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Evaluation of Interactive Computerized Training to Teach Paraprofessionals How to Implement Errorless Discrete Trial Instruction

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EVALUATION OF INTERACTIVE COMPUTERIZED TRAINING TO TEACH PARAPROFESSIONALS HOW TO IMPLEMENT ERRORLESS DISCRETE TRIAL INSTRUCTION

by

Kristina R. Gerencser

A dissertation submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Disability Disciplines

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2016
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ABSTRACT

Evaluation of Interactive Computerized Training to Teach Paraprofessionals
How to Implement Errorless Discrete Trial Instruction

by

Kristina R. Gerencser, Doctorate of Philosophy
Utah State University, 2016

Major Professor: Thomas S. Higbee, Ph.D.
Department: Special Education and Rehabilitation

Training paraprofessionals who work with children with Autism Spectrum Disorder and other related developmental disabilities can be a challenge due to limited resources, time, and money. Alternative ways to train paraprofessionals on a larger scale is needed. Interactive computerized training—a self-paced program that incorporates audio narration, video models, interactive activities, and competency checks—is one potential training method. Interactive computerized training has been successful at training college students and special education teachers to implement discrete trial instruction but their effectiveness in training paraprofessionals is unknown. The purpose of this study was to extend the literature on interactive computerized trainings to evaluate its utility to teach six paraprofessionals to implement discrete trial instruction. Errorless learning procedures are recommended during discrete trial instruction to minimize student errors and promote quicker skill acquisition. A secondary purpose was to evaluate
the effectiveness of the interactive computerized training to teach paraprofessionals to implement an errorless learning procedure. Following the training, all participants increased their fidelity of implementation of discrete trial instruction, at varying levels, with a student in their classroom. One participant reached the performance criterion of 90% or higher fidelity following ICT alone and two participants required performance feedback. Three participants required live coaching to increase their fidelity of DTI components to 80%. All feedback was delivered from a distance. Fidelity remained high to untrained instructional programs and at 2-week follow up. Potential limitations and future research related to training paraprofessionals are discussed.

(137 pages)
PUBLIC ABSTRACT

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Kristina R. Gerencser

As special education classrooms continue to rely on paraprofessionals to implement interventions, provide instructions, and monitor student progress— it is imperative paraprofessionals are well trained. Without adequate training, paraprofessionals can unintentionally create prompt dependency, limit academic growth, and reinforce problem behavior. However, providing quality training to paraprofessionals can be costly to school districts. Interactive computerized trainings may be a solution.

The current study investigated the effectiveness of an interactive computerized training to teaching paraprofessionals a commonly used teaching strategy for children with Autism Spectrum Disorder and other related developmental disabilities called discrete trial instruction. Often procedures to reduce student errors are embedded within discrete trial instruction. Secondary, this study evaluated the effectiveness of the training to teach paraprofessionals to implement an errorless learning procedure. All participants completed the interactive computerized training online from their home or work computer in an average of 5 hours. Following the training all participants increased their accuracy of teaching discrete trial instruction with a student in their classrooms. Five participants needed additional training of either performance feedback or performance feedback and coaching in order to reach high levels of accurate teaching.
ACKNOWLEDGMENTS

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Kristina R. Gerencser
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CHAPTER I
INTRODUCTION

In the U.S., over 400,000 paraprofessionals provide educational services to individuals with disabilities between the ages of 3-21 (U.S. Department of Education, 2014). Thus, paraprofessionals play an essential role in teaching individuals diagnosed with Autism Spectrum Disorder (ASD) and other developmental disabilities. Although classroom teachers have the overall responsibility for designing students’ educational goals, properly trained paraprofessionals can assist the special education teacher in a variety of ways, such as implementing interventions, teaching, and monitoring progress (Boomer, 1994). However, paraprofessionals often have lower levels of education and are rarely provided with the specialized training necessary to teach these students (Riggs & Mueller, 2001). Without adequate training, paraprofessionals can unintentionally create prompt dependency, limit academic growth, and reinforce problem behavior. With the growing reliance on paraprofessionals as teachers, it is imperative that paraprofessionals are well trained to deliver high-quality instruction.

One instructional strategy that is used in many early intervention and special education programs is discrete trial instruction (DTI). DTI breaks skills into small teaching components to teach a variety of skills (e.g., imitation, matching, receptive identification skills) to individuals diagnosed with ASD and other developmental disabilities (Smith, 2001). Each instruction, or learning opportunity, presented by the teacher is called a “discrete trial” or “trial.” Generally, a teacher works one-on-one with a student to teach targeted skills that are individually selected. The teacher will present
each learning trial in a systematic manner, with the following components: (a) gaining the student’s attention, (b) presenting an instruction (also referred to as discriminative stimulus), (c) allowing the student an opportunity to respond, (d) prompting if necessary, (e) delivering a consequence following the student’s response, (f) recording the student’s response on a data sheet, and (g) providing an inter-trial interval between 1 to 5 s before starting the next trial. With this sequence, many learning opportunities can be presented in a short period of time allowing the student to repeatedly practice the skill and receive feedback. These learning trials can be presented in mass-trial form (i.e., presenting the same target or targets from a single instructional program) or mixed-trial form (i.e., interspersing targets within and across multiple instructional programs). However, more clinical practices are moving to more mixed-trial formats as it may promote better discriminative learning (Grow, Carr, Kodak, Jostad, & Kisamore, 2011; Love, Carr, Almason, & Petursdottir, 2009). Children with ASD and other related developmental disabilities who receive early intensive behavioral interventions, such as DTI, demonstrate an increase in cognitive, social, and communication skills (Downs, Downs, Johansen, & Fossum, 2007; MacDonald, Parry-Cruwys, Dupere, & Ahearn, 2014; Sallows & Graupner, 2005), which can greatly improve their chance to accessing a less restrictive environment in public school.

**Prompts, Prompt Fading, and Error Correction Procedures**

Students diagnosed with development disabilities, including ASD, often have difficulties learning from their natural environment. Specialized teaching is often
necessary to teach these individuals new skills. Research has shown that providing extra cues or supports, called prompts, can be effective in teaching a desired behavior (Green, 2001). DTI includes a variety of prompting strategies and fading techniques in order to transfer stimulus control from a prompt to the relevant discriminative stimulus (e.g., instruction, flashcards). This process generally involves the teacher providing a prompt simultaneously with or immediately following an instruction to evoke the correct response. Gradually overtime, the teacher fades the prompts until the student responds independently to the instruction in the absence of the extra support. Often errorless learning procedures are used in combination of various prompting strategies to decrease student errors and increase student rate of acquisition (Mueller, Palkovic, & Maynard, 2007). Errorless learning procedures “entail the addition of stimuli that reliably control the target response…to the target antecedent at the beginning of instruction. Prompts are faded systematically across successive trials in an effort to transfer stimulus control to the target antecedents” (Green, 2001, p. 78). One common errorless learning procedure is most-to-least prompting (Severtson & Carr, 2012). This method refers to providing a student with the most assistance necessary to evoke a correct response and then across trials or teaching sessions the prompt is gradually faded (e.g., moving from a full physical prompting, to a partial physical prompting, to a gestural or model prompt, to then no prompt). If an error occurs, typically an error correction procedure is implemented by moving to the preceding prompt level in a hierarchy of prompts to reduce the likelihood of another error. Sometimes probe trials are implemented prior to teaching trials to identify the starting prompt level a student needs to respond correctly. Probe trials are
conducted with each instructional target using a least-to-most prompting hierarchy (e.g., independence, partial physical prompt, full physical prompt). The prompt level identified in the probe trial is used for the first teaching trial. Then within the teaching session, prompts may be gradually faded over subsequent correct trials. Because prompts, prompt fading, and error correction procedures are an integral part of DTI, special attention should be made to ensure instructors are implementing these procedures with fidelity.

**Integrity of Implementation of Discrete Trial Instruction**

When any component of DTI is implemented without integrity, it may result in potential problems for the student. Researchers have found that the efficiency of DTI can be reduced if service providers are not properly trained (Carroll, Kodak, & Fisher, 2013; DiGennaro Reed, Reed, Baez, & Maguire, 2011). A study conducted by Carroll et al. evaluated the effects of commonly identified DTI integrity errors made by educators on skill acquisition for students with ASD. Researchers conducted classroom observations and found that teachers engaged in multiple integrity errors during the delivery of instructions. The most common errors teachers made were failures to deliver: (a) a tangible reinforcer after correct responses, (b) a prompt to facilitate correct responding, and (c) the instruction only one time. Carroll et al. conducted two experiments to assess the effects of each integrity error individually and the effects of multiple errors. Researchers found that individual errors led to a decrease in the efficiency or effectiveness of DTI. Furthermore, they found that multiple errors led to an even greater decrease in the effectiveness of DTI. This finding is a concern because all the teachers
made multiple errors during classroom observations, thus demonstrating a need for training educators how to implement DTI with high fidelity.

**Traditional Training Procedures**

Although there is a great need for well-trained paraprofessionals to implement behavior analytic interventions such as DTI, there remains a discrepancy in the implementation of such evidence-based procedures. According to research conducted by Joyce and Showers (2002) and Fixsen, Naoom, Blase, Friedman, and Wallace (2005) we have identified many evidence-based strategies as a field. We continue, however to fall behind in the implementation of these interventions in desired settings with high procedural integrity. Joyce and Showers specified four training components that are essential for the acquisition of a new skill and the transfer of the skill into practice: (a) theory, (b) demonstration, (c) practice, and (d) coaching. The effects of these training components together are more substantial than any of the individual components alone. Although effective in providing knowledge, workshops alone without additional training components do not lead to implementation of the skills in the relevant environments (Joyce & Showers, 2002). As training components are included in a training package, larger effects are seen. Yet minimal transfer of the skill is seen to the natural environment. It appears that coaching may be an essential training component for effective implementation in the classroom environment. In an effort to investigate methods for effectively training large populations, such as paraprofessionals within a school district, researchers have investigated the effects of multiple different
combinations of training components.

Thomson et al. (2012) conducted a literature review that identified 17 studies that evaluated training procedures to teach service providers to implement DTI. The majority of the studies (76%; 13 out of 17) delivered the training predominantly through face-to-face interaction with a professional. Most of the studies used some or all of the components of behavioral skills training (BST). BST is an effective training package that consists of four components: instructions, modeling, rehearsal, and feedback. Trainees continue through these components until a desired performance criterion is met. These components align closely to the training components Joyce and Showers (2002) recommend, with the exception of coaching. However, some BST packages may incorporate some level of coaching during the rehearsal phase, where the trainee practices with the professional and receives coaching and feedback during implementation. BST components are typically conducted prior to implementation in the intended environment. BST packages have been shown to be an effective means of training a wide variety of behavior analytic skills (Homiltas, Rosales, & Candel, 2014; Iwata et al., 2000; Lavie & Sturmey, 2002), including DTI (Lafasakis & Sturmey, 2007; Sarokoff & Sturmey, 2004).

For example, Sarokoff and Sturmey (2004) investigated the effects of BST to train three special education teachers to implement DTI with one instructional program: match-to-sample. Teachers had previous training on DTI, but their integrity of implementation at baseline was low (43% to 49%). Following the BST, teachers’ demonstrated high integrity of DTI implementation (97% to 99%) on a match-to-sample program with a student with ASD.
In another literature review, Rispoli, Neely, Lang, and Ganz (2011) reviewed 12 studies that evaluated training procedures to teach paraprofessionals to implement behavior analytic interventions with individuals with ASD. These behavior analytic interventions included: (a) social stories, (b) prompting procedures, (c) Picture Exchange Communication System (Frost & Bondy, 2002), (d) DTI, (e) pivotal response training, (f) incidental teaching, and (g) activity schedules. The majority of the training procedures were consistent with Thomson et al. (2012), and involved a professional leading the training. The training procedures included one or a combination of the following strategies: (a) written instructions, (b) verbal instructions, (c) video demonstrations, (d) modeling, (e) role-playing, and (f) performance feedback.

All of these studies reported positive results, which lends support to the use of components of BST to train paraprofessionals and other service providers to use DTI. However, traditional use of BST can be a strain on resources. One limitation of standard BST is that a professional has to be present to administer the training. The time required for a professional to train service providers to a high level of fidelity can be costly. Due to the increase in demand for services, there is a shortage of qualified service providers able to implement DTI. Therefore, face-to-face training methods may not be suitable for the dissemination of DTI to service providers in remote locations or where resources are limited. Because of these potential limitations, school districts may not be able to provide adequate training to paraprofessionals. Thus, alternative cost-effective training procedures, other than face-to-face methods, are needed to effectively train paraprofessionals.
Asynchronous Training Procedures

Because of the limitations of traditional face-to-face training methods, more recently researchers have investigated other alternative training methods such as asynchronous training. Asynchronous training methods are procedures that do not require a professional and trainee to be present for instruction to occur (e.g., manuals, video modes, computerized instruction). By eliminating the presence of a professional, asynchronous training methods may reduce the financial cost of the training and, because trainees can access the training from anywhere and progress at their own pace, may allow more trainees to complete the training. In addition, competency checks or interactive activities can be embedded to allow trainees to practice and get feedback as an alternative to the in-person feedback given in face-to-face BST. In attempts to disseminate behavior analytic methods, various forms of asynchronous training have been developed such as manual-, video-, and computer-based instruction.

Self-Instruction Manuals

One type of alternative asynchronous training method is the use of self-instruction manuals. Self-instruction manuals are typically divided into content sections or chapters with embedded study-guide questions. Some manuals also provide opportunities for the trainee to engage in self-guided practice, which instructs the trainee to practice the implementation of the target skill with an imaginary student. Trainees are instructed to read and study the manual at their own pace. At the end of each content area or at the end of the manual, a competency quiz is typically administered to assess content knowledge.
before the trainee is instructed to demonstrate fidelity of the skill with a confederate, an adult simulating the role of a client, or with an actual client. Sometimes self-instruction manuals are combined with other training components, such as coaching and feedback or a video model that demonstrates how to implement the target skill. Self-instructional manuals have been used to teach service providers to implement stimulus-preference assessments (Graff & Karsten, 2012; Ramon, Yu, Martin, & Martin, 2015), and DTI (e.g., Thomson et al., 2012).

**Video Modeling**

Another alternative asynchronous training method is video modeling. Video modeling involves an individual observing a video that demonstrates a desired target behavior. Following the video model, the individual has an opportunity to imitate the target behavior in the appropriate context. Researchers have investigated the effectiveness of video modeling alone and in conjunction with additional components that consist of narrated instructions and written text, which draws the trainees’ attention to key components and/or to provide additional explanations of the target skill. Video modeling and video modeling with voice over instructions have been used to teach service providers to implement various behavior analytic strategies, such as: (a) a problem-solving intervention (Collins, Higbee, & Salzberg, 2009), (b) stimulus-preference assessments (Rosales, Gongola, & Homlitas, 2015), (c) functional analysis conditions (Moore & Fisher, 2007), and (d) DTI (Catania, Almeida, Liu-Constant, & Digennaro Reed, 2009; Vladescu, Carroll, Paden, & Kodak, 2012).
Interactive Computerized Training

Interactive computerized training is another alternative training method that uses a combination of the previous asynchronous training components (e.g., self-paced, competency questions, interactive activities, and video models) to create a comprehensive training package that can be accessed via a computer or an Internet site. Typically, the training content is divided into modules that include narrated slides with written text, graphics, and video examples of the target skills. In addition, competency checks and interactive activities (e.g., prompted self-guided practice opportunities) are typically embedded to provide the trainee with an opportunity to receive feedback on the content and to practice the taught skill. Following the completion of the training, trainees may be instructed to demonstrate the skill with a confederate, an adult whom played the role of a client, or with a real client. In the research literature, this training format has been used to teach naturalistic teaching procedures (McCulloch & Noonan, 2013; Wainer & Ingersoll, 2013), and DTI (Nosik, Williams, Garrido, & Lee, 2013; Pollard, Higbee, Akers, & Brodhead, 2014).

In summary, given the prevalence of students with ASD and other related developmental disabilities receiving special education service (U.S. Department of Education, Institute of Education Sciences, 2013), there is a growing demand for well-trained paraprofessionals who are able to implement behavior analytic strategies, like DTI, with fidelity. Due to the limited resources available for schools to provide training, workshop style training and traditional BST may not be the most cost-effective training procedures. Therefore, there is a high demand to develop efficient and economical
training procedures to teach paraprofessionals, and other service providers, how to implement DTI. Asynchronous training procedures may be a viable alternative to in-vivo training, thus more research is warranted.
CHAPTER II
LITERATURE REVIEW

Given the potential benefits of asynchronous training formats, I conducted a formal literature review on asynchronous training formats to teach DTI. I used the search engines PsychINFO, Academic Search Premiere, and ERIC with the following search term combinations to locate articles: (a) discrete trial teaching + computer training, (b) discrete trial instruction + computer training, (c) discrete trial teaching + self instruction manual, (d) discrete trial instruction + self instruction manual, (e) discrete trial teaching + video model*, and (f) discrete trial instruction + video model*. This search produced 73 possible articles, and 10 met the criteria for inclusion in this literature review. To be included in this literature review, the publication had to (a) be published in English in a peer-reviewed journal, (b) implement a type of asynchronous training procedure as the primary independent variable, (c) have the primary dependent variable be directly related to fidelity of implementation of DTI, and (d) use a single-case research design. Next, I conducted an ancestral search of all 10 articles to capture any articles that were not found in the initial search, which gave us two new articles. This provided a total of 13 articles to analyze in addition to an article from colleagues in press (Higbee et al., in press).

