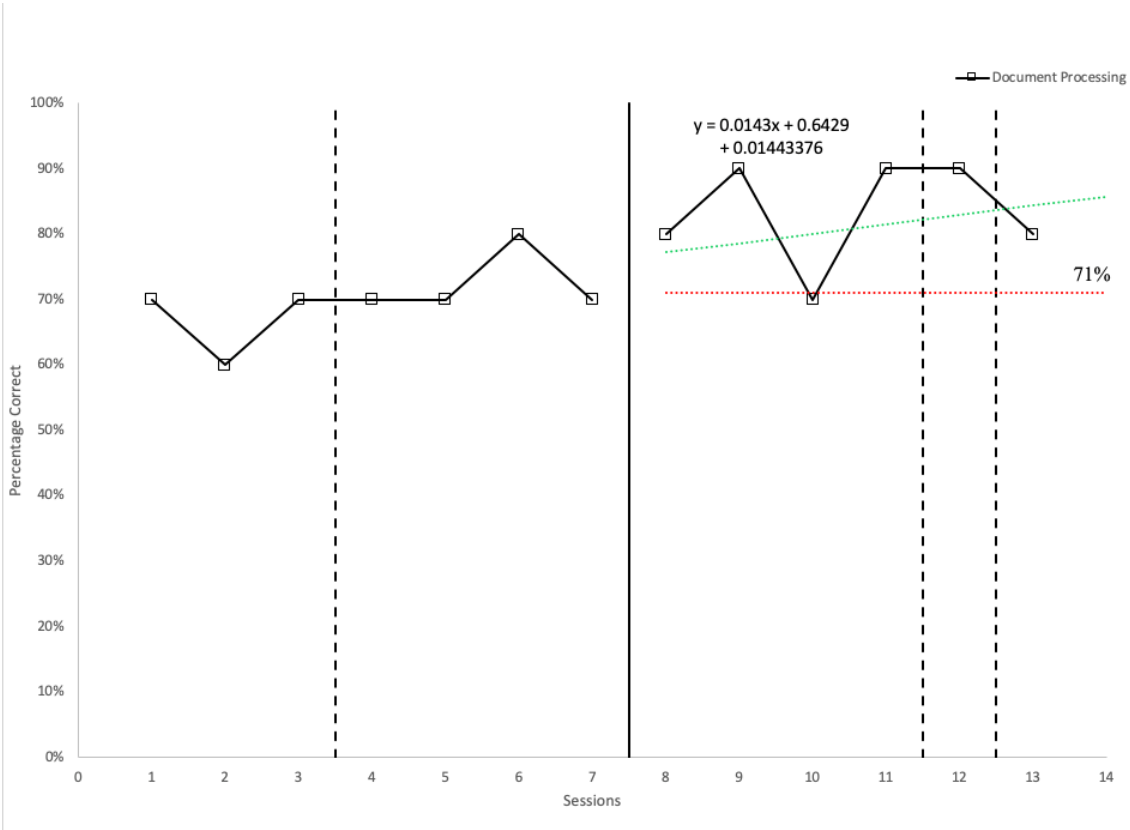
Participant 3. Feedback Reception



Tau-U	**PND**	**PEM**	**IRD**
.52	**.83**	**.83**	**.84**

Note: The above figures include the application of the conservative dual-criterion method where a mean line (red) and regression line (green) plus .25 standard deviations are populated to aid in visual analysis. In the tables below each graph, the scores for each of the following single-case effect size measures are displayed: Tau-u, Percentage of non-overlapping data (PND), percentage of data exceeding the median (PEM), and improvement rate difference (IRD). It is important to note that the Tau-u accounts for baseline trend.

Partcipant 3. Primary Job Product



Tau-u	PND	PEM	IRD
.62	.5	.91	.69

Note: The above figures include the application of the conservative dual-criterion method where a mean line (red) and regression line (green) plus .25 standard deviations are populated to aid in visual analysis. In the tables below each graph, the scores for each of the following single-case effect size measures are displayed: Tau-u, Percentage of non-overlapping data (PND), percentage of data exceeding the median (PEM), and improvement rate difference (IRD). It is important to note that the Tau-u accounts for baseline trend.

Curriculum Vitae

Seth Gregory Walker, M.Ed., BCBA, LBA
427 Anvil Way
Golden, CO 80401
(605) 641-1080

Education

Doctor of Philosophy	**Utah State University – Logan, UT** Disabilities Disciplines Program with emphasis in Applied Behavior Analysis	Expected 2020
Master of Education	**University of Utah – Salt Lake City, UT** Special Education: Applied Behavior Analysis	2015
Bachelor of Science	**Westminster College – Salt Lake City, UT** Clinical Psychology	2011

Certification and Licensure

Board Certified Behavior Analyst 2015-Present
Behavior Analyst Certification Board Inc.
Certificate # 1-15-19509

Licensed Behavior Analyst 2015-Present
Utah Department of Professional Licensing
License # 9569506-2506

