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An Evaluation of Using Behavioral Skills Training to Increase Instructional Pacing in the Implementation of Discrete Trial Training

Jessica Connolly
St. Cloud State University, jessica_connolly@hotmail.com

An Evaluation of Using Behavioral Skills Training to Increase Instructional Pacing in the Implementation of Discrete Trial Training

by

Jessica Connolly

A Thesis

Submitted to the Graduate Faculty of

St. Cloud State University

in Partial Fulfillment of the Requirements

for the Degree of

Master of Science

in Applied Behavior Analysis

April, 2016

Thesis Committee:
Kimberly Schulze, Chairperson
Eric Rudrud

Abstract

Research has indicated that there may be considerable variability in the participants' outcomes after receiving IBI treatment. It is possible that factors related to the quality of treatment, such as instructional pacing, may contribute to this variability. This study examined the effect of Behavior Skills Training (BST) on the instructional pacing of three instructor therapists during DTT. In addition, the study evaluated the instructor therapist's accuracy implementing the components of DTT by reviewing a sample of teaching trials implemented during each session. It also examined whether changes in the rate of learning opportunities presented by the instructor participants had a differential effect on the rate correct responding and the occurrences of maladaptive behaviors demonstrated by three client participants in each dyad. Results showed that the introduction of the BST package was associated with an increase in the rate of learning opportunities for two of the instructor participants, and an increase in the accuracy of implementing DTT for two of the instructor participants. The results also demonstrated that the rate of correct responding by the client participants corresponded to the rate of learning opportunities presented to them, while the effect on the occurrence of maladaptive behaviors were minimal across the conditions.

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Chapter I

INTRODUCTION AND LITERATURE REVIEW

The profile of autism spectrum disorder (ASD) has changed from a rare diagnosis to a disorder that doctors are encouraged to screen for in all of their young patients (Smith, McAdam & Napolitano, 2007). This developmental disability is reported to be identified in approximately 1 in 68 children (Centers for Disease Control and Prevention [CDC], 2014), and is more prevalent in children than cancer, diabetes, spina bifida, and Down's syndrome (Filipek et al., 1999). According to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM 5) (American Psychiatric Association, 2013), ASD is characterized by deficits in social communication and social interactions, and the presence of restricted, repetitive patterns of behavior, interests, or activities. As implied by the categorization of ASD as a "spectrum disorder," there is wide variation in the areas of need experienced across individuals who are diagnosed with ASD. Some individuals with a diagnosis of ASD may exhibit severe social communication and social interaction deficits (e.g., lack of joint attention, minimal attempts to communicate with others) while other individuals show less pronounced deficits, such as poor eye-contact when talking to others or a failure to initiate social interactions. In some individuals the presence of repetitive behaviors may reference stereotypic behavior, such as hand flapping or echolalia, while in other individuals it may be demonstrated by perseveration on topics of personal interest (Smith et al., 2007).

The nature of the characteristics of ASD, can have a life-long impact on an individual's ability to lead an independent and self-directed life, and will likely affect their ability to establish and maintain relationships with others. Historically, these skill deficits and areas of need were believed to be a permanent impediment to individuals with autism's ability to interact with others and learn new skills successfully, with no effective treatments identified (Green, 1996). Currently, the Centers for Disease Control and Prevention website (www.cdc.gov/ncbddd/autism/treatment.html) lists a variety of treatments to potentially address the related areas of need of those individuals diagnosed with ASD (e.g., applied behavior analysis, Floortime, occupational therapy, speech and language pathology etc.). This list implies that there are many interventions that are successful in addressing skills deficits in individuals with ASD. In fact, there are a limited number of established treatments that have been shown, through adequate research, to be effective for targeting the various behaviors associated with ASD (National Autism Centre [NAC], 2009). The National Standards Project published through NAC (2009) highlighted that almost all of the 11 established treatments listed (e.g., antecedent strategies, behavioral package, comprehensive behavioral treatment for young children) were either, derived completely from behavioral literature or were primarily based on the application of behavioral principles.

Outcomes of Intensive Behavioral Intervention

There is considerable evidence to support that procedures based on the principles of Applied Behavior Analysis (ABA) can be used to successfully teach a variety of skills to individuals of all ages (Green, 1996). Studies have demonstrated that ABA procedures can be used to teach specific skills that address typical areas of need in individuals with ASD, such as communication (Bondy, Tincani, & Frost, 2004), imitation (Young, Krantz, McClannahan, & Poulson, 1994), and play (MacDonald, Sacramone, Mansfield, Wiltz, & Ahearn, 2009). In addition, other studies (Lovaas, 1987; McEachin, Smith, & Lovaas, 1993; Sallows & Graupner,

2005) have reviewed highly intensive (approximately 40-hours per week) and comprehensive behavioral interventions designed to target learning a full range of skills, across different skill domains (e.g., imitation, functional communication, receptive language, expressive language, play etc.) and have demonstrated marked changes in participants' overall functioning.

Lovaas (1987) demonstrated that a program of intensive treatment (i.e., 40-hours per week over two years) which therapists provided in the family home, the school and the community resulted in nine participants (47%) who completed grade one in a typical class with an average to above-average IQ (i.e., best-outcome). In comparison, only one participant in the control groups completed grade one in a typical class with an IQ in the average range. McEachin, et al. (1993) conducted follow-up research to this initial experiment and demonstrated that that eight of the nine participants who were in the best-outcome group continued to be successful in a typical class, maintained average IQ, and were comparable to typically developing same-aged peers on measures of adaptive and social skills. This indicated the long-term maintenance of the gains attained through the intervention. The research of Sallows and Graupner (2005) demonstrated overall outcomes that were consistent with those reported by Lovaas (1987) in a community-based clinical setting. Forty-eight percent of participants in this study were successfully integrated in a typical classroom setting at age seven and were evaluated to be in the average range across a variety of assessments (i.e., IQ, language, adaptive skills) after receiving an average of 35 hours of treatment a week over two years.