To date researchers have investigated the use of self-instruction manuals, video modeling with voice over instructions, and interactive computerized trainings to teach service providers how to implement DTI. For this reason, the strengths and limitations of each asynchronous training format will be discussed below to determine potential gaps that need to be further investigated in designing a cost-effective training format to
teaching DTI to paraprofessionals.

**Self-Instruction Manuals**

Self-instruction manuals are one effective asynchronous training format to training service providers to implement DTI. A series of studies have been conducted with a self-instruction manual created by Fazzio and Martin (2006). Throughout the series of studies, the manual has been revised several times (Fazzio & Martin, 2006, 2007, 2009, 2011). Arnal et al. (2007, Experiment 1) assessed the first version of the manual (Fazzio & Martin, 2006) with eight undergraduate students using a pre-and-post design. The manual was 21 pages long with four content sections. At the end of each content section, participants were instructed to answer the open-ended study guide questions. Questions from the study guide questions were randomly selected to assess participants’ mastery of the content. A researcher graded the mastery test and instructed participants to continue studying the manual until they scored 100%. Teaching sessions consisted of 12 trials per program and DTI fidelity was evaluated with three instructional programs: imitation, receptive identification, and matching. Participants were scored on their accuracy of implementation of DTI components measured by a fidelity checklist. Following the mastery of the manual content, all participants increased in their fidelity of DTI with an adult playing the role of a child with ASD (hereafter called a confederate), however only one out of the seven participants reached the selected performance criterion (i.e., 90% or higher fidelity). Generalization and maintenance of the skill was not assessed.
Because the manual alone did not result in acceptable levels of DTI fidelity, Fazzio, Martin, Arnal, and Yu (2009) evaluated the effectiveness of the manual plus performance feedback and demonstration. To assess the effectiveness, researchers used a modified multiple-baseline design across five undergraduate students. During feedback, researchers provided corrective feedback related to the participants’ performance during the previous session related to the DTI components on the fidelity checklist. Following feedback, the researcher modeled the correct implementation of the DTI components the participant had previously implemented incorrectly. Following the manual alone, participants’ responding increased; however, none of the participants met criterion (i.e., 90% or higher fidelity across three instructional programs). Following the feedback and demonstration, all participants met criterion. Generalization of DTI was observed when assessed with a student with ASD, but no probes were conducted in baseline. Therefore, it is unclear to what extent the training resulted in the increase in performance observed during generalization.

Since the self-instruction manual alone was not sufficient for participants to reach criterion, the manual was revised. The revised manual included increase content (37-page manual), additional study guide questions, and self-guided practice opportunities that instructed the trainee to stop and practice the DTI components (Fazzio & Martin, 2007). Two studies investigated the revised manual (Salem et al., 2009; Thiessen et al., 2009). Thiessen et al. evaluated the effects of the self-instruction manual alone using a modified multiple-baseline design across four undergraduate students. Following the mastery of the manual, all participants reached mastery criterion (i.e., 80% or higher across three
instructional programs) with a confederate. For each program that met the mastery criterion, generalization was assessed with a child with ASD (no probes in baseline). High levels of integrity maintained during implementation with a child but responding was slightly lower than post training. Thus, the addition of content, study guide questions, and self-guided practice opportunities may have resulted in better outcomes than the previous studies. However, it is important to note that the mastery criterion was set lower than the previous studies (80% vs. 90%).

Salem et al. (2009) also evaluated the revised manual (Fazzio & Martin, 2007) plus an additional training component of a 17 min video demonstration to teach DTI to four undergraduate students. The video demonstrated an instructor implementing several DTI trials. Following mastery of the content and video demonstration, participants increased their fidelity of DTI implementation with a confederate. Several participants reached mastery at 80% or higher for several of the three instructional programs; however only one participant reached the mastery criterion for all three programs. Generalization of DTI was assessed with a child with ASD for two of four participants. Both participants maintained fidelity at criterion for only one of the three instructional programs. No maintenance of the skill was assessed.

Another study conducted by Thomson et al. (2012) replicated and extended Thiessen et al. (2009) and Salem et al. (2009) to evaluate the 37-page self-instruction manual and the video demonstrations with newly hired behavior therapists, instead of college students. Participants’ fidelity of DTI was first assessed with the manual alone. Only two of eight participants met the performance criterion (i.e., 80% or higher across
three instructional programs) with a confederate. Participants that did not reach criterion watched the 17 min video demonstration as described above. Following the video demonstration, all participants met criterion. No generalization or maintenance of the skill was assessed. Although more positive results were found across these three studies with the revised manual (Salem et al., 2009; Thiessen et al., 009; Thomson et al., 2012), the performance criterion was set lower than the initial studies (80% vs. 90% fidelity), which could have inflated the results. According to Carroll et al. (2013), multiple DTI fidelity errors can have a detrimental effect on student’s acquisition. Therefore, 80% performance criterion may be set too low. In addition, Salem et al. and Thomson et al. added a video demonstration component so it is unclear how participants would have responded to the revised manual training alone.

According to the self-instruction manual, all participants in the above studies were taught to implement a most-to-least prompt fading procedure. This method refers to providing a student with whatever prompt they need to perform the skill correctly and then across trials the amount of assistance is faded (e.g., moving from a full physical prompting, to a partial physical prompting, to a gesture or model prompt, to then no prompt; MacDuff, Krantz, & McClannahan, 2001). Participants were taught to start the teaching trial with the most intrusive prompt and then fade the prompt if the student/confederate responded correctly with the prompt for three consecutive trials. For example, if a student responded correctly to a full physical prompt for three consecutive trials, then the participant should move to a partial physical prompt. However, if the student made two consecutive errors then the teacher should return to the previous
prompt level. For example, if a teacher presented the instruction with a partial prompt and the student made two consecutive errors, the teacher should return to the previous prompt level, a full physical prompt.

Although, most-to-least prompting was used according to the manual and fidelity checklists, is unclear to what extent participants were evaluated on this procedure. The majority of sessions were conducted with a confederate playing the role as a child. Confederates followed a script or multiple scripts that were randomly selected from a pool of scripts. The script(s) determined when the confederate should respond correctly, incorrectly, or not at all. However, insufficient details were provided regarding the type and sequence of responses the confederate made, thus it is unclear to what extent participants were evaluated on the most-to-least prompting procedure.

Therefore, in another study, Severtson and Carr (2012) evaluated a modified self-instruction manual from Fazzio and Martin (2006) to train newly hired behavior therapist to implement DTI that incorporated a most-to-least prompting procedure. A multiple-baseline design with a sequential analysis was used to evaluate the necessary training components to teach participants to implement errorless DTI with integrity (i.e., 90% or higher for three consecutive sessions). The training package progressed from self-instructional manual instructions, to a video model demonstration, to performance feedback.

First, participants were instructed to study a 53-page self-instruction manual. In the manual, participants were taught a specific errorless teaching procedure that incorporated most-to-least prompting. Participants were taught to conduct probes trials,
prior to teaching trials, to identify the prompt level the student needed in order to make a correct response. Meaning, the participant conducted trials until the student responded correctly with whatever prompt level was needed for a correct response (i.e., independent, gestural, partial physical, or full physical). A session consisted of 12 trials (three probes trials and nine teaching trials). A probe trial was conducted with each target (three targets total) for one program, receptive identification program. Participants then were taught to start the teaching session with the identified prompt level obtained from the probe trial. If the student responded successfully, the prompt level should be faded over subsequent trials. If the student responded incorrectly the participant should increase the prompt level for the student to make a correct response.

Next, participants were given a competency quiz and the researcher reviewed any incorrect answers with the participant. Participants’ were then instructed to conduct a DTI session with a confederate child teaching a receptive identification program. The confederate followed a script that was randomly selected from a pool of five scripts. The confederate responded with five correct and seven incorrect responses (no response, wrong response, scrolling, select correct response but throw card, select correct card but failed to give to instructor, or select two stimuli) selected semi-randomly. In addition, when an incorrect response occurred the confederate script indicated the length of the error. Meaning, the confederate continued to engage in an error until the participant (a) provided the correct prompt level indicated by the script, (b) provided a more intrusive prompt than indicated by the script, or (c) delivered the instruction four times for given trial. Therefore, this allowed researchers to assess participants’ fidelity of a portion of the
prompting procedure (i.e., whether participants increased the prompt level following an incorrect response). However, it is unclear whether participants were evaluated on their ability to fade prompts within the session if the confederate was responding correctly. Following the manual training, all participants’ increased their fidelity of implementation of DTI. Three of the six participants reached fidelity with the manual alone. The three participants that did not reach criterion required all components of the treatment package (i.e., video demonstration and performance feedback and coaching) in order to meet criterion. These results extended the self-instruction manual literature demonstrating the effectiveness of self-instruction manuals as a potential training tool to teaching service providers to implement DTI. In addition, this study demonstrated that behavior therapists could be trained to implement a most-to-least prompting procedure.

Although self-instruction manuals had positive results, in increasing implementation of DTI across the studies, there are several limitations. First, many of the studies that evaluated variations of Fazzio and Martin’s self-instruction manual have weak experimental control using a modified multiple-baseline design. The modified multiple-baseline design contained the same number of data points for each baseline leg, but supposedly treatment was staggered across time. Severston and Carr (2012) was the only study to use a standard multiple-baseline design across participants. In addition, all studies failed to conduct generalization probes during baseline, thus limiting the extent conclusion can be drawn. Few participants met performance criterion with the manual alone. Additional training components, such as a video model of DTI and/or performance feedback were necessary for several participants to meet criterion. Therefore, DTI may be
too complex of a skill to be trained via self-instruction manuals alone.

**Video Modeling with Voice-Over Instructions**

Another asynchronous training method that has been used to teach DTI is video modeling with voice over instructions. To date, two studies have assessed the effectiveness of video modeling with voice over instructions to teach DTI to newly hired behavior therapists (Catania et al., 2009; Vladescu et al., 2012).

Catania and colleagues conducted the first study in 2009, where they investigated the effectiveness of video modeling with voice over instructions to teach three behavior therapists to implement DTI. Participants’ watched a video (7 min 15 s long) that demonstrated 11 discrete trials (four correct, four incorrect, and four no response trials) that taught a match-to-sample task. Voice narration was provided throughout the video to highlight the teaching components and provide a brief rationale. Following the training, participants were immediately (within 10 min) instructed to implement DTI with a confederate playing the role of a student with ASD. Sessions consisted of 10 trials where the confederate responded to a script that contained four correct, three incorrect, and three no response trials; the order of responses were randomly selected by a random number generator. According to the procedure description, if the confederate responded incorrectly or not at all, the participant should conduct a correction trial by providing a prompt. Then, the participant continued to the next trial without fading prompts. No details were provided regarding the specific prompting and error correction procedure. Following the video modeling with voice over instruction training, all three participants
increased their fidelity of implementation of DTI ($M = 98\%, 85\%, \text{and} 94\%$). In person feedback was provided to one participant who consistently implemented the prompting procedure incorrectly by pointing to wrong stimulus. Participants generalized DTI implementation across untrained programs (i.e., receptive identification and expressive identification) with a confederate and with a student. No generalization probes of the untrained programs were conducted in baseline. Therefore, it is unclear to what extent the training resulted in the increase in performance. Fidelity of the initial teaching procedure, assessed with the match-to-sample task, maintained during a one-week follow-up with a confederate.

In the second study, Vladescu et al. (2012) replicated Catania et al. (2009) and extended the study in two ways: (a) assessing generalization of the taught skill to a child with ASD, and (b) measuring children’s acquisition of the skill taught (i.e., receptive identification program). Following the video modeling with voice over instruction training, all three behavior therapists met the performance criterion (i.e., 90\% or higher accuracy across two consecutive sessions) with a confederate. Teaching sessions consisted of 12 trials of a receptive identification program. During the 12 trials, the confederate engaged in three correct responses, five incorrect responses, and four no responses that were selected pseudorandomly. However, no information was provided on the sequence to know whether the error correction procedure was evaluated. In addition to the training, the behavior therapists observed other hired behavior therapists implementing DTI with a client, which is a possible confound to the training. Researchers assessed generalization of the teaching procedure across untrained programs (match-to-
sample and expressive identification) with a confederate and with a student. However, no generalization probes were conducted in baseline, therefore the extent to which performance generalized to untrained program is unclear. Following the generalization probes, participants were instructed to teach one child a receptive identification program and measured both fidelity of implementation of DTI and students acquisition. Participants’ fidelity remained high during the child implementation phase and a corresponding increase in acquisition in the child’s performance was observed.

Although, these two studies demonstrated the utility of video modeling with voice over instruction, only a small range of the DTI skills were assessed. Both studies only taught one instructional program, although generalization was assessed with two untrained programs. Both studies did not include the delivery of a tangible reinforcer, did not specify an intra-trial interval between instructions, and did not fade prompts as part of the error correction procedure. It is also likely participants responded favorably to this training format, because following the training video, participants’ had the opportunity to immediately imitate the skill. Therefore, it is unclear how participants would respond if there were a longer delay in between the training and implementation of the skill.

**Interactive Computerized Training**

Lastly, interactive computerized trainings (ICT) have been investigated to train service providers to implement DTI (Higbee et al., in press; Nosik & Williams, 2011; Nosik et al., 2013; Pollard et al., 2014). ICT integrates components from both self-instruction manuals (e.g., self-paced, competency questions, interactive activities) and
video modeling with voice over instructions into a comprehensive training package.

Nosik and Williams (2011) investigated the effectiveness of ICT to teach four behavior therapists to implement DTI (across two programs: match-to-sample and receptive instructions) and a backwards-chaining procedure. The ICT was divided into three training components that resembled similar components of behavior skills training. Participants progressed through each component until they reached the performance criterion (i.e., 100% accuracy). The progression of components consisted of: (a) a competency based instruction with modeling, that incorporated instructions with video models of correct and incorrect implementation of DTI and embedded content questions; (b) written feedback, which required the participants to view four videos and score the instructors accuracy of implementation on a checklist; and (c) observed feedback, which included a video in which the participant observed the instructor in the video receiving corrective feedback.

Following each training component, participants were instructed to implement the procedure with a confederate. Participants were taught to implement a least-to-most prompting procedure that progressed from independence, to a verbal, gestural, and physical prompt. During the session, the confederate followed a script either responding correctly, incorrectly, or not at all. These responses were written on three slips of paper and selected without replacement to determine the response the confederate would emit for that trial. Because only three response types could be emitted it is unclear whether participants had an opportunity to progress through the prompting levels. Following the ICT package, participants’ increased their fidelity of both procedures (DTI and
backwards chaining) to 80% to 100% accuracy with a confederate and the skills generalized to an adult with an intellectual disability (no probe conducted in baseline). One participant met criterion following the first component and the other three participants required all three training components to meet criterion.

In a second study, Nosik et al. (2013) extended the previous study to investigate traditional face-to-face BST compared to computerized BST to teach six behavior therapists to implement DTI. The computerized BST contained the same components as the face-to-face BST (i.e., instructions, modeling, and feedback), except the rehearsal component. Participants were randomly assigned to either traditional or computerized BST and sessions were conducted with a confederate. Confederates responded with the same scripts from the above study; therefore, again it is unclear to what extent participants were evaluated on the least-to-most prompting procedure. Following the traditional BST, participants responding increased to 80% to 90% with a confederate. However, participants’ in the computerized BST only slight improved their implementation of DTI to 50% to 75%. It is unclear why participants did not respond as favorably as participants did in the first study (Nosik & Williams, 2011).

In another study, Pollard et al. (2014) extended the literature on ICT to investigate the effectiveness of using ICT to teach four college students to implement DTI with children with ASD. The ICT content was divided into four modules and housed on an online course management site. Each module was self-paced and comprised of audio narration with supporting graphics and text, video models that demonstrated the teaching skill, and interactive questions and self-guided practice opportunities. In addition, each
module included a competency assessment with a pretest and posttest. In order to proceed to the next module, participants’ had to pass the posttest with at least 80% of the questions correct. Participants were taught to use a least-to-most prompt and prompt fading procedure. In addition, participants were taught more advanced procedures, such as the delivery of an edible paired with social reinforcement, differential reinforcement of independence, and interspersal of tasks across trials and instructional programs. Following each module, participants role-played with a confederate for 20 trials interspersed across three instruction programs (imitation, receptive shape identification, and expressive color identification). Confederates followed one of five scripts, which were randomly selected prior to each session, and contained 13 correct responses, five incorrect responses, and two no responses. Confederates engaged in several error types: responding incorrectly to the instruction, not responding to the instruction, and not making eye contact with the instructor or materials. Each script also had two occasions where the confederate responded incorrectly for two consecutive trials to assess the participants’ ability to change prompting levels (i.e., change to a more intrusive prompt). However, participants were not taught to fade prompts. Following the entire training, participants demonstrated significant increases in DTI implementation with all participants reaching the mastery criterion (i.e., 85% or higher across two consecutive sessions). All participants demonstrated generalization of DTI skills to a child with ASD and to untrained programs. However, the untrained programs were the same type of programs taught during training but varied on the type of skill that was taught (i.e., imitation with objects vs. motor imitation, receptive number identification vs. receptive
letter identification, and expressive color identification vs. expressive number identification). During generalization with a student with ASD, one participant required a brief feedback session in order to meet criterion. A researcher scored the participant’s role-play session with a confederate and delivered feedback on the components she implemented incorrectly. Another participant required clarification on what counted as a correct response for a student, as correct responses can differ across students depending on their skills.