Board Certified Assistant Behavior Analyst 2014-2015
Behavior Analyst Certification Board Inc.
Certificate # 0-14-5931

Professional Experience

Early Career Fellow 2019-2020
Behavior Analyst Certification Board
Littleton, Colorado

- Provide operational support for the executive team
- Analyze state, national, and international trends in training and certification to inform Board of Directors decisions
- Facilitate subject matter expert meetings to produce valuable resources for the field of behavior analysis
- Disseminate the information regarding certification at state and national conferences
- Project Management: mobile application development, production of respecialization resources, development of

interactive computer trainings, support process improvement efforts

Graduate Research Assistant – Utah Professional Development Network 2018-2019
Utah State University Special Education and Rehabilitation Department
Logan, Utah

- Develop and deliver high-quality training, develop tools and resources, and provide technical assistance through the Utah Professional Development network
- Conduct monthly case reviews and create a community of support for professionals across multiple school districts who assess and treat problem behavior.
- Manage discussion boards and provide technical assistance for individuals participating in a two-year training series

Graduate Research Assistant – School Collaborations 2016-2018
Utah State University Special Education and Rehabilitation Department
Logan, Utah

- Collaborate with district-wide behavior specialist team to deliver high-quality training to both the specialist team and direct service staff.
- Assess and manipulate organizational processes in order to increase the quality and efficiency of service delivery.
- Consult with behavior specialist team in order to develop advanced skills in the assessment and treatment of severe problem behavior.

Board Certified Behavior Analyst 2015-2016
University of Utah Neuropsychiatric Institute HOME program
Salt Lake City, Utah

- Conduct curriculum assessments and functional assessments including functional analyses
- Develop individualized programming for focused and comprehensive ABA intervention
- Create research-based positive behavior support plans and train caregivers on implementation
- Collect data and modify ABA treatment based on visual analysis of data for up to 20 clients
- Develop and deliver behavior analytic training for behavior technicians, psychiatrists, and physicians

- Serve up to 20 clients that exhibit severe behavior in the form of self-injury, aggression, property destruction, and self-restraint

Board Certified Assistant Behavior Analyst 2013-2015

Utah Behavior Services

Taylorsville, Utah

- Conduct curriculum assessments and functional behavior assessments
- Supervise and train behavior interventionists on the implementation individualized behavior programming
- Develop and deliver ABA training for up to 20 staff in accordance with insurance company policy
- Analyze data and utilize data-based decision making in order to ensure client success
- Deliver 1:1 in-home ABA service

Professional Presentations

Nosik, M. R. & **Walker, S. G.** (2019) *A BACB Update on the Profession of Behavior Analysis.* Invited Presentation at the 2019 Missouri Association of Behavior Analysis Conference, St. Louis, Mo.

Walker, S. G., Shea, K. A., Hess, B., (2019) *Current approaches to Behavior Analytic Structured Decision-making Models.* Symposium chair and presenter at the Annual Meeting of the Utah Association for Behavior Analysis, Salt Lake City, UT.

Walker, S. G., Mattson, S. L., & Sellers, T. P. (2019) *An Application of Expert Video Modeling and Feedback to Increase Foundational Climbing Skills in Novice Rock Climbers.* Symposium presentation at the 45th Annual Convention of the Association of Behavior Analysis International, Chicago, IL.

Hoffmann, A. N., Sellers, T. P., Lee, J. T., Mattson, S. L., **Walker, S.** (2018) *Teaching Discriminated-Use of a Tablet Device for Leisure and Educational Activities with Children with Autism.* Poster Presented at the 44th Annual Convention of the Association of Behavior Analysis International, San Diego, CA.

Sellers, T. P., **Walker, S. G.**, Shea, K. A. (2018, March). Critical components of effective & ethical supervisory practices. Invited workshop at the 11th Annual Convention of Four Corners Association for Behavior Analysis, Park City, UT.

Walker, S.G. & Shea, K. A. (2018) *Process Mapping: A Guide to Developing Efficient Systems in Behavior Analysis Service Agencies with Organizational Behavior Management.* Webinar event for Utah Association of Behavior Analysis, Logan, UT.

Walker, S. G. & Shea, K. A. (2018) *Treatment of Severe Problem Behavior in Schools.* Presentation at Autism Translational Workshop, Provo, UT.

Walker, S. G. & Shea, K. A. (2017) *Process Mapping: A Guide to Developing More Efficient Systems in Behavior Service Agencies with Organizational Behavior Management.* Presentation at Utah Association of Behavior Analysis Annual Conference, Salt Lake City, UT.

Walker, S. G. & Lee, J. (2017) *Effective Staff Training with Behavior Skills Training: A Guide to Training and Maintaining Vital Skills.* Presentation at Utah Multi-Tiered Systems of Support Conference, Provo, UT.