Various other studies (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Birnbrauer & Leach, 1993; Flanagan, Perry, & Freeman, 2012; Smith, Groen & Wynn, 2000) examining comprehensive IBI treatments have also demonstrated considerable improvements in children's overall functioning (i.e., some children showed large gains in IQ scores and improvements in adaptive functioning) in spite of a lower intensity (i.e., less hours) of treatment. The gains that have been demonstrated for the participants in multiple studies that examined a range of intensive treatment programs has likely increased the hope of families with a loved one diagnosed with ASD for effective treatment. The positive outcomes demonstrated in research have helped to drive a large and assertive advocacy of parents to access intensive behavioral intervention for their children (Jacobson, 2000). The unfortunate side effect of this advocacy and sharp increase in demand for ABA services, is a shortage of qualified therapists and front-line classroom staff trained in the implementation of ABA-based procedures (Smith et al., 2007). This shortage of trained staff has created a need for effective and efficient training procedures that are demonstrated to improve, not only the knowledge of, but the actual implementation of ABA-based procedures.

Using Behavior Skills Training to Teach the Implementation of Behavioral Procedures

Training staff to implement behavioral procedures is essentially the same as teaching any new skill, and staff training packages may be based on the same principles of ABA that inform IBI programming (Sturmey, 2008). Behavior Skills Training (BST) is a training package based on ABA principles that consists of multiple components, including instructions, modeling, practice and providing feedback until a learner is able to perform a target skill at a level that meets a designated mastery criterion (Sturmey, 2008). The implementation of a competency-based measure of the effectiveness of staff training is important to determine that staff are able to demonstrate the target response, as opposed to simply being able to describe the required skill (Parsons, Rollyson, & Reid, 2012).

BST has been used to teach a variety of skills that may be used in behavioral programming. Miles and Wilder (2009) followed a BST procedure to teach caregivers to implement a 10-step intervention for guided compliance. They demonstrated that BST was successful in increasing the percentage of steps of the guided compliance procedure that the caregivers implemented correctly in response to non-compliant behavior exhibited by their children. In addition, after the caregivers met the mastery criteria for implementation of the guided compliance intervention in one setting they were able to demonstrate that they had generalized this new skill to a novel environment.

Lavie and Sturmey (2002) demonstrated, that by using a BST procedure, the participants in the study were taught to correctly implement a paired-stimulus preference assessment within 80 minutes (i.e., two 40-minute sessions). This BST procedure included: a description of the skills in a task analysis of a preference assessment, a checklist of the steps in the task analysis and then a verbal description of each of the skills on the checklist delivered by the trainer. The skills were then modelled using a video model of the procedure. Finally, the trainer observed the staff working directly with a child and provided feedback. This was continued until the staff demonstrated the skill at 85% correct over two days.

In an attempt to improve parent implementation of a behavioral procedure and also to evaluate whether improved parental performance of an intervention had an effect on the child's behavior, Hsieh, Wilder, and Abellon (2011) used BST to teach parents to complete a five-step procedure of incidental teaching with improved accuracy. The BST procedure improved all of the participants' implementation of incidental teaching, although data indicated this did not result in a corresponding improvement in the behavior targeted during incidental teaching for two out of the three children.

While research has assessed the use of BST to improve the participants' implementation of various behavioral techniques, several studies have targeted improving the implementation of discrete trial training (DTT). Sarokoff and Sturmey (2004) used a BST procedure to teach special education teachers to implement a DTT procedure correctly with all of the learners in the study. The instruction component consisted of reviewing each step of a written copy of a procedure for implementing DTT, as well as reviewing a graph of the data since baseline and the data sheet of the previous session. In the rehearsal component, the teacher practiced three consecutive discrete trials in front of the experimenter, at which time they received feedback (i.e., experimenter provided verbal feedback immediately following rehearsal, including both praise and corrective). After the feedback component the experimenter would then model three trials, highlighting the specific components that had been performed incorrectly during previously rehearsals. The BST procedure resulted in a large increase in the percentage of discrete trial training (DTT) steps implemented correctly by all of the participants. The BST procedure described in Sarokoff and Sturmey was implemented in 10-min sessions and was demonstrated to be an effective, and also efficient training procedure.

Although Sarokoff and Sturmey (2004) were able to demonstrate that BST was able to effectively teach DTT skills, it did not address whether these skills were generalized to untrained programs and whether improvements in the teacher's DTT skills resulted in improved responding from the child. Lafasakis and Sturmey (2007) addressed some of these limitations by investigating whether the target skills (i.e., implementation of DTT) generalized to untrained programs and whether improvements in a parent's DTT skills resulted in improved responding from the child. The results demonstrated that that BST was an effective and efficient way to train the participants, parents of children with developmental disabilities, how to implement DTT. The implementation of the procedure corresponded with an increased percentage of DTT steps performed correctly by the parents for the target programs. The results also demonstrated that the parents' teaching skills, using DTT, generalized to untrained programs and that improved implementation of DTT by the parent corresponded with increases in the child's correct responding. This research was expanded by Dib and Sturmey (2007) whose results showed that, in addition to using BST to increase the percentage of DTT steps performed correctly by teaching aides in the classroom, the increases in teaching accuracy corresponded with decreased stereotypic behavior by the learner.