Most recently, Higbee et al. (in press), replicated and extended Pollard et al. (2014), to investigate the effectiveness of ICT to teach DTI in a two-part international study with four undergraduate students and four special education teachers in Brazil. The ICT training was the same as Pollard et al., but translated into Portuguese. Participants’ fidelity of DTI implementation was measured during role-play sessions with a confederate (undergraduate participants) and during sessions with a student with ASD (teachers for all sessions and undergraduate participants during generalization probes). Following the completion of the ICT training, a significant increase in fidelity was observed for all participants. Across both students and teachers, a few participants required brief feedback on data collection or prompting errors to reach criterion. All feedback was given in person. Participants’ responding generalized to untrained instructional programs, as in Pollard et al., and maintenance of the skills remained at criterion (i.e., 85% or higher) for three out of the four teachers. Skill acquisition was not measured with the student with ASD.

In summary, ICT seems to be an effective alternative training method to increase
a variety of service providers (i.e., college students, teachers, and behavior therapists) implementation of DTI with various education and experience levels. ICT can be designed to have similar components of BST but without needing a professional present. Participants can receive instruction through audio, text, and graphic images. Participants can view the skill modeled through video demonstrations and receive frequent feedback through embedded competency questions and pre- and post-module content tests. In addition, participants can practice the skill through self-guided role-play sessions. Both Pollard et al. (2014) and Higbee et al. (in press) were able to assess more complex DTI skills, such as delivery an edible with praise, differential reinforcement of correct respond, and interspersing instructional targets across three different DTI programs. All studies, with the exception of Higbee et al., used confederates to simulate a child with ASD. Although, confederates can allow for more experimental control and expose participants to a variety of learner behaviors, none of the studies developed confederate scripts to assess more complex error correction procedures. Because of the positive results seen with teachers’ fidelity of implementation of DTI with student with ASD in Higbee et al., perhaps the use of confederates was unnecessary. The use of confederates limits the main advantage of asynchronous training method, thus eliminating the need for a professional present.

**Summary and Limitations of Asynchronous Training Methods**

The current literature demonstrates the potential utility of asynchronous training methods as an alternative solution to the barriers associated with more traditional training
methods (i.e., those mediated by a professional). Asynchronous training methods can increase the accessibility to evidence-based interventions, such as DTI, and has the potential to train large quantities of service providers. However, there are several limitations with the existing literature to consider. First, the majority of the literature has focused on convenient samples of college students and some behavior therapists. Few studies have investigated the effectiveness of these trainings procedures with parents and educators (Higbee et al., in press; Young, Boris, Thomson, Martin, & Yu, 2012). To date, Higbee et al. is the only study that has investigated the effects of an asynchronous training method, ICT, to train teachers to implement DTI. Although training teachers is of importance, paraprofessionals are often the ones providing instructions to individuals with disabilities. Therefore, more research is needed to determine the efficacy of asynchronous training methods to train paraprofessionals to implement DTI.

Second, many of the studies either provided inadequate descriptions of their prompting and error correction procedure (e.g., Nosik & Williams, 2011; Nosik et al., 2013) or failed to properly demonstrate participants could implement the strategy with limited opportunities provided by the confederate scripts (e.g., Pollard et al., 2014; Salem et al., 2009). Many studies employed a correction procedure after the confederate/student emitted an error, but few studies have assessed the effects of service providers’ implementation of prompting and prompt fading procedures within DTI. Severtson and Carr (2012), is the only study that demonstrated a training package that successfully taught behavior therapists to implement a more complex errorless DTI procedure. However, the extent to which participants were evaluated on fading prompts within a
teaching session was not clearly defined. In addition, half of the participants needed the entire training package, consisting of the self-manual instruction, video demonstration, and performance feedback in order to meet criterion. Although, self-instruction manuals and video modeling with voice over instructions demonstrated positive outcomes, ICT may be a more viable option for training more complex behavior analytic interventions, such as DTI that involves various prompt and prompt fading procedures. ICT can incorporate components of self-instruction manuals and video modeling into one comprehensive training package. With narration, text, graphics, video models, interactive activities and competency checks, ICT has similar components of BST provided in an asynchronous format.

Third, although confederate role-play sessions have the advantage of increasing experimental control and allowing trainees’ to be exposed to the same learner scenarios, many of the studies demonstrated high fidelity of DTI implementation to an adult or child during generalization. Thus, confederate role-play sessions may not be necessary. In Higbee et al. (in press) positive results were found with teachers without the use of confederate role-play sessions. By eliminating confederate role-play sessions as part of the training, the training cost can by reduce by eliminating the cost of a well-trained confederate to play the role as a client. In addition, it will also allow paraprofessionals to practice implementation of a DTI and an error correction procedure under natural conditions that may lead to better generalization and maintenance.

Fourth, across the studies, several participants needed additional training, which typically consisted of in person feedback, in order to meet the performance criterion. DTI
is a complex teaching procedure that may require more feedback and coaching for some individuals to master. However, providing face-to-face feedback and coaching limits one of the main purposes of asynchronous training—eliminating the need for a professional to be physically present. In a study by Fisher et al. (2014), a combination of ICT and telehealth was used to investigate the effectiveness to teach service providers to implement ABA procedures in a discrete-trial format and play-based format. Service providers viewed the training online and then practiced implementing the skills, with a friend recruited to play the role of a child with ASD, while receiving feedback and coaching via telehealth from a professional. The results of this study provide preliminary evidence of the potential utility of distance training. Therefore, if service providers require additional feedback to implement DTI with fidelity, it is possible that performance feedback could be delivered remotely using video conferencing or telehealth.

**Purpose and Research Questions**

In sum, DTI is an effective teaching strategy to teach a variety of skills to children with ASD and other developmental disabilities. Many children with disabilities spend a large portion of their day in school receiving instructions from paraprofessionals. In order for students to make optimal educational gains, paraprofessionals need to implement teaching strategies like DTI with high-levels of integrity. In order to train a large number of paraprofessionals at a low cost to school districts, other training strategies than face-to-face instruction need to be investigated.
Therefore, the purpose of this study was to extend the existing literature on asynchronous training formats, specifically computer-based instruction, to investigate the effectiveness to teach paraprofessionals to implement DTI directly with students with ASD and other related developmental disabilities in their classroom. A secondary goal was to investigate the effectiveness of a computer-based training to teach paraprofessionals to implement an errorless learning procedure. Thus, the following research questions were asked.

1. To what extent will an interactive computerized training increase paraprofessionals’ accurate implementation of DTI with a student with a developmental disability, measured by percentage of correctly completed components on a fidelity checklist?

2. To what extent will paraprofessionals accurately implement an errorless learning procedure, also measured by the fidelity checklist?

3. To what extent will paraprofessionals implementation of DTI generalize to untrained instructional programs, measured by the fidelity checklist?

4. To what extent will paraprofessionals find the interactive computerized training an effective training method to teach DTI, as measured by a feedback questionnaire?

5. If paraprofessionals fail to meet criterion or performance falls below criterion, to what extent will remote feedback via video conferencing increase paraprofessionals accuracy of implementation of DTI with a student with a developmental disability, measured by the fidelity checklist?

6. To what extent will paraprofessionals maintain high levels of procedural integrity assessed during a 2-week follow-up probe?
CHAPTER III

METHODS

Participants

Six classrooms were recruited but only three classrooms met all the requirements to participate. To be included in the study, each classroom needed to meet the following inclusion criteria: (a) a teacher willing to help conduct research sessions and commit to the weekly session requirements, (b) two paraprofessionals willing to participate, and (c) two students who met the inclusion criterion (see student criterion below). Classrooms were recruited from a rural school district in Central Utah. Information about the project (e.g., training, time commitment) was provided to special education district level specialists through email and in person communication from the primary researcher. The district level specialists nominated six potential classrooms to participate—three elementary classrooms and three preschool classrooms. The primary researcher approached each classroom; only the three preschool classrooms met the entire inclusion criterion to participate.

Each preschool classroom had a morning and afternoon session that consisted of: (a) one teacher, (b) two paraprofessionals, (c) between 10-13 special education students, and (d) two typical peers per class. Paraprofessionals were eligible to participate if they: (a) had no formal training in DTI and (b) demonstrated low fidelity of DTI implementation. Participants completed a short demographic survey to obtain information on the following characteristics: gender, age, education level, number of years employed...
in the school district as a paraprofessional, and number of years in the current classroom (see Appendix A).

Six paraprofessionals participated in the study—two per classroom (see Table 1). Paraprofessionals worked 25 hours per week earning between $13 to $17 per hour depending on the number of years employed. Participants had about 10 to 15 min outside of school hours to prepare and receive instruction for the classroom teacher. Participants ranged from 38 to 70 years old with an education level ranging between a high school diploma and a bachelor degree. Participants’ experience working history as a paraprofessional ranged between 7 and 20 years. All had been working in the same classroom for several years, except Candy. Candy took several years off and returned as a paraprofessional this school year. All participants verbally expressed they had received little to know training prior to working. All participants planned to stay working at the paraprofessional level, but Candy expressed interest in returning to school to become a

Table 1

**Participant Demographics**

<table>
<thead>
<tr>
<th>Participant (Student)</th>
<th>Age</th>
<th>Education</th>
<th>Years employed</th>
<th>Years in current class</th>
<th>Student diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danielle (Roxy)</td>
<td>46</td>
<td>High school diploma</td>
<td>9</td>
<td>9</td>
<td>Down syndrome</td>
</tr>
<tr>
<td>Jody (Kyle)</td>
<td>70</td>
<td>Some college</td>
<td>15</td>
<td>10</td>
<td>Developmental disability</td>
</tr>
<tr>
<td>Candy (Gwen)</td>
<td>42</td>
<td>Bachelors</td>
<td>7</td>
<td>1</td>
<td>Down syndrome</td>
</tr>
<tr>
<td>Poppi (Adam)</td>
<td>57</td>
<td>High school diploma</td>
<td>10</td>
<td>8</td>
<td>Developmental disability</td>
</tr>
<tr>
<td>Nancy (Mary)</td>
<td>55</td>
<td>High school diploma</td>
<td>20</td>
<td>5</td>
<td>Developmental disability</td>
</tr>
<tr>
<td>Vanessa (Abe)</td>
<td>38</td>
<td>Associate degree</td>
<td>8</td>
<td>4</td>
<td>Autism spectrum disorder</td>
</tr>
</tbody>
</table>
teacher. All participants were responsible for providing both individual and small group instruction. For the study, each participant was assigned a student with a developmental disability within the classroom for all sessions. Students were eligible to participate if they attended school three or four days a week, determined by their individualized education plan, and if their parents consented their participation in the study. In addition, the student had to demonstrate the following skills: (a) independently sitting in their chair for at least 5 min during instructional activities, (b) minimal challenging behavior during instructional activities, and (c) echoing, labeling, or requesting with one- to two-word phrases. Students whom exhibited challenging behavior (e.g., noncompliance to teachers’ instructions, intolerance to physical prompts) during instruction were excluded, because we worried that challenging behavior could interfere with the participant’s ability to practice and demonstrate the teaching components.

In each classroom, the lead teacher acted as the research assistant for 2 to 3 days per week. In addition, three other research assistants, including the primary researcher, were recruited to help run sessions for the remaining days. The teacher and research assistants were responsible for reading the session scripts, providing the participants with the necessary materials, and video recording each session. Pseudonyms were assigned to each participant and student to ensure confidentiality. Prior to the teacher and research assistants conducting research sessions on their own, the primary researcher explained the responsibilities and modeled a session. Then, each research assistant observed the primary researcher running a session. Next, each research assistant conducted a session independently under the primary researcher’s observation. Once the research assistant
conducted two sessions on their own with a 100% integrity, they began to run sessions independently.

**Setting and Materials**

**Teaching Environment**

Assessment of participants’ implementation of DTI was assessed either in a small conjoining room to the classroom, where additional special education related services were provided (e.g., speech), or in an individualized work space in the corner of the classroom with cubby walls to prevent participants from observing each other’s sessions. The instructional area included a small table, two chairs, and a bin with all the necessary materials to implement DTI. A research assistant used a video camera to record all sessions in order to score fidelity of implementation of DTI, interobserver agreement, and procedural integrity.

**Teaching Material**

A bin was given to the participant at the beginning of each session that contained the necessary materials for teaching DTI with their assigned student. Each bin included: (a) five edible and five tangible reinforcers (identified by the classroom teacher), (b) relevant teaching materials (i.e., flashcards), (c) a pencil, and (d) a curriculum binder. The curriculum binder included preference assessment data sheets (see Appendix B), instructional program sheets for three different programs, and the corresponding data sheets (see Appendix C and D). Dividers were used to separate each instructional program.
Six instructional programs (three for training and three for generalization) were selected to assess participant’s implementation of DTI across a sample of commonly taught instructional programs. Instructional programs used for training included: (a) non-verbal imitation (“Do this model action”), (b) receptive identification (e.g., “Touch cat”), and (c) expressive identification (“What is it”). Generalization programs included: (a) receptive actions (e.g., “Wave”), (b) match-to-sample (“Match”), and (c) verbal-verbal (e.g., “What is your name”). Each program contained two teaching targets. For example, a student might have “Peace sign” and “thumbs up” as targets for nonverbal imitation, “one” and “three” for receptive identification, and “eyes” and “bed” for an expressive identification.

**Student Assessment**

Prior to baseline, a student assessment was conducted to identify unknown targets for each instructional program to ensure each participant was exposed to all components on the DTI fidelity checklist (e.g., errorless learning procedure). During the student assessment, a researcher assistant provided the instruction for the target skill to the student (e.g., “What is it?” while holding up a flashcard). If the student did not perform the target response, the target was scored as a minus and reassessed. A target was considered for teaching if the student responded incorrectly to both instructional trials. If the student responded correctly to one or both probe trials, that target was not selected. This process continued for all six instructional programs for each student.
**Interactive Computerized Training**

Participants accessed the ICT modules from a desktop or laptop computer with internet access. Five participants completed the training modules at work and home, and one participant completed all the training modules from home. At the end of the study, the school district provided $50 in compensation to each paraprofessional for completing the training modules. The ICT modules were developed using Adobe Captivate® version 9 software and were accessible on an online course management system (Instructure Canvas). Training modules included audio narration, supported texts and graphics, video models, competency questions, and interactive activities. The content of the modules was developed from a combination of pre-existing didactic training PowerPoints™, previous ICT modules (Higbee et al., in press; Pollard et al., 2014), and modified from previous researched self-instructional manuals (Fazzio & Martin, 2011; Severtson & Carr, 2012). More specifically, the training content was divided into six modules: (a) introduction to ASD and ABA; (b) introduction to DTI and curriculum; (c) managing antecedents; (d) managing consequences; (e) prompts, prompt fading, an error correction procedure; and (f) data collection and pacing. Table 2 describes the DTI components and overall percentage of components participants were evaluated on per module.

All content and video examples were limited to the three instructional programs selected for teaching (i.e., imitation, receptive identification, and expressive identification) in order to control for generalization to untrained, novel programs (i.e., match-to-sample and verbal-verbal). Video models were recorded with an adult and a child with or without ASD.
Table 2

*DTI Components Covered in Each Module*

<table>
<thead>
<tr>
<th>Module topic</th>
<th>DTI components</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to ASD and ABA</td>
<td>• None</td>
<td>0</td>
</tr>
<tr>
<td>2. Introduction to DTI and curriculum</td>
<td>• None (brief overall of each components within a discrete trial)</td>
<td>0</td>
</tr>
<tr>
<td>3. Managing antecedents</td>
<td>• Conducts preference assessments</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>• Secure student’s attention</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Delivers correct S&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Correctly presents materials</td>
<td></td>
</tr>
<tr>
<td>4. Managing consequences</td>
<td>• Allows 5 s to respond to S&lt;sup&gt;1&lt;/sup&gt;</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>• Provides appropriate consequences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Removes materials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Correct interspersal</td>
<td></td>
</tr>
<tr>
<td>5. Prompts, prompt fading, and error correction</td>
<td>• Immediately provides prompt</td>
<td>15</td>
</tr>
<tr>
<td>procedures</td>
<td>• Provides correct prompt level</td>
<td></td>
</tr>
<tr>
<td>6. Pacing and data collection</td>
<td>• Session pacing, inter-trial interval</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>• Correct data collection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• End teaching for a target</td>
<td></td>
</tr>
</tbody>
</table>

In addition, competency questions and interactive activities were embedded throughout each module to draw attention to key content. If a participant answered a question or completed an interactive activity incorrectly, they were automatically taken back to the content slides to review the content and then reassessed using the same question. Participants were required to answer each question or complete the interactive activity correctly in order to advance to the next content slide. Competency questions were either multiple-choice, true/false, matching, or short fill-in-the-blank questions. Interactive activities were developed using Adobe Captivate® software or through collected video demonstrations. For example, an Adobe Captivate® interactive activity included the participant dragging and dropping items to correctly prepare the learning
environment for teaching. A picture of an example instructional area was presented on the slide and the participant was instructed to drag and drop all the necessary materials (e.g., data sheets, flashcards, reinforcers, etc.) into the learning environment. Another type of interactive activity involved the participants watching a video and then answering questions. For example, the participant watched a video of an instructor implementing a teaching session and scored trial-by-trial data. Following the video, the participant answered questions to assess their accuracy of data collection. In addition, three embedded self-practice role-play opportunities were included. During these opportunities participants were instructed to practice a skill with an imaginary student. Embedded self-practice opportunities included: (a) managing materials correctly, (b) stating the instruction in a neutral tone of voice, and (c) saying 10 different praise statements in 10 s.