Walker, S.G., Davis, J. L., & Davis, H. S. (2017) *A Meta-Analysis of Incontinence Interventions in Individuals with Intellectual Disabilities.* Poster presented at the 43rd Annual Association for Behavior Analysis International, Denver, CO

Walker, S. G. (2016) *Reinforcing Appropriate Behavior in the Home.* Presentation at University of Utah Neurobehavior HOME Program's Caregiver Conference, Salt Lake City, UT

Professional Development Presentations and Workshops

Walker, S. G. (2019) *Organizational Behavior Management: Managing Performance Through Consequences and Process Improvement.* Leadership Seminar Series for Utah State University's Center for Persons with Disabilities. Logan, Utah.

Walker, S. G. (2018) *Assessing Problem Behavior.* Development Workshop Inc. Staff In-Service, Idaho Falls, Idaho.

Carbone, P. S. & **Walker, S. G.** (2015) *Behavioral Interventions for the Pediatric Dental Provider.* Presentation for Pediatric Dental Residents at Primary Children's Hospital, Salt Lake City, UT

Professional Affiliations

Association of Professional Behavior Analysts Student Member	2019-Present
Association for Behavior Analysis International Student Member	2016-Present
Four Corners Association for Behavior Analysis Student Member	2018
Utah Association of Behavior Analysis Student Committee Member	2018-2019
Utah Association of Behavior Analysis Full Member	2014-Present

Teaching Experience

SPED 5050 – Applied Behavior Analysis 2: Applications in Special Education Lead Instructor	Spring 2019
SPED 6780 – Ethics and Professional Behavior in Applied Behavior Analysis Guest Lecturer	Spring 2019
REH 6200 – Theories of Counseling Guest Lecturer	Spring 2019
SPED 5050 – Applied Behavior Analysis 2: Applications in Special Education Teaching Assistant	Spring 2018

SPED 6720 – Educational Applications of Applied Behavior Analysis Spring 2017
Guest Lecturer
SPED 5050 – Applied Behavior Analysis 2: Applications in Special Education Spring 2017
Teaching Assistant
SPED 6720 – Educational Applications of Applied Behavior Analysis Fall 2017
Guest Lecturer

Peer Reviewed Publications

Walker, S. G., Sellers, T. P., & Mattson, S. L. (2020) *Increasing Accuracy of Rock-Climbing Techniques in Novice Athletes Using Expert Modeling and Video Feedback.* Journal of Applied Behavior Analysis.

Walker, S. G. & Carr, J. E. (Submitted) *Generality of Findings from Single-Case Designs: It's Not about the "N".* Behavior Analysis in Practice.

Walker, S. G. & Nosik, M. R. (In Preparation) *Identifying Effective Academic Writing Strategies in Behavior Analysis.*

Walker, S. G., Griffith, K. R., Mattson, S. L., Sellers, T. P., & Pinkelman, S. E. (Submitted) *Training Parents to Conduct Trial-Based Functional Analyses and Functional Communication Training in Home via Telehealth.*

Walker, S. G. & Sellers, T. P. (In preparation) *Systematic Review of Behavior Analytic Interventions to Address Needle Compliance in Individuals with Disabilities.*

Book Chapters

Sellers, T. P. & **Walker, S. G.** (submitted, 2017). Telesupervision: In-Field Considerations. In Aaron J. Fischer, A. J., Collins, T., Dart, E. H., Radley, K. C. (E.) *Technology Applications in School Consultation, Supervision, and School Psychology Training.* Routledge.

Grants

Agency: Institute of Educational Science (IES) 84.305L-1 – Low-Cost, Short-Duration, Evaluation of Educational Interventions
Purpose: The purpose of this project is to conduct research evaluating the effects of teacher-implemented, mindful breathing intervention on on-task behavior and disruptive behavior in elementary and secondary school children receiving special education. To train a doctoral student/research assistant to conduct applied research within a multidisciplinary team and work with that team to disseminate the results of the project.
Duration: 2018-2020
Amount: **$250,000 – Not Funded**

Agency: Interagency Outreach Training Initiative (IOTI), Logan, UT

Role: Grant Developer and Project Director
Purpose: To increase knowledge and skills related to assessing and treating problem behavior across multiple levels of learners using online and live training, coaching, and workshops. To train a doctoral student/research assistant to conduct applied research, build systems, and to provide professional development, coaching, and technical assistance.
Duration: July 2018-June 2019
Amount: **$42,801 Funded**

Agency: Interagency Outreach Training Initiative (IOTI), Logan, UT
Role: Grant Developer and Project Director
Purpose: To Provide a combination of in-person and online, self-paced, competency based training and follow-up implementation coaching on assessment and treatment of problem behavior to professionals and caregivers. To train a doctoral student/research assistant to conduct applied research, build systems, and provide professional development, coaching, and technical assistance.
Duration: July 2017 – June 2018
Amount: **$44,000.00 Funded**

Editorial Service

Guest Reviewer

Behavior Analysis in Practice, 2020 (n=2)
Journal of Positive Behavior Interventions, 2020 (n=1)
European Journal of Behavior Analysis, 2019 (n=1)
Behavior Analysis in Practice, 2019 (n=2)
Behavior Analysis in Practice, 2018 (n=3)