BST may consist of training components that are implemented in a variety of different sequences or the components being delivered in a different manner. For example, the instruction component may be verbal instructions from the trainer or may be a self-instruction manual or video. The modeling component may be delivered through video modeling.

Use of Video Modeling in Behavior Skills Training

Video modeling has been demonstrated as a training strategy to successfully teach the implementation of DTT both on its own or as a component of a larger training package. Catania, Almeida, Liu-Constant and Digennaro Reed (2009) used video modeling to teach three new staff members to implement DTT correctly. A brief video (7 min 15 s) was shown to participants, in which two experimenters, one in the role of an instructor and the other in the role of a confederate learner, modelled the sequence of steps required for the correct implementation of

DTT for a match-to-sample task. The video depicted a variety of potential responses on the part of the learner (correct response, incorrect response, no response) and the appropriate corresponding response of the instructor in each situation. A voiceover described each of the component steps required for the correct implementation of DTT, as they were modeled in the video. The participants were shown the video model 10 min before they were asked to demonstrate DTT with a confederate learner (i.e., the primary author). The results demonstrated that after the implementation of the video modeling there was an immediate increase in the accuracy of the participants' implementation of DTT (*M*= 98%, 85%, 94% respectively). In addition, the data demonstrated that the participants also engaged in high levels of correct responding during generalization probes on implementation of DTT with different tasks and with actual students, and during a maintenance probe.

Vladescu, Carroll, Paden and Kodak (2012) replicated and expanded this research by demonstrating that children learned new target skills when staff had been trained through video modeling to implement DTT with a high degree of treatment integrity. The intervention consisted of the participants viewing two videos (7 min 6s and 9 min 39s respectively). Both of the videos were only viewed during the first session, after which only the second video was viewed. The first video broke DTT into its component steps, and provided a model and voiceover explanation of each component. The second video was a simulated DTT session for a receptive identification task conducted by the first and third author, consisting of 12 trials. A voiceover highlighted key components of the session as they occurred. As in Catania et al., within 10 min of viewing the video the participants were asked to demonstrate DTT with a confederate learner. The results indicated that all of the participants met the mastery criteria (i.e., two consecutive sessions of 90% accuracy implementing DTT) during the video modeling phase, and also demonstrated generalization to novel teaching programs with both a confederate and with a child.

The research of Severston and Carr (2012) suggested that video modeling, without the rehearsal and feedback components included in BST procedures, may not be sufficient for all participants to implement DTT accurately. In order to expand on previous research and determine the effectiveness of the different components (i.e., instructions, modeling, rehearsal, and feedback) of the BST package, Severston and Carr conducted a sequential analysis of a BST procedure used to teach new instructors to correctly implement DTT during teaching sessions. The different components of the BST procedure were introduced in a sequence according to the efficiency of the training associated with each phase. The phases (in order of introduction) were: a self-instruction manual (instructions), a video model (modeling), and then practice sessions (rehearsal) and brief performance feedback. The video modeling that was used consisted of 41-min video that illustrated both examples and non-examples of DTT. The clips that were presented were also accompanied with text and voiceover describing the examples. This video model was only presented once during the phase. In this study, only the training components that were necessary for the participant to meet mastery criterion were implemented, at which point a generalization probe (i.e., participants engaging in teaching trials that they did not have experience with) and a follow-up probe were conducted. In each session after the training component had been completed as outlined, the participant was asked to perform a set number of DTT trials (i.e., post-training probe). The data collected during post-training probes, was used to calculate the percentage of DTT steps that the participant performed correctly.

The results demonstrated that while three of the participants (50%) met the mastery criteria (i.e., three consecutive sessions of 90% or more of the steps of DTT performed correctly) in the self-instruction manual condition, the other three participants only met mastery after progressing through all of the conditions (i.e., self-instruction, video modeling and performance feedback conditions). While the video modeling component increased the percentage of DTT components that the three remaining participants performed accurately, it was not sufficient to meet the mastery criteria. These results demonstrated that all of the participants were able to meet the mastery criteria by using training that included video modeling as a component of a larger treatment package.

Other research has demonstrated that video modeling as a component of BST procedures has been successful in teaching staff to implement: preference assessments (Lavie & Sturmey, 2002), Picture Exchange Communication System (Rosales, Stone, & Rehfeldt, 2009), and a variety of behavior modification procedures (Koegel, Russo, Rincover, 1977). The benefits of using of video modeling to train staff include that it has been demonstrated to be an economical approach (Catania et al., 2009) that allows various situations to be modeled (e.g., stimulus and response variations) and it enables the standardization of training materials which promotes internal consistency (Morgan & Salzberg, 1992).

Discrete Trial Training

Research training individuals to implement DTT accurately is important, as this teaching procedure is one of the most commonly used interventions in behavioral programming (Sturmey, 2008), and it is often a large component of teaching in comprehensive behavioral interventions (Lovaas, 1987; Sallows & Graupner, 2005). This is illustrated by the fact that it is also possibly the most extensively researched of the ABA procedures that are used to teach children with autism (Smith, 2001). Many readiness skills (e.g., sitting at a table, imitation, complying with instructions) that are required for individuals to learn more complex skills are taught to children with autism using DTT (Rehfeldt & Rosales, 2007). It is also used to teach component parts of larger skills in a systematic manner (Leaf & McEachin, 1999).