Additional handouts and materials need for the interactive activities were provided in a downloadable packet on Instructure Canvas. See Table 3 for a description of the content, training components, and additional materials covered in each module.

**Prompts prompt fading, and error correction procedure.** Throughout the training, and specifically targeted in Module 5, participants were taught to use an errorless learning procedure— most-to-least prompting (procedure modified from Severtson & Carr, 2012). Most-to-least prompting was used across all instructional programs, but the type of prompt used varied slightly from program to program. The hierarchy of prompts were kept consist to three levels. Prompts for non-verbal imitation included: (a) full physical prompt, (b) partial physical prompt, and (c) independent (no prompt). Prompts for receptive actions included: (a) full physical prompt, (b) model
<table>
<thead>
<tr>
<th>Module topic</th>
<th>Content</th>
<th>Additional materials</th>
<th>Video models</th>
<th>Competency checks</th>
<th>Interactive activities</th>
</tr>
</thead>
</table>
| 1. Introduction to ASD and ABA   | • Characteristics of ASD  
• Prevalence of ASD  
• Treatment for ASD  
• Basic principles of ABA  
• ABC model of behavior | • None  | 0  | 5  | 1  |
| 2. Introduction to DTI and curriculum | • Individualized curriculum and potential skills taught  
• Programming terminology (e.g., programs, targets, S^D)  
• Components of a discrete trial | • None  | 5 (3-37 s)  | 2  | 3  |
| 3. Managing antecedents         | • Environmental arrangement  
• Building rapport  
• Identifying reinforcers  
• Gaining attention  
• Providing the instruction  
• Managing materials | • Preference assessment data sheet  
• 101 ways to praise a child | 7 (4-101 s)  | 11  | 4  |
| 4. Managing consequences        | • Types of learner responses  
• Delivering appropriate consequences for correct and incorrect responses  
• Varied praise  
• Program interspersal | • Flashcards  | 11 (3-77 s)  | 8  | 2  |
| 5. Prompts, prompt fading, and error correction procedures | • Types of prompts  
• Prompt hierarchies  
• Probe and teaching trials  
• Prompt fading  
• Error correction | • 3 program data sheets  | 4 (9-49 s)  | 4  | 2  |
| 6. Pacing and data collection   | • Inter trial interval  
• Data collection | • 3 program data sheets  | 2 (77-100 s)  | 7  | 1  |

Prompts, and (c) independent, no prompt. Prompts for receptive and match-to-sample programs included: (a) full physical prompt, (b) gesture prompt (i.e., point prompt), and (c) independent (no prompt). Prompts for expressive and verbal-verbal programs included: (a) full vocal prompt (e.g., apple), (b) partial vocal prompt (e.g., “ah…”), and (c) independent (no prompt).
Prior to teaching, participants were taught to conduct *probe trials* for each target, across the three instructional programs, to determine the prompt level required for the student to respond correctly. Probe trials were conducted in the following discrete trial sequence: (a) secure student’s attention, (b) provide the instruction and materials (if necessary), (c) wait 5 s for the student to respond (i.e., test for independence), (d) provide an appropriate consequence, and (e) circle or slash the prompt level. If the student responded correctly, the participants delivered reinforcement (i.e., praise and reinforcer) and circled an “I” in the prompt level box on the data sheet for that session. If the student responded incorrectly, the participant delivered feedback by breaking eye contact and/or saying, “try again” and marked a slash through “I” to signal independence was assessed. Then, another trial was presented with a prompt using a least-to-most prompt hierarchy. For example, for a receptive identification program, the participant would represent the instruction while simultaneously pointing to the correct answer (i.e., gesture prompt). If the student responded incorrectly again, the participant would give feedback and circle “F” on the data sheet (indicating that the first teaching trial should begin with a full physical prompt). If the student responded correctly, the participant would deliver reinforcement and circle “G” on the data sheet. This process continued for each target. Between one or two probe trials per target (6-12 trials total) were conducted to determine the starting prompt level for teaching. The prompt level the student needed to evoke the correct response was circled at the top of the data sheet for each target (see Figure 1).

Next, participants were taught to start teaching the targets at the predetermined prompt levels identified from the probe trials. Within the teaching session, participants
were taught to follow two rules regarding when to fade prompts and how to correct
errors. The following prompt and prompt fading rules were used within the teaching
session: (a) following two consecutive correct responses at a specified prompt level, fade
prompt to the next level (e.g., two correct responses with a full physical prompt, the next
trial the prompt is faded to a partial physical prompt), and (b) following one incorrect
response or no response, increase to the next prompt level (e.g., an incorrect response
with a gesture prompt, the next trial the prompt is increased to a partial physical prompt).

Participants were taught to score each trial based on the prompt level provided (i.e., \[ F = \cdot \])
full physical/vocal; P = partial physical/vocal, G = gesture, I = independent) and based on the student’s response (i.e., plus (+) for a correct response; minus (-) for an incorrect response). For example, if the student responded correctly to the instruction with a full physical prompt, the data would be scored as F+. If the student responded incorrectly to the instruction with a full physical prompt, the data would be scored F-. Every correct response, independent or prompted was reinforced with varied praise and a top ranked edible or tangible item.

**Dependent Measures**

**Measuring Fidelity of DTI**

The primary dependent variable was participants’ accuracy of DTI implementation measured by a fidelity checklist (see Appendix E; modified from Pollard et al. [2014] and Fazzio, Arnal, & Martin [2010], self-instructional manual checklist). The DTI fidelity checklist assessed 13 target behaviors, which included: (a) assessing preference, (b) interspersing trials within and across instructional targets, (c) presenting materials correctly, (d) securing student’s attention, (e) presenting the correct instruction in a neutral tone of voice, (f) allowing the student 5 s to respond, (g) prompting immediately, (h) providing the correct prompt level, (i) providing an appropriate consequence, (j) removing materials in between trials, (k) recording data correctly, (l) inter-trial interval of 5 s or less, and (m) ending teaching for a target correctly. See Table 4 for a description of each target behavior.

A session consisted of between six and 12 probe trials (depending on the prompt
Table 4

**DTI Components and Definitions**

<table>
<thead>
<tr>
<th>Target behaviors</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessing student preference correctly</td>
<td>(a) Conduct a brief MSWO for edible and tangible reinforcers (as described in Carr, Nicolson, &amp; Higbee, 2000) and identify the first and second ranked items</td>
</tr>
<tr>
<td>Present materials correctly</td>
<td>Receptive identification/Match-to-sample programs</td>
</tr>
<tr>
<td></td>
<td>(a) Flashcards presented in a different order than the previous trial</td>
</tr>
<tr>
<td></td>
<td>(b) Flashcards were evenly spaced and facing the student</td>
</tr>
<tr>
<td></td>
<td>Expressive identification program</td>
</tr>
<tr>
<td></td>
<td>(a) A single flashcard held up in front of the student</td>
</tr>
<tr>
<td>Secure student’s attention</td>
<td>(a) Used a visual shield</td>
</tr>
<tr>
<td></td>
<td>(b) Used the student’s name once</td>
</tr>
<tr>
<td></td>
<td>(c) Student already attending to materials or instructor prior to instruction</td>
</tr>
<tr>
<td>Delivered correct instruction (S&lt;sup&gt;5&lt;/sup&gt;)</td>
<td>(a) Used instruction specified on the program/data sheet - no added or omitted words</td>
</tr>
<tr>
<td></td>
<td>(b) Spoken in a neutral tone of voice</td>
</tr>
<tr>
<td>Waited 5 s for a response</td>
<td>(a) Following independent trials the instructor refrained from delivering a prompt, removing materials, or delivering another instruction before 5 s elapsed</td>
</tr>
<tr>
<td></td>
<td>(b) Following prompted trials the instructor immediately delivered a prompt simultaneously with or right after the instruction, refrained from delivering another prompt, removing, materials, or delivering another instruction before 5 s elapsed</td>
</tr>
<tr>
<td></td>
<td>(c) If the student responded with a correct or incorrect response within 5 s, this was automatically scored as correct</td>
</tr>
<tr>
<td>Provided prompt immediately</td>
<td>(a) Present prompt simultaneously with or immediately after the instruction</td>
</tr>
<tr>
<td>Provided the correct prompt level</td>
<td>(a) Probe trials: used least-to-most prompting</td>
</tr>
<tr>
<td></td>
<td>(b) Teaching trials: started each target at the prompt level identified from probe trials</td>
</tr>
<tr>
<td></td>
<td>(c) Teaching trials: used most-to-least prompting and faded the prompt following to correct response at the specified prompt level or continued presenting independent opportunities following a correct response</td>
</tr>
<tr>
<td></td>
<td>(d) Teaching trials: increased the prompt level following an incorrect response or stayed at the most intrusive prompt level until the student responded correctly</td>
</tr>
<tr>
<td>Immediately delivers an appropriate consequence</td>
<td>(a) Correct: delivered varied praise (differed from previous statement) and a reinforcer (first or second ranked item from MSWO or item requested by the student) within 5 s</td>
</tr>
<tr>
<td></td>
<td>(b) Incorrect: delivered feedback within 5 s by saying “try again,” breaking eye contact, or a combination</td>
</tr>
<tr>
<td>Removes materials</td>
<td>(a) Clears or removes materials prior to starting a new trial</td>
</tr>
<tr>
<td>Correctly record data</td>
<td>(a) Probe trials: circle the correct prompt level to be used for teaching</td>
</tr>
<tr>
<td></td>
<td>(b) Teaching trials: after every trial, records the correct prompt level and student response (e.g., I+, P-)</td>
</tr>
<tr>
<td>Inter-trial interval</td>
<td>(a) Presents another instruction within 5 s from the last delivered consequence (5 s following an edible reinforcer, 5 s following the return of a tangible reinforcer, or 5 s following an informal preference assessment)</td>
</tr>
<tr>
<td>Correct interspersal</td>
<td>(a) Following a correct response, moved to another target from within the program or across another program</td>
</tr>
<tr>
<td></td>
<td>(b) Following an incorrect response, stayed with target until student responds correctly or conducted a maximum of 10 trials</td>
</tr>
<tr>
<td>Correctly ends teaching for each target</td>
<td>(a) Conducted a minimum of 5 trials ending teaching either at the starting prompt level identified from probe trial or less or at a maximum of 10 trials</td>
</tr>
</tbody>
</table>
level the student needed in order to respond correctly), and between 30 and 60 teaching trials. Participants were taught to conduct a minimum of five teaching trials and no more than 10 trials per target. A teaching session did not end on an incorrect response unless the participant reached the maximum number of 10 trials. Teaching continued, using the prompt and prompt fading procedure rules, until the student responded at the starting prompt level (i.e., identified from the probe trial) or at a lesser prompt level. A cut off of 10 teaching trials was used to reduce the variability of the number of trials conducted across participants and sessions.

The percentage of correctly implemented discrete trial components during probe and teaching trials was calculated per session by totaling the number of correctly implemented components divided by the total possible components (subtracting components that were not applicable) and multiplying by 100. In addition, a separate percentage was calculated to evaluate the fidelity of participants’ implementation of the prompting and error correction rules. The total number of correct prompting and error correction trials were divided by the total number of opportunities and converted into a percentage. In addition, the percentage of correct implementation for each component was tracked to identify common errors made by participants per training phases.

**Student Acquisition**

Following baseline, student acquisition was monitored to identify when a target reached mastery. A target was considered mastered when a student performed at 80% or higher across four consecutive teaching sessions. The target percentage was calculated by dividing the number of correct, independent response divided by the total number of trials.
and multiplying by 100. If a target reached mastery a new unknown target, identified from the student assessment, was introduced for teaching. This was done in order to ensure that fidelity of the prompting and error correction procedure could be assessed.

Prior to scoring any of the dependent variables, researcher assistants were trained and met a criterion of 90% or higher agreement with the primary researcher across two consecutive videos.

**ICT Characteristics**

The duration of training was also assessed for each participant. A start time quiz and end time quiz was developed for each module using the quiz function on Instructure Canvas. Prior to starting each module, the participant was required to complete the start quiz that prompted them to enter their start time. Following the completion of the start time quiz, access to the first module was unlocked. Then at the end of the training module, the last slide reminded the participants to go back to Instructure Canvas and enter their end time by completing the end time quiz. In order for the next module to be unlocked, the participant had to complete the end time quiz.

Following the completion of training modules participants were asked to complete a feedback questionnaire regarding their experience with the training (see Appendix F). The feedback questionnaire was designed using the quiz function on Instructure Canvas and contained six questions on a Likert scale and three open-ended questions.
Interobserver Agreement and Procedural Integrity

Interobserver Agreement

Trial-by-trial interobserver agreement (IOA) was assessed for 33% to 62% of baseline sessions, 33% to 43% of post-ICT sessions, 50% of post-teaching checklist sessions, 33% to 50% of post-performance feedback sessions, 33% post-extended feedback and coaching sessions, and 100% for generalization and maintenance sessions via video recording for each participant. IOA was calculated using the DTI evaluation tool by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100 to get a percentage of IOA. An agreement was scored when both observers record the same response for each component as correct, incorrect, or not applicable. For all participants, the mean IOA was 93% (range, 85% to 100%). See Table 5 for the mean IOA per phase and range for each participant.

Session Procedural Integrity

Procedural integrity was assessed for at least 33% of sessions across all conditions for each participant to ensure the research assistants implemented the sessions correctly. Data were collected per opportunity by scoring “yes” or “no” for each component. Then the data were converted into a percentage by dividing the number of yes’s by the total number of components. The following five procedural integrity components were assessed: (a) the researcher read the correct instruction from a script to signal the participant to prepare learning environment for teaching, (b) the researcher gave the participant a bin of all the necessary materials (i.e., curriculum binder with program
Table 5

Mean IOA and Range for each Participant and Phase

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline</th>
<th>Post ICT</th>
<th>Checklist</th>
<th>Feedback</th>
<th>Gen/Main</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danielle</td>
<td>96 (93-98)</td>
<td>93</td>
<td>95</td>
<td>92 (90-93)</td>
<td>93 (92-95)</td>
</tr>
<tr>
<td>Jody</td>
<td>93 (89-97)</td>
<td>93 (93-95)</td>
<td>94</td>
<td>93 (90-97)</td>
<td>92 (89-96)</td>
</tr>
<tr>
<td>Candy</td>
<td>98 (97-98)</td>
<td>94</td>
<td>97</td>
<td>91 (88-95)</td>
<td>94 (88-99)</td>
</tr>
<tr>
<td>Poppi</td>
<td>93 (88-97)</td>
<td>98</td>
<td>94</td>
<td>91 (88-93)</td>
<td>92 (89-99)</td>
</tr>
<tr>
<td>Vanessa</td>
<td>92 (89-96)</td>
<td>96 (95-97)</td>
<td>NA</td>
<td>NA</td>
<td>94 (94-95)</td>
</tr>
<tr>
<td>Nancy</td>
<td>95 (85-100)</td>
<td>90</td>
<td>85</td>
<td>89 (86-92)</td>
<td>93 (91-95)</td>
</tr>
</tbody>
</table>

Note. Ranges are in parentheses. Feedback includes performance feedback and extended feedback and coaching. Gen = generalization probes; Main = maintenance.

sheets and data sheets, reinforcers, teaching materials, a pencil, and checklist if necessary), (c) the researcher gave the participant the allotted time to prepare the learning environment for teaching (5 or 10 min depending on the phase), (d) after the allotted time, the researcher read the correct instructions from a script to signal the participant to begin implementing DTI with their assigned student, and (e) the researcher did not provide any other feedback or instructions to the participant (see Appendix G). Prior to starting the session, the research assistant video recorded inside the participant’s bin and curriculum binder to ensure all the necessary materials were present. For all participants, the mean integrity was 99% (range 80% to 100%). Procedural integrity was 100% for all sessions across phases for Danielle, Jody, Nancy, and Vanessa. Both Candy and Poppi had one session at 80% integrity; research assistant failed to read the second script.