The nature of DTT is very structured with the targets and the teaching procedure clearly defined prior to the commencement of a session (Sundberg, & Partington, 1998). Each discrete trial is a small learning opportunity that generally lasts 5-20 s, and consists of five potential components: the discriminative stimulus, a prompt, response, consequence, and intertrial interval (Smith, 2001). The discriminative stimulus, or instruction, is a cue to the learner to perform a specific behavior. The response is the behavior that a learner emits after the discriminative stimulus. Often manuals outline that a maximum acceptable interval between the discriminative stimulus and the response be 1-5 s (Anderson, Taras, & Cannon, 1996; Lovaas, 2003). The purpose of this brief latency to respond is to assist the learner to make the link between the two components of the discrete trial (Lovaas, 2003). The consequence component of the discrete trial is provided contingent on whether the response is correct (e.g., praise, edible, access to a toy) or incorrect (e.g., ignore response, saying “no” or “try again”) (Smith, 2001). Lovaas (2003) outlined that reinforcing consequence should be delivered immediately (i.e., 0-1 s) after the target response, in order to avoid reinforcing some intervening behavior (e.g., self-stimulatory or maladaptive behaviors). He also outlined that a 3-5 s duration be set for accessing reinforcement to maximize the amount of time for teaching. The consequence indicates the end of the discrete trial, and is followed by an intertrial interval (ITI). The ITI is a brief pause (i.e., 1-5 s) between the consequence of one trial and the delivery of the discriminative stimulus for a subsequent trial (Smith, 2001). It is implemented as a means to assist the learner in discriminating one trial from another (Lovaas, 2003).

One of the frequently cited benefits of DTT (Lovaas, 2003; Smith, 2001; Sundberg & Partington, 1998) is that the brief nature of the trials allows for a high rate of teaching trials or learning opportunities to occur. Smith (2001) suggested that a learner may have up to 12 learning opportunities per minute during DTT. This is important as learning for an individual with autism often requires multiple trials (Lovaas, 2003), and the teaching of a new skill will often occur over the course of rapidly delivered and repeated trials (Green, 1996). In Natural Environment Teaching (NET), the number of learning opportunities relies on establishing operations and an instructor's ability to determine what is motivating to a learner. In comparison, during DTT the instructor will arrange for the delivery of the discriminative stimulus for the target skill repetitively and has much more control over the number of teaching trials or learning opportunities (Weiss, 2001). Thus, in order to deliver the optimal number of learning opportunities to a learner, the type of teaching procedure is not only relevant but also the behavior of the instructor implementing the teaching.

Instructional Pacing

An instructor needs to know how to determine and maintain an ideal instructional pace for a teaching session, in order to maximize the number of learning opportunities for a learner. The importance of a well-paced teaching session is often referenced in literature as an important component in the implementation of IBI treatment and DTT (Green, 1996; Leaf & McEachin, 1999; Perry, Prichard & Penn, 2006; Severston & Carr, 2012), although research supporting a specific rate of learning opportunities that should be presented or how to determine if the ideal pace is being used, is less common. Heward (1994) described instructional pacing as being comprised of multiple variables including: response latency, feedback delay (i.e., duration between response and consequence), ITI, and the rate at which the teacher talks.

Response latency is the duration between the delivery of the discriminative stimulus by the instructor and the response of the learner (LaMela & Tincani, 2012). There is limited research regarding the effect of response latency on learning in children with autism. Preliminary research conducted by Tincani and Crozier (2008) examined the effect of brief response latency (i.e., 1 s or less) and extended response latency (i.e., 4 s) on the rate of responding for two participants with challenging behaviors. This study demonstrated that a short wait-time (i.e., response latency) resulted in increased rate of response opportunities, rates of responding and rates of correct responding per minute, compared to a longer wait-time. In addition, the results indicated that in the short response latency condition the participants engaged in decreased occurrences of individually-defined problem behaviors.

This research was replicated by LaMela and Tincani (2012) using participants with a diagnosis of ASD. They also demonstrated that a short response latency (i.e. 1 s or less) in teaching increased the number of response opportunities presented to the learner, as well as the rates of responding and correct responding per minute, compared to a longer response latency (i.e., 4 s). The results indicated that in the short response latency condition the participants engaged in slightly fewer occurrences of problem behaviors.

Another component of instructional pacing that has some supporting literature is the effect of ITI on learning and maladaptive behaviors for individuals with autism. Koegel, Dunlap, and Dyer (1980) systematically manipulated the length of ITIs in order to determine if this variable affected the learning of three children diagnosed autism (age range: 7-11 years old) who were reported to engage in high levels of behaviors that interfered with teaching (i.e., self-stimulatory behavior, maladaptive behavior). In this study an ITI was defined as the duration between the verbal consequence of one trial and the start of the discriminative stimulus for the subsequent trial. The results indicated that during baseline, while long ITIs (i.e., 4-s to 24-s) were implemented, the participants' levels of correct responding were highly variable. In comparison, when a short ITI (i.e., 1-s to 4-s) was implemented for the same target there was an immediate increase in correct responding across all three participants, as well as rapid mastery of targets (i.e., meeting criteria of 14 correct out of 15 unprompted trials) that had not progressed to mastery during the previous long ITI condition. Koegel et al. (1980) suggested that the shorter ITI condition may have helped the participants with autism to be more successful as it may have reduced the participant's opportunities to engage in off-task behaviors which may have impeded learning.

Dunlap, Dyer, and Koegel (1983) further investigated the potential relationship between correct responding and self-stimulatory behaviors by manipulating ITI durations with participants who were diagnosed with autism (age range: 6-11 years old) who were reported to engage in high levels of self-stimulatory behavior (i.e., finger flapping and prolonged gazing). The effect of the ITI on the child's ability to correctly respond to the designated discrimination tasks (e.g., common objects, pronouns, prepositions etc.) and levels of *autistic* self-stimulation (i.e., repetitive, stereotypic, and providing sensory input) and *other* self-stimulation (e.g., picking at or pulling clothing, tapping furniture, tipping or rocking chair), were examined during one-to-one teaching. The results indicated that there was an inverse relationship observed between the levels of *autistic* self-stimulatory behavior and the percentage of correct responding according to the ITI that was implemented. Short ITIs resulted in lower levels of *autistic* self-stimulatory behavior and higher percentages of correct responding, while longer ITIs resulted in higher levels of *autistic* self-stimulatory behavior and lower percentages of correct responding. Behaviors categorized as *other* self-stimulation did not appear to be affected by changes in ITI durations. Dunlap et al. (1983) suggested that the reduction of *autistic* self-stimulatory behavior was directly the result of shorter ITIs, which in turn increased the percentage of correct responding of the child. They suggested that certain self-stimulatory behaviors were incompatible with on-task behavior (i.e., *autistic* self-stimulatory behavior) while others were not (i.e., *other* self-stimulatory behavior).

Roxburgh and Carbone (2012) replicated these two studies by assessing the impact of changing the pace of instructional demands on the level of problem behaviors and the accuracy of responding demonstrated by two participants (aged 7 and 8 years old) diagnosed with autism who were reported to engage in high levels of problem behaviors (e.g., self-stimulatory behavior, bolting, kicking, hitting etc.). They also sought to extend previous research by including measures of opportunities to respond, frequency of responding, and the magnitude and rate of reinforcement delivered to participants during session. The fast (1-s), medium (5-s) and slow (10-s) rate of presentation of teacher demands was determined by the duration between the completion of a child’s response to the delivery of the next demand.

The results indicated that fast rates (1-s) of teacher presented demands resulted in lower rates of problem behavior. Sessions conducted with fast rate (1-s) also resulted in an increased number of instructional demands presented, an increased number of learner responses emitted, and participants receiving an increased magnitude and rate of reinforcement over the medium (5-s) and slow (10-s) session conditions. The results also extended previous literature (Dunlap et al., 1983; Koegel et al., 1980) by providing evidence that fast presentation of teacher demands could decrease escape-motivated behavior, in addition to self-stimulatory behavior. Roxburgh and Carbone (2012) suggested that the increased rate of instructions may have acted as an abolishing operation decreasing the value of escape and therefore reducing the number of problem behaviors. They suggested that the improved set of conditions represented by the increased rate of reinforcement and reinforcement magnitude that the participants experienced in the fast condition may have competed with the value of escape. In addition, the results suggested that if an increased rate of teacher presented direction is associated with more reinforcement (rate or magnitude) this may lead to more learning opportunities and less problem behaviors.

These results reflect the findings of research on typically developing children. Tincani, Ernsbarger, Harrison, and Heward (2005) conducted related research with four typically developing children (ages: 5-6 years old) during a Direct Instruction program (i.e., Language for Learning). They compared the effects of fast (1-s) and slow (5-s) rates of presentation of instructional demands on a variety of variables, including, the teacher presented learning opportunities per minute, the rate of correct responses per minute, and measures of off-task behavior. In addition, the researchers manipulated the teacher talk rate, as an additional component of instructional pacing. During the fast teaching condition the instructors were also directed to deliver instructions quickly (e.g., 82-104 wpm) and during the slow teaching condition the instructors were also directed to deliver the instructions slowly (e.g., 35-49 wpm).The data indicated that the fast-paced teaching resulted in less off-task behavior, an increased rate of correct responses per minute, increased rate of responding and an increased rate of learning opportunities presented for all of the participants during the implementation of Language for Learning program. Although the research did not allow for a differential analysis of talk rate and ITI, it is logical that an increased talk rate would allow for an increased number of learning opportunities to be presented. The research that has been reviewed supports the notion that various components of instructional pacing of a session can be modified and that this can alter the rate of learning opportunities presented by an instructor in a session and may affect correct responding, as well as off-task behavior.

In spite of the limited amount of research examining the effects of the various components of instructional pacing on learning in children with autism, there still appears to be acceptance within the behavior analysis community that pacing should be a consideration in the implementation of DTT and an IBI program. Perry et al. (2006) collected data on the opinions of parents and professionals regarding the central components of quality IBI. The participants chose what they considered to be the top three characteristics of a quality IBI program from a compiled list of eleven characteristics. Maintaining an appropriate pace was selected as a "top 3" indicator by 12% of the participants, although it was one of the least chosen from the list.

In addition, researchers have included pacing as a component associated with the delivery of quality treatment in quality assurance measures. Davis, Smith and Donahoe (2002) used a measure to evaluate 26 supervisors and 22 aides from sites that used the UCLA treatment model (Lovaas, 1987). Davis et al. investigated whether the procedures used for identifying qualified supervisors were valid. The scores for different components were used to compare the skill sets of supervisors and aides to each other, as well as designated cut-off levels. As such, the measures were designed to evaluate more advanced therapist skills. For instance, in regards to the ability to implement new programs, the system scored prompting, task difficulty, pacing and reinforcement. The pacing score was calculated based on a formula factoring in delayed start of session, prolonged access to reinforcers, and long ITIs.

The York Measure of Quality of Intensive Behavioural Intervention (YMQI) (Perry, Prichard, & Penn, 2008) is another comprehensive tool that was designed to assess the quality of IBI programming. Perry, Koudys and Sheese (2008) suggested in the implementation manual for the York System of Quality Assurance (YSQA) that the quality of an intervention was likely a factor contributing to the variability of outcomes of children receiving IBI service, but they indicated that a comprehensive definition and measure of a quality intervention and its components were lacking in the literature. The YMQI was designed to be used as one such measure of quality of teaching. Pacing was one of nine categories that the measure evaluated.