Feedback Procedural Integrity

Procedural integrity was assessed for 100% of all live distance performance
feedback sessions to ensure each participant received a similar experience. The same research assistant delivered all the feedback sessions and email correspondences to each participant. Data were collected per opportunity by scoring “yes” or “no” for single components and by tallies for correct and incorrect feedback integrity. Then the data were converted into a percentage by dividing the number of yes’s and correct tallies by the total number of components. The following procedural integrity components were assessed: (a) sent an email with scheduled date and time (attachment of a blank feedback form included for initial session), (b) introduced self and oriented the participant how the meeting would proceed, (c) oriented the participant to the feedback form (initial session), (d) delivered corrective feedback for all components marked with Some or No, (e) delivered specific praise for components marked with a Yes, (f) answered all participant’s questions, (g) ended feedback by reviewing skills the participant should work on and skills to maintain, and (h) sent the participant their completed feedback form via email (see Appendix H). If a participant met the performance criterion (i.e., 90% or higher integrity), feedback was delivered via email with a new completed feedback form attached. For all participants, the mean integrity was 99% (range 97% to 100%). Danielle received two live performance feedback sessions and one via email with 100% integrity. The length of the live feedback sessions ranged between 26- to 31-min. Jody received one live performance feedback session with 97% integrity, lasting 33 min, and two feedbacks via email. Two live performance feedback sessions were provided to Candy with 100%. The sessions lasted between 29- to 37-min. Poppi also received two live performance feedback sessions. Mean integrity was 99% (range, 98% to 100%) and
sessions ranged between 32- to 37-min. Two live performance feedback sessions were delivered to Nancy. Mean integrity was 99% (range, 98% to 100%) and feedback lasted between 32- to 40-min. No additional training components were needed for Vanessa.

**Experimental Design and Procedures**

A noncurrent multiple-baseline design across participants (two participants per classroom) was used to evaluate the effectiveness of the ICT on paraprofessionals’ implementation of DTI with a student with a developmental disability across baseline, post training, and generalization sessions. One to two sessions were conducted per day between two to four days per week depending on student and technician attendance. If two sessions were conducted in a day, at least 30 min separated the two sessions. In order to minimize the disruption to their typical classroom schedule, each classroom teacher identified potential research session times.

**General Procedures**

A session began with the research assistant reading a script instructing the participant to prepare the learning environment for teaching. The script said the following:

> “Please prepare the learning environment for discrete-trial instruction with [Student’s research name]. You will have 5 min to prepare the learning environment. I will let you know when the 5 min are up or you can let me know when you are ready.”

The research assistant simultaneously gave the participant a bin, which included all the necessary teaching materials. The participant had 10 min for the initial session and then 5
min for each subsequent session to look over the materials and setup the learning environment. During this time, the participant was expected to read and look over the three instructional program sheets and corresponding data sheets and prepare materials and reinforcers for teaching.

Once the participant said they were ready, or if the time elapsed, the research assistant read another script that said the following: “Use the information in student’s code name curriculum binder for teaching. Please let me know when you are finished.” If the participant asked a question, at any point, the research assistant responded by saying, “I am sorry, but I cannot answer any questions at this time. Try your best and let me know when you are finished.”

During this time, the participant should do the following components: (a) conduct two brief multiple-stimulus-without-replacement (MSWO) preference assessment to identify the top two preferred edible and tangible reinforcers (Carr et al., 2000), (b) conduct probe trials to determine the starting prompt level for each target, and (c) conduct teaching trials interspersing targets from within and across the three instructional programs.

The participant should start the first trial for each target at the prompt level determined from the probe trial(s). A correct response was defined as the student responding correctly to the instruction independently, or with a prompt within 5 s. An incorrect response was defined as the student responding incorrectly to the instruction (with or without a prompt), or not responding to the instruction within 5 s. Following a correct response, participants were taught to deliver reinforcement (i.e., varied praise
paired with an edible or tangible) and collect data. Varied praise was defined as a different praise statement from the previous praise statement (e.g., “Good job!,” “Awesome!,” “Good job!”). In Module 3 participants learned how to assess preference by conducting a formal and informal preference assessments. Prior to teaching, participants learned to conduct two brief MSWO preference assessments. Edibles and tangibles ranked first and second were to be delivered as reinforcers contingent on correct responding. During teaching, participants were taught they could conduct informal preference assessment checks by holding up two top-ranked items and asking the student to “pick one.” The item the student selected could then be used as the reinforcer for the next correct trial. After each correct response, participants were taught to intersperse targets within the same instructional program and/or across the three other instructional programs. For example, the participant could conduct a target from the non-verbal imitation program and then move to a target from the receptive identification program, then conduct another target from the receptive identification program, then go back to a target from the imitation program, and then run a target from the expressive identification program.

If a student responded incorrectly the participant was taught to break eye contact and/or say, “try again” while clearing materials (if necessary) and collect data. The participant then was taught to stay with the target until the student responded correctly or if they conducted a maximum of 10 trials. Following each error the participant was taught to increase the prompt level (e.g., independent → partial physical → full physical prompt). When the student responded correctly, the participant should deliver
reinforcement and move to another target.

This process continued until the participant finished the teaching session, by saying they were finished. For a target to be considered completed, the participant should have conducted a minimum of five trials with the last trial ending at the starting prompt level (identified during the probe trial) or at a lesser prompt level. If at the fifth trial the student made an incorrect response, the participant should continue teaching that target until the student responded with a correct response at the starting prompt level or until a maximum of 10 trials had been conducted (see Figure 2).

Figure 2. Example of completed data sets for an example imitation target clap hands.
Baseline and Generalization Probe

During baseline participants were given a bin with all the necessary materials to review. Participants were instructed to implement DTI with their assigned student. No feedback or assistance was provided. Following baseline, a generalization probe with three, untrained programs (i.e., receptive actions, match-to-sample, and verbal-verbal) was conducted prior to training using the same procedures as in baseline.

Interactive Computerized Training

Following baseline, participants were given access to the DTI training modules. Participants were given a job aid on how to access the modules. Participants were instructed to complete each module in one sitting, and were able to complete the module only once, in order to measure the amount of time it took for each parent participant to complete each module. Participants recorded the time they started and completed the module within Instructure Canvas. Participants were given a deadline of one week to complete all six training modules. Participants could complete the module anywhere as long as they had access to a computer and Internet. Participants were told they could use the classroom printer to print out the additional materials needed to complete the training modules.

Post Training

Once the participant completed the ICT modules, the participant continued implementing teaching sessions with their assigned student identical to baseline. Participants continued implementing sessions until they reached the performance
criterion of 90% or higher DTI fidelity and responding was stable across five consecutive sessions (within 10 percentage points). If performance was below 80% following two post ICT sessions, participants received additional training components (see below).

Additional Training Components

**Teaching checklist.** Sessions were identical to baseline and post-training sessions except participants were given a one-page laminated checklist to use to guide their teaching session (see Appendix I). The checklist was divided into two sections outlining the steps the participant should follow when preparing the learning environment and during teaching. An expo marker was provided to check off completed steps. The checklist included the following components: (a) read program sheets, (b) remove data sheets from binder, (c) review data sheets, (d) arrange materials and reinforcers, (e) conduct preference assessment for tangibles, (f) conduct preference assessment for edibles, (g) conduct probe trials for all teaching targets, and (h) conduct teaching trials.

The script the research assistant read to the participant to instruct them to prepare the learning environment for teaching was modified to say the following:

> “Here is a checklist to help guide your teaching session with [Student’s research name]. You may use the dry erase marker to check off completed steps. Please prepare the learning environment for discrete-trial instruction with [Student’s research name]. You will have **10 min** to prepare the learning environment. I will let you know when the **10 min** are up or you can let me know when you are ready.”

The time was increased back up to 10 min to allow participants more time to read over the checklist, instructional programs, and prepare the learning environment for teaching. In subsequent sessions the script was shorted to the following:
“Use the checklist to guide your teaching session. Please prepare the learning environment for discrete trial instruction with student’s code name. You will have 10 min to prepare the learning environment. I will let you know when the 10 min are up or you can let me know when you are ready.”

**Performance feedback.** Following two sessions below 80% with the checklist, participants received feedback on their performance delivered from a distance using a video conferencing application called Vsee. The classroom teacher was instructed to download Vsee on their classroom iPad. Feedback sessions were scheduled during school hours at a convenient time for the participant to leave the classroom for 20-30 min. Prior to the scheduled feedback session, the participant received an email that provided information about the upcoming feedback session and a blank feedback form (see Appendix J). The feedback form was developed into six sections with subcomponent target behaviors. The six section included: (a) preparing the learning environment, (b) assessing preference, (c) conducting probe trials, (d) managing antecedents, (e) prompting and responding to errors, (f) managing consequences, and (g) general teaching procedures. For each component, a percentage was calculated from the participant’s last teaching session to determine if the participant demonstrated the target behaviors, which were scored as either *No* (0-49%), *Some* (50-89%), or *Yes* (90-100%).

During the feedback session, the participant sat in a quiet office or conference room located in the school with the iPad and Vsee application. A research assistant (hereafter referred as coach) used the feedback form to deliver positive and corrective feedback. Corrective feedback was delivered for all components marked as *No* or *Some* (e.g., “Remember you should record data after every instruction; correct and incorrect responses. This is important so you can correctly prompt and respond to student errors
and know when to stop teaching”). Praise was delivered for all components marked as Yes (e.g., “Great job, removing materials after every teaching trial!”). Once feedback was provided for all the components on the form, the coach reviewed skills the participant should work on and skills the participant should continue to maintain.

Following the feedback session, an email was sent to the participant with their completed feedback form that they could review. The next day, participants continued running sessions with their assigned student identical to the teaching checklist phase. Following every third session, participants received follow-up feedback based on their last (i.e., third post feedback) session. If the participant met criterion of 90% or higher fidelity, the coach delivered feedback via email with a new completed feedback form attached. If the participant was below criterion, another live distance feedback session was scheduled and conducted in the same manner as described above. Participants continued receiving feedback every third session until they reached the performance criterion of 90% or higher DTI fidelity and responding was stable across five consecutive sessions (within 10 percentage points).

**Extended feedback and coaching.** If performance was still below criterion following two rounds of distance feedback with the coach, the participant received a single session of extended feedback and coaching. The coach observed the participant implementing a typical teaching session with their assigned student. During this session, the coach provided verbal instruction, modeling, and direct feedback for 30 min of the teaching session through the video conferencing application. Towards the end of the 30 min, if the teaching session had not ended, the coach stopped the teaching session to
summarize the feedback delivered and answers any additional questions from the participant. Participants continued running follow-up sessions until responding stabilized.

**Generalization**

Generalization was assessed with three novel instructional programs: receptive actions, match-to-sample, and verbal-verbal. The purpose of this probe was to assess participants’ ability to read new instructional program sheets and corresponding data sheets to teach other common skills taught with DTI. The three novel programs were introduced into the curriculum binder and the session was conducted as baseline. Participants had no experience or training with the instructional programs and no feedback was provided.

**Maintenance**

Following the final research session, a follow-up probe was conducted at 2-weeks to assess maintenance of DTI implementation following ICT and in the absence of performance feedback. The session was conducted the same as post training sessions. If a student had mastered a target(s), new targets were introduced. No feedback was provided.
CHAPTER IV

RESULTS

Duration of Interactive Computerized Training

Table 6 displays the amount of time required for each participant to complete the ICT training. Five participants completed the module by the deadline—1 week. Candy completed the training after 8 days. Overall, it took participants an average of 305 min (range, 221-353 min) to complete all six modules. Participants were able to complete module one through six in an average of 33 min (range, 25-40 min), 45 min (range, 23-70 min), 47 min (range, 32-82 min), 55 min (range, 24-74 min), 64 min (range, 51-85 min), and 61 min (range, 24-102 min).

Discrete Trial Instruction Integrity

Figure 3 depicts the results for each participant’s accurate implementation of DTI components with a student with a developmental disability measured by the percentage of

Table 6

*Duration (min) to Complete ICT*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Module 1</th>
<th>Module 2</th>
<th>Module 3</th>
<th>Module 4</th>
<th>Module 5</th>
<th>Module 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danielle</td>
<td>35</td>
<td>50</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>25</td>
<td>260</td>
</tr>
<tr>
<td>Jody</td>
<td>35</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>315</td>
</tr>
<tr>
<td>Candy</td>
<td>33</td>
<td>71</td>
<td>32</td>
<td>75</td>
<td>85</td>
<td>57</td>
<td>353</td>
</tr>
<tr>
<td>Poppi</td>
<td>28</td>
<td>47</td>
<td>40</td>
<td>71</td>
<td>51</td>
<td>100</td>
<td>337</td>
</tr>
<tr>
<td>Nancy</td>
<td>40</td>
<td>30</td>
<td>82</td>
<td>34</td>
<td>57</td>
<td>102</td>
<td>345</td>
</tr>
<tr>
<td>Vanessa</td>
<td>25</td>
<td>23</td>
<td>39</td>
<td>42</td>
<td>68</td>
<td>24</td>
<td>221</td>
</tr>
<tr>
<td>Average</td>
<td>33</td>
<td>45</td>
<td>47</td>
<td>55</td>
<td>64</td>
<td>61</td>
<td>305</td>
</tr>
</tbody>
</table>
Figure 3. The percentage of correctly implemented discrete trial instruction components.
correctly implemented components of DTI measured by a fidelity checklist. Danielle’s data are presented in the upper panel of Figure 3. During baseline Danielle demonstrated low integrity of the DTI components, averaging 28% (range, 27% to 28%). In baseline, she conducted mass trials for each target and inaccurately ran the expressive identification program as a receptive identification program. Integrity remained low during a generalization probe to untrained instructional programs (31%). Following the completion of the training, Danielle’s performance increased slightly to 43% accuracy. She continued to inaccurately run the expressive identification program. She often provided the incorrect instructions specified on the program sheets and data sheets. In addition, Danielle frequently repeated the instruction without following the sequence of DTI components (i.e., allow the student an opportunity to respond, deliver a consequence, and collect data). A teaching checklist was provided to help guide her teaching session and draw attention to important information provided on the instructional program and data sheets. Following two sessions with the checklist, her performance increased again slightly to 54% (range, 51% to 56%), but still below criterion. Prior to session 12, she received performance feedback delivered from a distance. Her performance jumped to 72% (range, 71% to 73%) and plateaued. Danielle received another feedback session and her performance increased again (84%) and gradually increased to criterion (92%). Performance remained above criterion and she received one more feedback check-in, which was delivered via email. Her performance remained high during a generalization probe to three untrained instructional programs at 80%. Across two of the three programs (match-to-sample and receptive actions), Danielle
added a word to the instruction (e.g., “Match truck.” instead of “Match.” and “Raise your arms” instead of “Raise arms.”). During a 2-week follow up probe, Danielle’s implementation of DTI remained high at 96% integrity.

Jody’s data are also presented in the top panel. During baseline, she only ran a few trials (between 4-29) before saying she was finished. Her integrity of DTI components was low, 20% (range, 13% to 25%) during baseline sessions and the generalization probe (25%). A slight increase to 42% accuracy of DTI component was seen following the completion of the training (range, 41% to 43%). Jody increased the number of teaching trials, but failed to use the specified instruction on the program and data sheets. The teaching checklist was introduced to help guide Jody’s teaching session and to prompt her to read the instructional program sheets. Jody disregarded the checklist and did not use it during her sessions, responding remained low at 45% (range, 41% to 48%). Performance feedback was introduced prior to session 12. Her performance immediately increased to 72% and gradually increased to meet the performance criterion by session 14. Performance feedback check-ins occurred following every third session (once a week). At each check-in, prior to session 15 and session 18, her performance was above the 90% integrity criterion; therefore, performance feedback was delivered via email. Her procedural integrity of the DTI components remained high and stabilized around 90% (range, 85% to 94%). Integrity remained high at 81% when her performance was assessed to three novel instructional programs. Similar to Danielle’s performance, Jody made integrity errors providing the correct instruction for match-to-sample and receptive action programs. A follow-up session was conducted at 2-weeks and Jody’s
implementation of DTI components remained relatively high at 81%.

Candy’s data are presented in the middle panel of Figure 3. The accuracy of her implementation of DTI components was low and stable during baseline around 35% (range, 28% to 39%). Her performance remained low during the generalization probe at 36%. Following ICT Candy’s accuracy of implementation of DTI components increased to 70.5% (range, 69% to 72%). Candy consistently conducted the preference assessment, but did not conduct the probe trials for each target prior to teaching. Following session 11, the teaching checklist was introduced to help her structure the sequence of steps correctly during her sessions. With the introduced of the checklist, Candy began to conduct probe trials prior to teaching, but a slight drop in her performance was observed, 65.5% (range, 63% to 68%). The majority of her integrity errors were inaccurate implementation of the errorless learning procedure. Thus prior to session 14, performance feedback was introduced. Her integrity of implementation increased to 78% (range, 74% to 81%), but still fell below criterion. She received another distant feedback session prior to session 17. Performance dropped during session 17 but returned to similar integrity levels following the next two sessions. Candy’s implementation of DTI plateaued and she continued to make errors with the errorless learning procedure. Following session 19, extended feedback and coaching was introduced (see methods for description of extended feedback and coaching). Towards the end of the extended feedback and coaching session, the student engaged in challenging behavior (i.e., noncompliance, screaming, and crying). Candy received feedback and coaching through the preference assessments, probe trials, and 22 teaching trials across the six instructional targets. Following extended feedback
and coaching her integrity of implementation of DTI components only increased slightly, but her integrity of implementation of the errorless learning procedure increased from an average of 47% to 73%. Her performance stabilized below the performance criterion around 80% proficiency (range, 75% to 84%). During the generalization probe Candy’s integrity of implementation of DTI components remained around the same integrity level, 74%. She made integrity errors with the receptive actions program and gave the same instruction as the imitation program.

Poppi’s performance was relatively similar to Candy’s performance and is also depicted in the middle panel of Figure 3. During baseline, Poppi’s integrity of implementation of DTI was low and stable around 36% (range, 31% to 42%). She consistently conducted mass trials of each target and ran the expressive identification program as a receptive identification program. Her accuracy of implementation was low at 24% during the generalization probe. After the completion of the training modules, her accuracy of implementation of DTI increased slightly to 45.5% (range, 45% to 46%). Although a slight increase in her integrity was observed, Poppi continued to conduct mass trials and run the expressive identification program incorrectly, among other errors. She also misinterpreted the operational definition of the student’s response for the imitation target, peace sign. The teaching checklist was introduced at session 12 to prompt her to read the instructional program sheets and data sheets. During session 12, she used seven out of the 10 min setup time to read over the checklist and instructional program sheets. A slight increase in her accuracy was observed across the two sessions to 49% (range, 45% to 53%), however her integrity was still below the performance
criterion. Performance feedback was delivered from a distance prior to session 14. The coach provided clarification about the correct presentation of material and instruction for each program. Poppi’s performance gradually increased after feedback and she started to intersperse targets and accurately present the expressive identification targets and imitation target. Prior to session 17, the coach provided another round of feedback. Following the feedback, her integrity of DTI components began to plateau around 70% (range, 69% to 70%). Poppi also received a session of extended feedback and coaching. Feedback was provided through the preference assessments, probe trials, and 24 teaching trials across the six instructional targets. Following extended feedback and coaching her integrity of implementation of DTI components jumped to 80% proficiency (range, 77% to 83%) and stabilized. An increase in her accuracy of implementation the errorless learning procedure was also observed. Poppi’s integrity of implementation of DTI components generalized to novel instructional programs increased compared to baseline at 62% integrity. Poppi failed to clear and re-arrange the materials during the match-to-sample program and ran the receptive action targets as imitation. Due to the end of the school, a 2-week follow-up session could not be conduct with either Candy or Poppi.

Nancy’s data are shown in the bottom panel of Figure 3. Accuracy of DTI components was low during baseline. During the first baseline session Nancy did not conduct any target instructions and only opened the curriculum binder to the preference assessment data sheet. She played with the student for several minutes and then said she was done. During the remaining baseline sessions, she looked over the curriculum binder and conducted several instructional trials with each target. The procedural integrity of her
DTI implementation stabilized at 30.5% (range, 0% to 39%). Nancy completed the ICT and a slight increase in her performance was observed to 53.5% (range, 50% to 57%). Nancy followed the same additional training components as the previous participants. Following the introduction of the teaching checklists her performance did not change (51%; range, 47% to 55%). Performance feedback was provided prior to session 16. Nancy’s implementation of DTI components increased and gradually increased from 63%, to 67%, to 73%. Nancy frequently made errors related to the errorless learning procedure and the delivery of appropriate consequences. Nancy revived another feedback session before session 19. Only a 2% increase was observed in her implementation of DTI components, thus indicated more extensive feedback was need. Extended feedback and coaching was provided prior to session 20. Nancy received feedback and coaching through the preference assessments, probe trials, and 22 teaching trials across the six instructional targets. Following extended feedback and coaching her integrity of implementation of DTI components only increased slightly, but her integrity implementing the errorless learning procedure increased from an average of 51.5% to 70%. Her performance stabilized below the performance criterion around 78% proficiency (range, 70% to 84%). During the generalization probe to novel instruction programs Nancy’s integrity of DTI components was relatively similar at 76%. She also incorrectly taught the receptive actions program. Following the conclusion of the study, in person performance feedback and coaching was provided to increase her DTI proficiency prior to the classroom adopting the new teaching procedure.

Vanessa’s data are also presented in the bottom panel. Vanessa had the highest
baseline and scored around 54% (range, 38% to 60%) accurate implementation of DTI components. In comparison to the other participants, Vanessa spent more time reading over the instructional program sheets and data sheets prior to teaching. Responding was at similar levels of integrity during the generalization probe to novel instructional programs (45%). Following ICT, her accuracy of implementation of DTI components immediately increased to criterion and stabilized around 93% (range, 85% to 96%). A drop in her integrity of DTI was observed on session 15, because she failed to conduct the preference assessments. Integrity of implementation of the DTI components remained high during generalization (86%). No major errors were observed in her implementation of DTI components to novel programs except her pacing in between instructional targets was slower. A follow-up session was conducted at 2-weeks and Vanessa’s implementation of DTI components remained high at 92% integrity.

**Errorless Learning Procedure Integrity**

Figure 4 depicts the results of each participant’s accuracy of implementation of the errorless learning procedure throughout the study. The following components were compiled into a percentage of accurate implementation: immediate delivering of the correct prompt level, fade the prompt level following two correct responses at the same prompt level, and increase the prompt level following a student error. During baseline, all participants, except Vanessa, demonstrated low percentages of correct implementation of the errorless learning procedure. As participant’s integrity increased for the overall DTI components, a corresponding increase in accurate implementation of the errorless
Figure 4. The percentage of correctly implemented errorless learning components.
learning procedure was observed. Figure 5 represents the average percent correct of accurate implementation of the errorless learning procedure for each participant across each training phase. Participant data are displayed per classroom.

The top panel of Figure 4 and Figure 5 represents Danielle and Jody’s accurate implementation of the errorless learning procedure. Implementation of the errorless learning procedure remained low following ICT and the teaching checklist sessions. Both participants made errors conducting the probe trials using the least-to-most prompt hierarchy and using that data to guide their teaching session to prevent student errors. Following performance feedback, both participants gradually increased their accuracy of implementation and reached an accuracy around 93% for Danielle and 90% for Jody for the last three sessions following feedback. Accuracy of implementation of the errorless learning procedure remained high during the generalization probe to three novel instructional programs, which included a new prompt type— a model prompt for receptive actions program. During a 2-week follow-up session, both Danielle and Jody maintained high integrity of implementation of the errorless learning procedure at 97% and 73%.

Candy and Poppi’s accuracy of implementation of the errorless learning procedure are depicted in the middle panel of both Figure 4 and Figure 5. Both participants had low accuracy of the errorless learning procedure during baseline. A slight increase during the last two baseline sessions was observed with Poppi, likely due to an increase in independent responding from the student. Following ICT accuracy of
Figure 5. Percent correct of errorless learning procedure components separated by classroom.
the errorless learning procedure remained low. After introducing the checklist integrity of the procedure remained low for Poppi, but a slight increase in accuracy was observed for Candy. After two rounds of performance feedback, both participants’ accuracy of implementation of the errorless learning procedure stabilized around 48% respectively for Candy and 45% for Poppi. Extended feedback and coaching was implemented to coach Candy and Poppi through the accurate implementation of the DTI components and errorless learning procedure. Although an increase in their accuracy of overall DTI components was not observed (refer to Figure 3), an increase in their correct implementation of the errorless learning procedure was seen. Both participants maintained their level of accuracy of the errorless learning procedure during the generalization to new programs.

The bottom panel of Figure 4 and Figure 5 represent Nancy and Vanessa’s accuracy of implementation of the errorless learning procedure. Unlike the participants’ in classroom 1 (Danielle and Jody) and classroom 2 (Candy and Poppi), Nancy and Vanessa did not show a similar pattern between each other. During baseline, Nancy rarely provided a prompt during teaching. Following ICT, Nancy’s accuracy of the errorless learning procedure increased slightly. Her accuracy of the errorless learning procedure slowly increased following each additional training component but remained below 80% accuracy. During the generalization probe her accuracy of the errorless learning procedure was 68% integrity. Vanessa’s accuracy of the errorless learning procedure began to increase during baseline as a result of the student independent responding increased; fewer opportunities to assess the errorless learning procedure.
Following ICT, Vanessa’s accuracy of implementation of the procedure increased and remained high around 90%, even when new learning targets were introduced once the student met mastery. Vanessa’s implementation of the errorless learning procedure remained high during generalization probe (82%) and 2-week follow-up session (96%).

**Error Analysis**

An analysis of correctly implemented DTI components was calculated to determine common errors across participants. Table 7 depicts the percent correct per DTI component evaluated across each phase per participants organized by classroom. Common DTI integrity errors across all participants included: (a) implementing the errorless learning procedure, (b) delivering a correct consequence, (c) inter-trial interval, (d) scoring data correctly, and (e) ending teaching of targets. Following ICT and the introduction of the teaching checklist, all participants except Poppi, accurately conducted the brief-MSWO preference assessments to identify the top ranked edibles and tangibles reinforcers. In addition, all participants had high integrity in securing the student’s attention. Three participants (Candy, Nancy, and Vanessa) consistently provided the correct specified instruction for each teaching target. Following performance feedback and extended feedback and coaching, an increase in accurate implementation was seen in the majority of the components. However, all participants consistently scored low in their accuracy of implementation of providing the appropriate inter-trial interval between instructions and ending teaching for a target.
Table 7

**Mean Percent Correct of DTI Components Across Phases per Participant**

<table>
<thead>
<tr>
<th>DTI Component</th>
<th>Danielle</th>
<th>Jody</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ICT</td>
<td>Checklist</td>
</tr>
<tr>
<td>Assess preference</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Present materials</td>
<td>27</td>
<td>64</td>
</tr>
<tr>
<td>Secure attention</td>
<td>96</td>
<td>98</td>
</tr>
<tr>
<td>Deliver instruction</td>
<td>43</td>
<td>62</td>
</tr>
<tr>
<td>Allow 5 s</td>
<td>13</td>
<td>34</td>
</tr>
<tr>
<td>Prompt immediately</td>
<td>32</td>
<td>57</td>
</tr>
<tr>
<td>Correct prompt</td>
<td>26</td>
<td>37</td>
</tr>
<tr>
<td>Correct consequence</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Remove materials</td>
<td>47</td>
<td>69</td>
</tr>
<tr>
<td>Score data</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Inter-trial interval</td>
<td>73</td>
<td>66</td>
</tr>
<tr>
<td>Interspersal</td>
<td>84</td>
<td>83</td>
</tr>
<tr>
<td>Ending teaching</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Average</td>
<td>44</td>
<td>55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DTI Component</th>
<th>Candy</th>
<th>Poppi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ICT</td>
<td>Checklist</td>
</tr>
<tr>
<td>Assess preference</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Present materials</td>
<td>58</td>
<td>58</td>
</tr>
<tr>
<td>Secure attention</td>
<td>94</td>
<td>88</td>
</tr>
<tr>
<td>Deliver instruction</td>
<td>93</td>
<td>97</td>
</tr>
<tr>
<td>Allow 5 s</td>
<td>63</td>
<td>47</td>
</tr>
<tr>
<td>Prompt immediately</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Correct prompt</td>
<td>57</td>
<td>45</td>
</tr>
<tr>
<td>Correct consequence</td>
<td>56</td>
<td>70</td>
</tr>
<tr>
<td>Remove materials</td>
<td>79</td>
<td>82</td>
</tr>
<tr>
<td>Score data</td>
<td>64</td>
<td>53</td>
</tr>
<tr>
<td>Inter-trial interval</td>
<td>91</td>
<td>76</td>
</tr>
<tr>
<td>Interspersal</td>
<td>76</td>
<td>72</td>
</tr>
<tr>
<td>Ending teaching</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Average</td>
<td>67</td>
<td>66</td>
</tr>
</tbody>
</table>

*(table continues)*
### Student Acquisition

Student acquisition of targets was assessed throughout post training sessions. Once a target met mastery, four consecutive sessions at 80% or higher, a new target was introduced. This was conducted to ensure there were opportunities to evaluate the participants’ accuracy of implementation of the errorless learning procedure. Four of the six students mastered three or more targets (see Table 8). Due to different developmental disabilities and student abilities across participants, it is unknown the effects of integrity level of DTI related to student acquisition in this study.

### Feedback Questionnaire

After the completion of the training modules, participants had the opportunity to...
complete a feedback questionnaire regarding their experience. The questionnaire was available on Instructure Canvas following the last module. All six participants completed the questionnaire. The results of the questionnaire are presented in Table 9. Overall, participants rated the six Likert questions with either agree or strongly agree. Neutral was marked for three questions regarding interest, clarity, and amount of content. Participants reported the liked the videos and interactive activities embedded in the modules. Three participants reported data collection was the most difficult content (Module 6).

Table 8

*Number of Targets Taught and Mastered Post Training*

<table>
<thead>
<tr>
<th>Student (Teacher)</th>
<th>Total targets</th>
<th>Mastered targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roxy (Danielle)</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Kyle (Jody)</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>Gwen (Candy)</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Adam (Poppi)</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Mary (Nancy)</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Abe (Vanessa)</td>
<td>10</td>
<td>4</td>
</tr>
</tbody>
</table>
### Table 9

**Feedback Questionnaire Results**

<table>
<thead>
<tr>
<th>Question</th>
<th>Response</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>The modules kept my interest during the training</td>
<td>Agree</td>
<td>( n = 5 )</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td>I found the modules informative about how to teach using discrete trial instruction</td>
<td>Strongly agree</td>
<td>( n = 2 )</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>( n = 4 )</td>
</tr>
<tr>
<td>The modules described the content clearly</td>
<td>Strongly Agree</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>( n = 4 )</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td>There were plenty of video examples that clearly demonstrated how to implement various components of the teaching procedure</td>
<td>Strongly agree</td>
<td>( n = 3 )</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>( n = 3 )</td>
</tr>
<tr>
<td>I felt like there was enough information in the modules to learn how to implement discrete trial instruction</td>
<td>Strongly agree</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>( n = 4 )</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td>I would recommend the interactive computerized training to another person who is interested in learning how to implement discrete trial instruction</td>
<td>Strongly agree</td>
<td>( n = 2 )</td>
</tr>
<tr>
<td></td>
<td>Agree</td>
<td>( n = 4 )</td>
</tr>
<tr>
<td>What training features did you like the most?</td>
<td>Videos</td>
<td>( n = 2 )</td>
</tr>
<tr>
<td></td>
<td>Videos and interactive activities</td>
<td>( n = 4 )</td>
</tr>
<tr>
<td>What content did you find to be difficult to understand?</td>
<td>No response</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td></td>
<td>Data collection</td>
<td>( n = 3 )</td>
</tr>
<tr>
<td></td>
<td>Prompting</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td></td>
<td>Really nothing, if you paid attention to the video and read questions all the way before answering it was understandable</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td>What comments or suggestions do you have for future modifications to the training modules?</td>
<td>No response</td>
<td>( n = 3 )</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td></td>
<td>I think you need to be able to pause it to take notes. I learn it better if I can write stuff down that the instructor says</td>
<td>( n = 1 )</td>
</tr>
<tr>
<td></td>
<td>Use spell check</td>
<td>( n = 1 )</td>
</tr>
</tbody>
</table>
CHAPTER V
DISCUSSION

Although previous studies have been conducted to evaluate the utility of ICT to teach college students and teachers to implement DTI (Higbee et al., in press; Pollard et al., 2015), this is the first study conducted with paraprofessionals. The primary purpose of this study was to investigate the effectiveness of ICT to train paraprofessionals to implement errorless DTI with a student with a developmental disability. This study sought to extend the literature by addressing limitations of previous asynchronous training formats (self-instructional manuals, video modeling, ICT) in order to design a cost-effective training procedure to teach DTI. The specific extensions of this study were: (a) to a new population (paraprofessionals), (b) to more advanced teaching procedures, (c) to direct implementation with a student with a disability (not with confederates), and (d) to evaluate feedback provided from a distance. Although the results of this study provide mixed support for the use of ICT to train paraprofessionals to implement DTI, all participants were able to increase their teaching integrity following ICT and feedback components. However, only one participant was able to reach proficiency following the ICT alone. Two participants met criterion following feedback, three participants reached about an 80% proficiency following extended feedback and coaching. All participants’ accuracy of implementation of DTI generalized to three novel instructional programs. Participants who met criterion maintained high levels of integrity at a 2-week follow-up assessment. Each extension and implications for future research will be discussed.
Extension 1: New Population

Often paraprofessionals in special education classrooms are responsible for implementing specialized teaching procedures like DTI. However, little training or oversight is provided to ensure that these procedures are implemented with fidelity. While DTI is extremely beneficial in teaching a variety of skills, it is most effective when implemented with high level of procedural integrity. Therefore, the first extension of this study was to determine whether ICT, which has been shown to be an effective to DTI training method for college students and special education teachers would also be effective to train paraprofessionals.