Both of the quality assessment tools (Davis et al., 2002; Perry, Prichard, & Penn, 2008) include pacing as an integral part of a comprehensive measure of quality intervention. The inclusion of pacing in quality assurance measures is a step toward ensuring this component of IBI teaching is implemented consistently according to specified criteria. The next step is determining a training strategy that will be effective in teaching therapists to provide learning opportunities at an optimal rate for the learners that they serve. In order to ensure that training results in optimal and consistent instructional pacing, staff should receive competency-based training. Behavior Skills Training (BST) has been shown to be an effective and efficient way of providing training to individuals on the implementation of ABA based procedures, and provides a structured approach for teaching a new skill (Dib & Sturmey, 2007; Lafakis & Sturmey, 2007; Lavie & Sturmey, 2002; Miles & Wilder, 2009; Sarokoff & Sturmey, 2004). It has also been demonstrated that it is possible to use video modeling (Severston & Carr, 2012), as an alternative to the instructor modeling component of BST, which may allow for more flexibility in budgetary and time limitations, and may assist in providing a consistent model to all participants.

Statement of Purpose

The purpose of this study was to explore the effect of using BST to increase the instructional pacing (i.e., rate of learning opportunities presented to a learner) of an instructor therapist during DTT. The BST package included a self-instruction manual, a video model of examples and non-examples of brisk instructional pacing, rehearsal and feedback components. In addition, the study evaluated the instructor therapist's accuracy implementing the components of DTT by reviewing a sample of teaching trials implemented during each session. In order to determine whether changes in instructional pacing affected the behavior of client participants, the study also examined the rates of correct responding and the occurrences of maladaptive behaviors of the client participants paired with the instructor therapists in this study.

Chapter II

METHODS

Participants

The participants in this study were instructor therapists and clients in a provincially funded community-based Intensive Behavioral Intervention (IBI) program. All of the clients had a diagnosis of autism. An invitation to participate which outlined the purpose of study was distributed to a clinical team, and the instructor participants or the guardians of the client participants volunteered to take part in the study. The instructor participants were required to have passed their provincial evaluation on IBI competencies, including the implementation of DTT, in order to participate. The client participants were required to have a service plan in place that included a variety of skill acquisition programs across a variety of skill domains. One client was paired with one instructor therapist for the duration of the study.

Mike was a 27-year-old male who had worked as an instructor therapist for three and a half years. He was paired with Rico a client who he worked with regularly. Rico was a 6-year-old male who had been receiving IBI services for approximately one year. He was able to expressively identify a variety of common objects, and had programs in place to expand his receptive and expressive vocabulary. Rico was observed to engage in a variety of maladaptive behaviors, including off-task vocalizations, getting out of his seat during teaching and manipulating different body parts with his finger (i.e., poking himself) over the course of the clinical day. These behaviors were not considered to be a barrier to successful learning (i.e., no Behavior Support Plan in place).

Diana was a 34-year-old female who had worked discontinuously as an instructor therapist over the past 10 years for a cumulative total of 5 years. She was paired with James, a client with whom she worked regularly. James was a 5-year-old male who had been enrolled in the IBI program for eight months. He was able to vocally request for preferred items and expressively identify a variety of common items, he had a program in place to expand his receptive and expressive vocabulary. James was observed to intermittently engage in maladaptive behaviors, such as getting out of his seat and inappropriately touching materials during a teaching session.

Beth was a 46-year-old female who had worked as an instructor therapist for three years. She was paired with David a client with whom she worked regularly. David was a 4-year-old male who had been attending the IBI program for approximately a year. He was able to make requests using single words, although his requests were occasionally unintelligible without additional communicative responses (e.g., pointing, leading) due to an articulation issue. David was able to receptively identify a wide variety of common objects, and expressive identification of these same targets had begun approximately 5 months prior to beginning baseline in the study. He engaged in maladaptive behaviors occasionally during teaching sessions, such as crying, whining or inappropriately touching materials, although like the other client participants these behaviors were reported by his clinical team to not interfere with learning new skills.

Setting and Materials

The initial components (i.e., reviewing self-instruction manual, quiz, reviewing video model, feedback on baseline) of the BST procedure were conducted in a staff computer lab at the regional facility where the instructor participants delivered IBI service. The computer lab contained a 12 computers and desk space. The materials to complete this portion of the BST included, a five page illustrated self-instruction manual (Appendix B), a 10-question multiple choice quiz that reviewed the material covered in this manual, a pen, a 10-min 41-s video model of an experienced staff modelling examples and non-examples of conducting a well-paced session, headphones, and a computer to watch the video model and to display the graphed results (e.g., rate of learning opportunities, percentage of DTT components completed correctly) of the instructor participants' baseline data.

The feedback and rehearsal components of the BST procedure, and recording of the video probe sessions during both baseline, training and follow up were conducted in the clinical environment (i.e., classroom) where the client participant typically received IBI treatment. These sessions were run in the client's individual workspace. These workspaces contained a table, a shelf containing materials for programming during a typical teaching (i.e., non-study) session, and three chairs. The picture cards required to run expressive labeling trials, a token board with tokens, a choice board with picture icons of preferred activities or items, a bin containing edible reinforcement, and a variety of preferred activities or toys were on the table in the work area or in close proximity. In addition, there was clip board that contained all of the data sheets for the client's programming for that clinical day, a pen and a timer. A video camera with a designated memory card was used to digitally tape the baseline and post-training probe sessions.

Response Measurement

Data were collected by the author by reviewing the video recordings. The primary dependent variable was the rate of learning opportunities (Green, 1996). Each learning opportunity implemented during the session was recorded, if it was not a labeling target this was indicated by circling the trial number. A learning opportunity was characterized as the delivery of a discriminative stimulus (S^d), followed by a response from the learner, and then the consequence that was delivered contingent on the response. A discriminative stimulus, prompt, response and consequence delivered as an error correction was not considered to be a separate learning opportunity (LaMela & Tincani, 2012) but rather was all considered to be the consequence for the initial discriminative stimulus. The rate of learning opportunities was then calculated by dividing the number of trials (i.e., learning opportunities) delivered by the total of the number of minutes in a teaching session. Any break time (i.e., engaging with reinforcement after receiving all of the tokens on board) was subtracted from the 5-min video probe session in order to calculate the total number of minutes in a teaching session. The rate of learning opportunities was determined for both the expressive labeling trials and the total trials run in the teaching session.

In addition to the rate of learning opportunities, five trials were randomly selected from across the across the full session and reviewed using a performance checklist to determine the average percentage of DTT components that the instructor participant implemented correctly. In order to ensure that the trials selected were distributed across the entire session, the session was divided into five blocks of trials and a trial was randomly selected from each block of trials using a random number generator. These data were used to conduct error analyses to determine any trends in the errors that instructor participants were committing while implementing DTT and that may have been affecting the participants' instructional pacing.

The performance checklist reviewed whether the instructor participant implemented the following components of DTT: (a) program materials were positioned properly (b) delivered the instruction when the client had been orienting toward task and/or instructor for at least 1 s, (c) delivered a single clear, concise instruction (e.g., two to three words), (d) delivered the instruction as per program, (e) appropriately prompted the task (i.e., 0 s delay) (f) delivered reinforcement contingent on a correct response (i.e., target response was given within 5 s of the discriminative stimulus) (g) promptly (i.e., within 3 s of response) delivered appropriate reinforcement (h) behavior specific praise was delivered just before or at the same time as tangible reinforcement (i) implemented the error correction procedure as written, if necessary (i.e., incorrect response or no response within 5 s of the discriminative stimulus), (j) recorded data promptly (i.e., within 5 s of trial completion) and (k) inter-trial interval was 5 s or less.

This performance checklist of DTT components was adapted from those identified in previous research on training staff to implement DTT (Sarokoff & Sturmey, 2004) and a checklist outlined by the Provincial Trainers Network for the video evaluation component of staff training (Provincial IBI Competencies Checklist, Provincial Trainers Network). For each step the instructor participant's response was recorded as: (+) response was observed and implemented correctly, (-) response was not observed, when a necessary part of the procedure, or response was observed but it was implemented incorrectly, or (N/A) when not applicable for the particular trial. The percentage of DTT components completed correctly was calculated by dividing the number of steps completed correctly by the number of steps completed correctly plus the number of steps completed incorrectly for each trial. The results for each trial in a session were then added together and divided by five, to determine the average percentage of components completed correctly for each session.

A quiz was also completed by the instructor participants after reviewing the self-instruction manual. This quiz consisted of ten multiple choice questions on the content of the self-instruction manual. Each correct response was worth one point. The score of the quiz was determined by dividing the number of correct responses by the total number of questions (i.e., ten) on the quiz.

Data were collected on two variables of the client participants' behavior in each dyad. These variables were the rate of the client participants' correct responding and the percentage of the intervals that the client engaged in maladaptive behaviors. The rate of correct responding was calculated by dividing the number of correct responses that the client engaged in by the number of minutes in the teaching session. Similar to the rate of learning opportunities, data were collected on both the rate of correct labeling responses and the rate of total correct responses. If a client participant's response was not observable due to a camera angle, or auditory interference, the determination of whether it was a correct or incorrect response was based on the consequence delivered by the instructor participant.

The occurrences of maladaptive behavior were measured using partial-interval recording (Cooper, Heron, & Heward, 2007). The entire 5-min video probe session was divided into 10-s intervals, if any maladaptive behavior (individually defined for each client) occurred at any time within this interval a (+) was recorded, if no maladaptive behavior occurs within this interval a (–) was recorded. These data were used to calculate the percentage of intervals in which the maladaptive behavior occurred by dividing the number of intervals when a behavior occurred by the total number of intervals.

The individually defined maladaptive behaviors were selected after observing the client participant's baseline videos and discussing commonly observed maladaptive behaviors with the supervising therapist for the client's clinical team. The maladaptive behaviors identified for Rico were:

- Off task vocalizations: characterized as screaming (i.e., making vocalizations louder than a speaking voice) and any audible vocal behavior (e.g., singing, humming) that was not related to the task that was presented. This did not include naming the incorrect item in response to an S^d or singing during break time.
- Out of seat behavior: characterized as standing up (i.e., buttocks no longer touching chair), flopping on the floor (i.e., 50% or more of body touching the floor), or sitting in the chair in a manner where all four chair legs are not on the ground at the same time (e.g., tipping back in chair). This did not include standing up or sitting on the floor in response to an instruction or in order to access reinforcement.
- Poking: characterized as Rico placing his finger(s) in or pressing on parts of his body (e.g., eye, ear, nose) with his finger(s) for 3 continuous seconds. This did not include indicating a body part by pointing in response to an instruction (e.g., find nose).