In Pollard et al. (2014) and Higbee et al. (in press), ICT increased procedural integrity of DTI for all participants, however a few participants required additional feedback in order to reach a proficiency level of 85% with a student with ASD. In the current study, an immediate increase in the accuracy of implementation of DTI components was observed for two participants, Candy and Vanessa. The accuracy of other participants slightly increased following the ICT, but additional training components were required. Given the complexity of DTI, and that additional feedback was needed in the previous studies it was not surprising that some of the participants in the current study required additional feedback. In addition, these results align with previous implementation research by Joyce and Showers (2002), in that learning a new skill that involved a more complex repertoire (e.g., implementing an errorless learning procedure in addition to DTI) requires additional training components such as feedback and coaching in order to obtain transfer of the skill into practice.
However, it is also important to note that although the modules were developed and modified from existing ICT studies and asynchronous training studies, these particular modules were untested. It is possible that the modules used in the current study would have been insufficient to teach college students and special education teachers to implement these more advanced DTI components. It is also possible, however, that paraprofessionals may have not have responded as well to the training compared to college students and special education teachers due to potential learning histories and motivation variables. Thus, the amount of additional feedback and coaching required for some participants to increase their procedural integrity to acceptable levels in this study can been seen as a limitation.

In the current study, all participants had an extensive working history as paraprofessionals. However, none of the participants had received formal training to work with students with developmental disabilities and all had low levels of education. All participants had previous experience providing one-on-one and group instruction to students. The majority of their training was informal, “on-the-job” feedback from their classroom teacher when she had time to provide it. Thus, it is possible participants developed a learning history of teaching using certain procedures that they implemented over several years. Because of this teaching history, it is possible it competed with their ability to learn a new way to teach similar skills. For example, Poppi often failed to end the teaching trial following an incorrect response. Instead, when the student responded incorrectly, she would immediately prompt the correct response and deliver reinforcement. This is problematic because the student may learn to chain the two
responses together. Because this response was at strength in Poppi’s repertoire prior to the study, it may have competed with her ability to accurately implement the new teaching procedure.

Another common error made across all participants was their insufficient use of time during the setup time to read over the provided materials (i.e., instructional program sheet, data sheets, teaching checklist). Instructional program sheets were provided for all six skills taught, which provided details on the instruction, materials, brief overview on how to teach the skill, student correct response, prompt hierarchy, prompt fading and error correction rules, and data collection. It is likely that many participants made several errors due to their failure to read the program sheets and data sheets. For example, many of the participants incorrectly ran the expressive identification program as a receptive identification program. In addition, participants failed to deliver the correct instruction and failed to correctly present the material. Similar errors were also seen during the generalization probe with three untrained programs. Although the program sheet and terminology were discussed in Module 2, some participants may have had some reading comprehension challenges. If participants are not accurately reading and understanding the material, it is possible ICT may not be the most effective training strategy for these individuals. Future researchers many want to investigate reading comprehension as a participant variable, as this could have been different variable compared to previous research participants of college students and teachers.

Another variable to consider is motivation. Although all participants said they were interested and willing to participate in the study, several participants failed to use
the teaching checklist as a support to guide their teaching sessions and failed to
implement feedback that was repeatedly given. Higbee et al. (in press) found positive
results with special education teachers, but it is possible the motivation to learn and
acquire a new skill is different for these two populations. Future researchers may want to
evaluate motivational systems in addition to the training to help paraprofessionals reach
high levels of procedural integrity and maintain proficiency.

Although precautions were taken to reduce potential threats to internal validity
with two paraprofessionals participating in the study per classroom, there may have been
some treatment reactivity. Several participants reported they did not feel comfortable
with the video camera. This may have been primarily due to the lack of familiarity with
research procedures and lack of performance feedback or procedural integrity checks
prior to the study. However, due to the complexity of the data collection tool it was
necessary to video record the sessions. It is also likely that live integrity scoring would
have resulted in similar behavior reactivity. In addition, although participants were
instructed to refrain from discussing the study with each other, it is likely that they
noticed when the procedures varied between one another, for example when someone
received an additional training component when the other did not. Some participants
made discouraging comments, such as “I must suck since I have to have another feedback
session.” Furthermore, beyond asking participants not to communicate with each other
about details of the study, no other measures were taken to ensure that participants did
not communicate with one another. Therefore, it is possible this could have led to
changes in performance. Future researchers should take precautions to avoid reactivity
variables and may wish to measure participants’ level of comfort at various points throughout the training and evaluation process.

**Extension 2: Advanced Discrete Trial Instruction Teaching Procedures**

Although learning histories, motivational issues, and treatment reactivity could play a part to the lower levels on integrity observed this study also increased the complexity of the DTI skills taught. One reason why the teaching modules used in this study appear that they may have been less effective compared to other studies is that they took longer to complete. In the previous ICT studies took participants took an average of 2 hours to complete four modules: (a) data collection and program overview, managing antecedents, (c) prompting strategies, and (d) managing consequences. In this study, one new module was developed to provide background information on the basic principles of applied behavior analysis and its utility in working with individuals with ASD and other related development disabilities. In addition, we separated data collection and program overview into two separate modules: Module 2—Introduction to DTI and Curriculum and Module 6—Pacing and Data Collection. It took an average of 5 hours for participants to complete all six modules. However, the ambitions of the teaching modules used in the current study were higher than in previous research. Evaluation of an errorless learning procedure in conjunction with DTI made the procedure more complex than previous studies. Previous ICT studies only assessed the participants’ ability to provide a prompt and increase prompts following consecutive errors across a small number of learning trials (12 to 20). However, they did not assess participants’ ability to fade prompts.
Severtson and Carr (2012) used a self-instructional manual to teach an errorless learning procedure for a single instructional program—receptive identification. Three of the six participants the study required additional training components of a video and performance feedback in order to reach proficiency. In the current study, participants were expected to implement all DTI components across three different instructional programs simultaneously, interspersing instructional targets within and across the three programs. All participants, except Vanessa, had low procedural integrity when implementing the errorless learning procedures 90% (range, 82% to 100%).

Unfortunately, inaccurate implementation of prompting and error correction procedures can negatively impact student learning (e.g., prompt dependency, increase errors, delay acquisition). Perhaps the addition of the errorless learning procedure increased the difficulty level for paraprofessionals to implement with accuracy following ICT alone. Five participants required additional feedback and coaching in order to increase their accuracy of the errorless learning procedure.

In addition, this study required participants to conduct a brief MSWO preference and to deliver the top ranked items as reinforcers paired with varied praise for correct responses. If a participant did not conduct the preference assessments before starting the session, then reinforcement-delivery was automatically scored as incorrect for every learning trial. Because of this strict requirement, many participants lost points. This error was particularly detrimental to Vanessa where a decrease in integrity was observed during session 15 and Poppi because she failed to accurately conducted the assessment until she received extended feedback and coaching.
When a student is learning a new skill, reinforcement should be provided on a rich reinforcement schedule. However, it may not be appropriate to provide a reinforcer for all correct responses (e.g., prompted response). The component was defined this way because it seemed important to teach participants to deliver reinforcers instead of presumed reinforcers. For ease of data collection, participants were required to deliver reinforcement this way following every correct response (independent and prompted). However, this disproportionality weighted this component and resulted in lengthier teaching sessions as students were contacting reinforcement frequently. In future studies, researchers may want to define some of these teaching procedures more loosely or parse out the components further to provide a more accurate representation of integrity.

In addition to the reinforcement components, the errorless learning procedure increased the number of learning trials and length of teaching sessions compared to previous studies. Previous ICT studies only evaluated participants’ accuracy across 20 discrete trials, which took about 3 min per session (Pollard et al., 2014). In the current study, learning trials were increased to evaluate the errorless learning procedural components (i.e., probe trials, fading prompts, error correction) and more closely mimic a typical one-on-one teaching session. Post-training teaching sessions were around 30 min long, which included conducting the preference assessments, between 6- to 12-probe trials, and between 30- to 60-teaching trials. Future researchers may want to investigate ways to assess procedural integrity that are not as time intensive.
Extension 3: Direct Implementation with a Student

Another extension of this study was that participants directly implemented DTI with a student with a developmental disability from their classroom instead of with a confederate. In the Higbee et al. (in press) study, positive results were obtained when special education teachers implemented the skills they learned through the ICT directly with a student with ASD. Thus, by eliminating confederate role-play sessions, the cost of ICT can be reduced. In the current study, although participants reached to higher procedural integrity levels following ICT and additional training components, the unpredictable behaviors of students could have resulted in variability in participant’s ability to accurately implement the teaching procedure. Despite the fact that students were selected based on inclusion criteria, students’ rates of acquisition varied. Some students acquired more targets and seemed to be more compliant than other students, who mastered fewer or no targets. However, students’ behavior could also be related to higher levels of procedural integrity. As participants increased their integrity, a corresponding increase in the number of targets student’s mastered was observed. However, throughout the sessions, we noticed more noncompliant behaviors from Gwen (Candy), Adam (Poppi), and Mary (Nancy). All participants had no training on how to effectively manage challenging behavior, thus it is possible noncompliant behaviors were unintentionally reinforced. It is also possible, that the increased length of the teaching sessions resulted in more challenging behaviors. These unforeseen problems could have also contributed to the variable outcomes observed.

While there are advantages to using confederate adult learners, they may result in
false positives as they do not exhibit all the variables a real student is likely to engage in during a teaching session. Many studies have shown positive results of participants acquiring integrity with a confederate and then generalizing proficiency with a student with ASD. However, these were typically observed in one or a couple of session probes, which may not be sufficient enough to demonstrate transfer of the skill to the natural setting. It is unknown how participants would respond to repeated sessions with a student, as it could increase the likelihood that challenging or distracting behaviors to occur. Although the schedule of reinforcement was high, this study did not teach paraprofessionals to provide reinforcement breaks in between blocks of learning trials, which might have prevented some challenging behavior. Future studies may want to teach paraprofessionals to provide reinforcement breaks at different intervals throughout their session to sustain the student’s attention and reduce challenging behaviors. In addition, more research is needed to determine whether the use of confederate students or real students results in quicker and more generalized procedural integrity across a variety of learners.

**Extension 4: Distance Performance Feedback and Coaching**

The fourth and final extension of this study was to evaluate the effects of delivering feedback and coaching from a distance to participants who did not reach the performance criterion. In previous studies, performance feedback and coaching was delivered in person. However, in person feedback and coaching may not always be practical and/or feasible. If a school district is to pay a consultant to deliver feedback,
providing feedback from a distance can reduce the cost and travel time allowing the professional to deliver feedback to more paraprofessionals in a short period of time. The results of this study demonstrate that feedback and coaching can effectively be delivered from a distance—although the results of participant integrity scorings were variable. Following two sessions of live feedback, Danielle reached the performance criterion of 90% accuracy. Jody only required one live feedback session and check-in feedback was delivered via email. Candy and Poppi’s integrity increased following feedback sessions but performance was still below criterion. Thus a session of extended feedback and coaching was provided from a distance and they both reached about 80% proficiency. This is seen as an acceptable performance criterion in other studies, however a more stringent performance standard was selected in this study because integrity errors can effect a student’s acquisition of targeted skills. Although all participants increased their integrity of implementation of DTI components, some participants, such as Nancy, may require more intensive training methods (e.g., motivational or consequence based interventions) in order to accept and implement feedback to reach proficient levels.

**Implications and Summary**

In summary, school districts tend to rely heavily on traditional face-to-face training methods and the classroom teachers to train paraprofessionals, which may have little impact on the performance of paraprofessionals. One benefit of ICT is that trainees can access the training on their own time and complete it at their own pace. ICT can incorporate the BST training components of instruction, modeling, and feedback into an
engaging training package. From previous studies, ICT appeared to be an effective teaching tool. Due to the increase in complexity of DTI skills, new population, and direct implementation with a student, it is unknown which variable or combination of variables contributed to lower success in the current study. However, performance feedback and coaching delivered from a distance was successful in increasing procedural integrity and has been documented as a critical component for transfer of skills (Joyce & Showers, 2002). Because several feedback checks were needed for some participants, future researchers may want to investigate the effects of training classroom teachers to proficiency and then evaluating the effects of teachers delivering the additional performance feedback and coaching components. ICT can provide participants with foundational knowledge, but some accountability and feedback will likely also be needed. ICT may still be a potential solution to the current challenges school districts face with training paraprofessionals on effective teaching strategies. Additional research in this area is need to learn more about the boundaries of using ICT in order to serve the populations these training methods are intended. In addition, more research is need on training other behavior analytic interventions and skills that can be used in the classroom such as promoting compliance and pivotal response training.
REFERENCES


APPENDICES
Appendix A

Participant Background Information Survey
Participant Background Information Form

Directions: Please fill out this form to the best of your ability. Please do not write your name or any other identifying information on the form.

1. Age: ______

2. Sex: Male Female

3. Highest degree obtained:
   - high school diploma
   - some college
   - associate degree
   - bachelors
   - graduate schools

4. Total number of years as a paraprofessional: ______

5. Number of years as a paraprofessional in your current classroom: ______
Appendix B

Preference Assessment Data Sheet
## Preference Assessment Data Sheet

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**Module 3: Managing Antecedents**
Appendix C

Instructional Program Sheet Example
Program: Non-Verbal Imitation (NVI)

Student: ____________________

Date Initiated: ____________________  Date Completed: ____________________

Instruction:

$S^{ BV1} = \text{“Do this.”}$

$S^{ NVI} = \text{Model the action.}$

R= Student repeats the action

Brief Description:

This program focuses on teaching imitation with the goal of generalized imitation (i.e. the student imitating any novel model). Give the student the instruction “Do this” while simultaneously modeling or showing them what to do. For example, the instructor would say, “Do this” while simultaneously clapping his or her own hands. Be careful not to say, “Clap hands” while presenting the instruction - only say “Do this.”

Materials Needed: None

Prompt Sequence:

Use most-to-least prompt and within session prompting and prompt fading (see fading rules below). Prior to teaching, conduct a probe trial for each teaching target to identify the starting prompt level. Circle the starting prompt level at the top of the data sheet.

Most-to-Least Prompt Hierarchy:

1. Full physical prompt (F): hand-over-hand guidance
2. Partial physical prompt (P): guidance at the forearm or elbow
3. Independent (I): no prompt

Fading and Error Correction Rules:

1. Following 2 consecutive correct responses at starting prompt level, fade prompt to the next less intrusive prompt level
2. Following an incorrect response or no response, move up to a more intrusive prompt level
   a. Return to rule 1

Data Collection: Collect data trial-by-trial for a minimum of 5 trials, either ending on a lesser prompt level than the starting prompt level or at the starting prompt level. Continue prompt and prompt fading to return to starting prompt level, maximum of 10 trials per target.

Mastery Criterion: 80% or higher for four consecutive sessions
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<th>Probe Date</th>
<th>Probe +/-</th>
<th>Date Introduced</th>
<th>Initial Mastery Date</th>
<th>2 Week Maintenance Check Date</th>
<th>2 Week +/-</th>
<th>6 Week Maintenance Check Date</th>
<th>6 Week +/-</th>
<th>Gen to New Setting Date</th>
<th>Gen +/-</th>
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<td>Ok sign</td>
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<td>Peace sign</td>
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Appendix D

Corresponding Data Sheet Example
Student: _____________________  Program: Non-verbal Imitation

SD: “Do this” and model target action  R: Student repeats the action
I = Independent  P = Partial Physical  F = Full Physical

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Target: "Ok sign"

R = index finger to thumb, rest of fingers up

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| TEACHING |

Target: "Peace sign"

R = pointer and middle fingers up

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| Session #:
Date:
Initials:
Appendix E

Discrete Trial Instruction Instructor Evaluation Tool
DTI Instructor Procedural Integrity

Date:_________ Participant:________________ Data Collector:______________ P IOA
Session #:_________ Session Type:______________

*Note: student's data should be collected on data sheet to track the integrity of data collection and prompt and prompt fading procedure. + = correct implementation; - = incorrect implementation; NA = not applicable

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<td>Correctly conducts brief MSWO for tangible items</td>
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<table>
<thead>
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<td>Managing Consequences</td>
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<td>Trials</td>
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<tr>
<td>Secures attention</td>
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<tr>
<td>Delivers correct SD</td>
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<tr>
<td>Allows 5 s to respond</td>
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<tr>
<td>Immediately provides prompt</td>
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<tr>
<td>Provides correct prompt (LTM)</td>
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<tr>
<td>(+) response: provide varied praise &amp; reinforcer (1st/2nd)</td>
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<tr>
<td>(-) response: Provide FB/break eye contact</td>
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<tr>
<td>Removes material</td>
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<tr>
<td>Record data correctly</td>
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<tr>
<td>Inter-trial interval 5 s</td>
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| NVI Target 1: _________________________ |       |
|                                       |       |
| 1                                      | NA    |
| 2                                      |       |
| NVI Target 2: _________________________ |       |
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| 1                                      | NA    |
| 2                                      |       |
| ROL Target 1: _________________________ |       |
|                                       |       |
| 1                                      | NA    |
| 2                                      |       |
| ROL Target 2: _________________________ |       |
|                                       |       |
| 1                                      | NA    |
| 2                                      |       |
| EOL Target 1: _________________________ |       |
|                                       |       |
| 1                                      | NA    |
| 2                                      |       |
| EOL Target 2: _________________________ |       |
|                                       |       |
| 1                                      | NA    |
| 2                                      |       |

End of Session

Has minimum of 5 data points and ended on a correct response (at prompt level or lesser) or conduct a maximum of 10 trials (1 point per target) /6

Notes/Common Errors: total p.1 /
# DTI Instructor Procedural Integrity

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**Participant:** ______________  
**Data Collector:** ____________  
**Session #:** __________  
**Session Type:** ______________

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**NVI Target 1:** ____________

**NVI Target 2:** ____________

**ROL Target 1:** ____________

Totals / / / / / / / / / / / / / /
**DTI Instructor Procedural Integrity**

Date: __________  Participant: __________________  Data Collector: ____________  P  IOA

Session #: __________  Session Type: ____________

<table>
<thead>
<tr>
<th>Trials</th>
<th>Correct interspersal</th>
<th>Correctly presents material</th>
<th>Secures attention</th>
<th>Delivers correct SD</th>
<th>Allows 5 s to respond</th>
<th>Immediately provides prompt</th>
<th>Provides correct prompt level (MTL)</th>
<th>(+) response: provide varied praise &amp; reinforcer</th>
<th>(-) response: provide FB/break eye contact</th>
<th>Removes material</th>
<th>Record data correctly</th>
<th>Inter-trial interval 5 s</th>
</tr>
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**ROL Target 2:** ______________

**EOL Target 1:** ______________

**EOL Target 2:** ______________

% Correct: total correct/total components = p.1____+p.2____+p.3____ = _______/_______ = ________%
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Appendix F

Feedback Questionnaire
Feedback Questionnaire Questions

Quiz Instructions: Thank you for participating in the training on how to teach discrete trial instruction. We are interested in your honest opinion about your experience during the training. Please answer all the questions below.

1. Where did you complete the module?
   a) Work
   b) Home
   c) Both work and home
   d) Other

2. The modules kept my interest during the training.
   a) Strongly disagree
   b) Disagree
   c) Neutral
   d) Agree
   e) Strongly Agree

3. I found the modules informative about how to teach using discrete trial instruction.
   a) Strongly disagree
   b) Disagree
   c) Neutral
   d) Agree
   e) Strongly Agree

4. The modules described the content clearly.
   a) Strongly disagree
   b) Disagree
   c) Neutral
   d) Agree
   e) Strongly Agree

5. There were plenty of video examples that clearly demonstrated how to various components of the teaching procedure.
   a) Strongly disagree
   b) Disagree
   c) Neutral
   d) Agree
   e) Strongly Agree
6. I felt like there was enough information in the modules to learn how to implement discrete trial instruction.
   a) Strongly disagree
   b) Disagree
   c) Neutral
   d) Agree
   e) Strongly Agree

7. I would recommend the interactive computerized training to another person who is interested in learning how to implement discrete trial instruction.
   a) Strongly disagree
   b) Disagree
   c) Neutral
   d) Agree
   e) Strongly Agree

8. What training features did you like the most?

9. What content did you find to be difficult to understand?

10. What comments or suggestions do you have for future modifications to the training modules?
Appendix G

Procedural Integrity Sheet
Procedural Integrity Data Sheet

Data Collector: ___________ Participant: ______________ Researcher: _____________
Session Date: ____________ Session Type: _____________ Session Number: ______

Directions: Mark whether the researcher correctly completed each component.

1. All necessary materials are in the box (i.e., three instructional programs, corresponding data sheets, program materials, 5 edible reinforcers and 5 tangible reinforcers, and a pencil).
   Yes     No

2. The researcher started the session by give the participant the material bin while simultaneously reading the instructional script: “Please prepare the learning environment for discrete-trial instruction with [Student’s research name]. You will have 5 min to prepare the learning environment. I will let you know when the 5 min are up or you can let me know when you are ready.” (Note: 10 min for initial session)

Post-teaching checklist read revised script for initial session: “Here is a checklist to help guide your teaching session with [Student’s research name]. You may use the dry erase marker to check off completed steps. Please prepare the learning environment for discrete-trial instruction with [Student’s research name]. You will have 10 min to prepare the learning environment. I will let you know when the 10 min are up or you can let me know when you are ready.”

Subsequent sessions read: “Use the checklist to guide your session. Please prepare the learning environment for discrete-trial instruction with [Student’s research name]. You will have 10 min to prepare the learning environment. I will let you know when the 10 min are up or you can let me know when you are ready.”

   Yes     No

3. The researcher allowed the participant 5 min (10 min for initial session or post-teaching checklist sessions) to read the material and prepare the learning environment for teaching.
   Yes     No

4. Once the time was up or the participant said they were ready, the researcher instructed the participant to begin the teaching session by reading the following script: “Use the information in [Student’s research name] curriculum binder for teaching. Please let me know when you are finished.”

   Yes     No

5. The researcher did not provide any other feedback or instructions during the session.
   Yes     No

Treatment Integrity Percentage: Total (# of yeses/5) = ___/___ *100 = ____%
Appendix H

Feedback Procedural Integrity Sheet
## Treatment Integrity: Step 2 DTI Performance Feedback

<table>
<thead>
<tr>
<th>Component</th>
<th>Integrity</th>
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</thead>
<tbody>
<tr>
<td>Prior to feedback: Email sent to technicians with a scheduled date/time for meeting and DTI checklist attached</td>
<td>YES</td>
</tr>
<tr>
<td>During feedback: Professional introduced themselves and oriented the paraprofessional how the meeting would flow</td>
<td>YES</td>
</tr>
<tr>
<td>During feedback: Oriented paraprofessional to the DTI feedback checklist (screen share)</td>
<td>YES</td>
</tr>
<tr>
<td>During feedback: Delivered corrective feedback for all components marked with some and no on the DTI feedback checklist (e.g., “Remember, it is important to score data after every instruction.”)</td>
<td>Tally correct:</td>
</tr>
<tr>
<td>During feedback: Delivered specific praise for components marked yes on the DTI feedback checklist (e.g., “Good job, removing the materials after every teaching trial.”)</td>
<td>Tally correct:</td>
</tr>
<tr>
<td>During feedback: Answered all questions asked by the paraprofessional</td>
<td>Tally correct:</td>
</tr>
<tr>
<td>During feedback: Person giving feedback did not role play or model any of the components (target behaviors)</td>
<td>Tally correct:</td>
</tr>
<tr>
<td>During feedback: Meeting ended with a review of the of skills to work on and skills to maintain</td>
<td>YES</td>
</tr>
<tr>
<td>After feedback: Email sent with completed DTI feedback checklist</td>
<td>YES</td>
</tr>
</tbody>
</table>

**Treatment Integrity Percentage:**

\[
\text{Total (# of correct/total components) = ___/___ *100 = ____%}
\]
Appendix I

Discrete Trial Instruction Teaching Checklist
Teaching Session Checklist

Preparing the Learning Environment:

☐ Read program sheets to identify the:
  - Instruction or S
  - Materials needed for teaching
  - Prompt sequence/hierarchy
  - Fading and error correction procedure
  - Data collection rules
☐ Remove data sheets from binder
☐ Review data sheets to identify the:
  - Two targets from each program for teaching
  - Instruction or S
  - Requirements for a correct response
☐ Arrange materials and reinforcers to be easily accessible but out of reach of the student

Teaching using Discrete Trial Instruction:

☐ Conduct preference assessment for tangibles/toys
☐ Conduct preference assessment for edibles
☐ Conduct probe trials for all targets across the 3 instructional programs
  - Present up to two probe trials per target
  - Use least-to-most prompt hierarchy and
  - Circle prompt level needed to start teaching
☐ Conduct teaching trials at the starting prompt level identified from probe trials
  - Refer to Fading and Error Correction rules on the instructional program for removing prompts (rule #1) and responding to errors (rule # 2)
  - Refer to the Data Collection section on the instructional program sheet
Appendix J

Discrete Trial Instruction Feedback Form
## Discrete Trial Instruction Feedback Form

**Date: ____________**

**Observer: __________________**

**Instructor: __________________**

**Student: __________________**

<table>
<thead>
<tr>
<th>Target Behavior</th>
<th>Demonstrated Behavior (Yes/Some/No)</th>
<th>Comments/Feedback</th>
</tr>
</thead>
</table>
| **Preparing the Learning Environment** | Read program sheets and data sheets to identify:  
- Instruction ($S^D$),  
- Materials,  
- Prompt sequence,  
- Fading and error correction procedure,  
- Data collection rules and codes,  
- Student correct response |  |
| | Remove data sheets from binder |  |
| | Has materials and reinforcers ready |  |
| **Assessing Preference** | Conduct preference assessment for tangibles/toys |  |
| | Conduct preference assessment for edibles |  |
| | Uses top 1<sup>st</sup> and 2<sup>nd</sup> ranked edibles and tangibles as potential reinforcers |  |
| **Conducting Probe Trials** | Conducts prior to teaching for all targets across the 3 instructional programs |  |
| | Use least-to-most prompting |  |
| | Circle starting prompt level on data sheet |  |
| **Managing Antecedents** | Correctly presents materials |  |
| | Gains student’s attention before giving instructions |  |
| | Uses specified instruction and proper tone of voice |  |
| | Allows 5 s for the student to respond |  |
### Prompting and Responding to Errors

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Conducts teaching trials for each target at the starting prompt level identified from probe trial</td>
<td></td>
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<tr>
<td>Immediately presents prompt simultaneously or as close as possible with the instruction</td>
<td></td>
</tr>
<tr>
<td>Provides the correct prompt level (refer to probe trial data and rule #1)</td>
<td></td>
</tr>
<tr>
<td>Fades prompt level following to correct responses (rule #1)</td>
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<tr>
<td>Increases prompt level following an error (rule #2)</td>
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</table>

### Managing Consequences

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<th>Activity</th>
<th>Description</th>
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<tbody>
<tr>
<td>Delivers consequence immediately following the student’s response</td>
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<tr>
<td>Delivers appropriate consequence for response:</td>
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<tr>
<td>• Correct: reinforcer and praise</td>
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</tr>
<tr>
<td>• Incorrect: “try again” or break eye contact and turn away from student</td>
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<tr>
<td>Immediately stops trial if student begins to respond incorrectly or engage in inappropriate behaviors</td>
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<tr>
<td>Removes and rearranges materials between each trial</td>
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</tbody>
</table>

### General Teaching Procedures

<table>
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<tr>
<th>Activity</th>
<th>Description</th>
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<tbody>
<tr>
<td>Intersperses targets within and across programs</td>
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<tr>
<td>Records data after every trial</td>
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<tr>
<td>Records data correctly with the prompt level and student response (e.g., P+)</td>
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</tr>
<tr>
<td>Ends teaching after a minimum of 5 trials with the last response at or below starting prompt level OR after 10 trials</td>
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<tr>
<td>Paces time between trials 5 seconds or less</td>
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</tr>
</tbody>
</table>

### Skills to work on:

### Skills to maintain:
KRISTINA (NINA) GERENCSER  
kgenerces@gmail.com

Education History

**Doctor of Philosophy in Disability Disciplines (Applied Behavior Analysis Track), Utah State University, Logan, UT**
- 2012-2016
- Advisor: Thomas S. Higbee, Ph.D., BCBA-D
- Dissertation: Evaluation of Interactive Computerized Training to Teach Paraprofessionals How to Implement Errorless Discrete Trial Instruction

**Master of Arts in Behavior Analysis, Western Michigan University, Kalamazoo, MI**
- 2010-2012
- Advisor: Richard W. Malott, Ph.D., BCBA-D
- Master Projects:
  - Clinical Project: The Effects of a Token Economy and Continuous Reinforcement on Skill Acquisition in an Early Childhood Special Education Classroom
  - Organizational Behavior Management Project: Graduate Student Instructor Preparation and Training

**Bachelor of Interdisciplinary Studies, Arizona State University, Tempe, AZ**
- 2007-2010
- Major: Psychology and Child Development and Family Studies
- Minor: Sociology

Certifications/Licenses

Board Certified Behavior Analyst, #1-12-12077 (September 2012-present)
Licensed Behavior Analyst, #9499737-2506, State of Utah (August 2015-present)

Areas of Interest

- Behavior Analysis
- Autism Spectrum Disorder
- Developmental Disabilities
- Early Behavioral Interventions
- Parent/Staff/Teacher Training
- International Dissemination and Training

Peer-Reviewed Publications


Manuscripts under Review


Manuscripts in Preparation


Research in Progress


Conference Presentations


Poster Presentations


Training Presentations

- Utah Regional LEND program, Center for Persons with Disabilities, Utah State University (2012-current)
  - Provided various trainings related to early intensive behavioral interventions for children with Autism Spectrum Disorder.
- Naked Heart Foundation Training (non-profit organization), Nizhny Novgorod, Russia (December 2015)
  - Provided large-group training to preschool teachers and individual consultation to professionals setting up an early intervention program for children with Autism Spectrum Disorder.

Teaching Experience

**Utah State University**

Special Education 6720: Educational Application of Behavior Analysis I

- Graduate level course
- Position: Teaching Assistant
- Duration: Fall 2014
- Supervisor: Thomas S. Higbee, Ph.D., BCBA

**Utah State University**

Special Education 4000: Education of Exceptional Individuals

- Undergraduate level course
- Position: Instructor
- Duration: Fall 2013
- Supervisor: Darcie Peterson, M.Ed
**Utah State University**
Special Education 4000: Education of Exceptional Individuals
- Undergraduate level course
- Position: Teaching Assistant
- Duration: Spring 2013
- Supervisor: Darcie Peterson, M.Ed

**Western Michigan University**
PSY 1400/3600: Concepts and Principles of Behavior Analysis
- Undergraduate level course
- Position: Graduate Student Instructor
- Duration: Spring 2011-Fall 2012
- Supervisor: Richard W. Malott, Ph.D., BCBA-D

**Western Michigan University**
PSY 3570: Intermediate and Advanced Autism Practicum Seminar
- Undergraduate level course
- Position: Graduate Student Instructor
- Duration: Fall 2010-Spring 2012
- Supervisor: Richard W. Malott, Ph.D., BCBA-D
- Practicum: WoodsEdge Learning Center, Portage, MI

**Guest Lectures**
- Presented various guest lectures on Autism Spectrum Disorder, discrete trial instruction, and strategies to teach play and verbal behavior to undergraduate and graduate students at Utah State University.

**Administrative Duties**
- Student representative for Utah State University’s Disabilities Discipline Doctoral Program Committee (2014-2015 school year).

**Clinical and Consultation Experience**
**Behavioral Consultant Nebo School District, UT (via USU)**
- Position: Behavioral Consultant
- Duration: July 2014-Present
- Started a preschool classroom providing one-on-one discrete trial instruction for children with autism spectrum disorder (2014-current)
- Started a hybrid model classroom (kindergarten through 1st grade) providing one-on-one and small group instruction for children with autism spectrum disorder (current)
- Training paraprofessionals to implement discrete trial instruction
- Training teachers to administer the Verbal Behavior Milestones Assessment and
Placement Program
• Developing behavior plans
• Curriculum programing

**Behavioral Consultant for Granite School District, UT (via USU)**
• Position: Behavioral Consultant
• Duration: December 2012-May 2013
• Provide onsite and distance training and consultation for the district behavioral team. Assisted and gave feedback on conducting functional analyses

**Autism Support Services: Education Research and Training (ASSERT), Center for Persons with Disabilities, Logan, UT**
• Position: Case Manager, Supervisor, and Consultant
• Duration: August 2012-Present
• Manage client cases
• Monitor client progress
• Develop behavior plans
• Supervise behavior therapists
• Provide training for new hires
• Conduct parent observations and trainings
• Consultation services for families in the community

**Practicum, WoodsEdge Learning Center: Early Childhood Developmentally Delayed Classroom, Kalamazoo, MI**
• Position: Supervisor and Case Coordinator
• Duration: September 2011-May 2012

**Practicum, WoodsEdge Learning Center: Early Childhood Developmentally Delayed Classroom, Kalamazoo, MI**
• Position: Instructor providing discrete trial instruction
• Duration: August 2010-May 2012

**Employment History**

**Paraprofessional**, June 2011-June 2012
Oakland Academy Charter School, Portage, MI
• Duties: Assisted a 4th grade child in a full inclusion classroom, developed and taught modified materials, monitored student’s progress

**Autism Interventionist**, July 2007-June 2010
Arizona Autism (AZA) United, Phoenix, AZ
• Duties: Provide ABA 1:1 habilitation and respite care in home and/or community settings
• Awarded runner up for habilitator of the year in 2008
Editorial Activities
Guest Co-reviewer, Education and Treatment of Children, 2014

Grants
Assisted in the writing process of a language and literacy leaderships grant application for the Office of Special Education Program (OSEP)—2014

Women and Gender Graduate Student Research Grant, Utah State University - $300 (2014)

Professional Memberships
• Association of Behavior Analysis (ABAI)
• Utah Association of Behavior Analysis (UTABA)
• Behavioral Analysis Association of Michigan (BAAM)
• Council for Exceptional Children (CEC)
• Division on Autism and Developmental Disabilities (DADD)
• National Student Speech Language Hearing Association (NSSLHA)
• California Association of Behavior Analysis (CalABA)