The maladaptive behaviors identified for James were:

- Out of seat behaviors were as defined for Rico.
- Touching materials: characterized by placing fingers on materials, including attempts (i.e., reaching towards items that were out of reach), or manipulating materials inappropriately during a teaching session or transition. This did not include pointing

at materials while engaging in a verbal response or touching materials when directed by an instructor (e.g., give me pencil).

The maladaptive behaviors identified for David were:

- Touching materials were as defined for James. In addition, the definition for David did not include lifting up the token board to retrieve the picture icon to request the "toilet" which was affixed to the back of the token board.
- Vocal protests: characterized as David screaming (i.e., making vocalizations louder than speaking voice) or crying (i.e., making moaning sounds with or without tears). This did not include laughing louder than a speaking voice or responding in a louder voice when directed by the instructor.

Inter-observer Reliability

Two secondary observers reviewed the video footage recorded for 30% of the probe sessions. The inter-observer agreement (IOA) for learning opportunities was calculated by dividing the smaller number of learning opportunities recorded by the larger number of learning opportunities recorded and then multiplying by 100. The IOA for correct responding was calculated by dividing the smaller number of correct responses recorded by the larger number of correct responses recorded and then multiplying by 100.The IOA for the maladaptive behavior was calculated by dividing the number of intervals where there is agreement between the observers on whether the behavior occurred or did not occur by the total number of intervals and then multiplying by 100. The IOA for the components of DTT was calculated by dividing the total number of agreements on a component observed by the number of agreements plus disagreements for each session and multiplying by 100.

For Mike, the mean IOA for labeling learning opportunities was 95.8 % (range: 91.6%-100%), for total learning opportunities was 95.8% (range: 91.4%-100%), and correct implementation of DTT components was 81.3 % (range: 78%-84%). For Rico, the client participant paired with Mike, the mean IOA for correct responding was 93% (range: 85%-100%) for labeling targets, 92.9% (range: 90.4%-95.8%) for total targets, and for the occurrence of maladaptive behavior was 96% (range: 90%-100%). The mean IOA for Diana's labeling learning opportunities was 94.7% (range: 87.5%-100%), for total learning opportunities was 95.5% (range: 94.1%-97.8%), and for correct implementation of DTT components was 91.7% (range: 89%-95%). For James, the client participant paired with Diana, the mean IOA for correct responding was 95.7% (range: 90.9%-100%) for labeling tasks, 94.9% (range: 90.9%-100%) for total tasks, and for the occurrence of maladaptive behavior was 93.3% (range: 90%-97%). For Beth, the mean IOA for labeling learning opportunities was 96.3% (range: 89%-100%), for total learning opportunities was 91% (range: 87.5%-95.6%), and for correct implementation of DTT components was 88.3% (range: 85%-95%). The mean IOA for David, the client who was paired with Diana, was 90.1% (range: 85.7%-100%) for correct labeling responding, 88.8% (range: 85%-93.3%) for total correct responding, and 88.7% (range: 83%-93%) for the occurrence of maladaptive behaviors.

Procedure

Experimental Design

A non-concurrent multiple baseline design (Watson & Workman, 1981) across participants was used to assess the effect of the BST procedure on the target behaviors.

Baseline

Before beginning the study, the author met with each participant individually to outline how the video probe sessions would be conducted. In addition, each participant was given an outline to review of how to conduct the baseline sessions. The session focused on presenting learning opportunities trials for expressive labeling targets (rather than intermixing targets from a variety of skill domains), although some instructions were also given to engage in learning readiness behaviors (e.g., “sit down,” “hands ready”) and high probability responses. Prior to the baseline session an instructor participant was instructed to “Run a block of discrete trial teaching.” The instructor participant started a vibrating timer that was set for 5 min and the video recording commenced. The instructor participant presented the discriminative stimulus for a learning opportunity, and provided a consequence based on the client participant’s response. Tokens were delivered based on the individualized reinforcement schedules for each of the client participants. The instructor participant would continue to present learning opportunities until the client participant had acquired all of the tokens on the board (i.e., five), at this point the client would take a brief break to engage with their chosen reinforcer. After the break, the instructor participant would resume teaching for the remainder of the 5 min video probe session or until the client had acquired all of the tokens on the board again. The teaching targets used from session to session varied, as targets were acquired new targets were introduced and intermixed with a variety of randomly chosen previously mastered targets.

The baseline probe sessions were videotaped by a college placement student and scored later by the author. During baseline, the author was not present and no feedback was delivered to the instructor participants regarding instructional pacing or anything else related to the implementation of DTT. Once the baseline and training conditions were completed for a dyad, the subsequent baseline would begin for the next pairing. Baseline sessions were conducted one to three times per week.

Intervention Procedure

In the training phase, a multi-component BST session was implemented that consisted of four components; instruction, modeling, rehearsal and feedback (Sarokoff & Sturmey, 2004).

The first segment of the initial training session included the instruction and modeling components. These components of the training were conducted during indirect clinical time at the start of the day, prior to the arrival of the client participants. The instruction component was implemented by having the instructor participant read the five-page illustrated self-instruction manual (Appendix B) designed by the author. This manual detailed the objective of the booklet, some background information on instructional pacing, variables that may affect instructional pacing and how to conduct a well paced session. It also outlined the key components of a discrete teaching trial. The instructor participant was given up to 15 min to review this package in the computer lab. When they had finished reviewing the self-instruction package or the 15 min had elapsed, the instructor was given up to 10 min to complete a 10-question multiple choice participant quiz regarding the content of the instruction package.

The instructor participant then reviewed a video model on a computer in the computer lab. The video model was 10-min 41-s video and consisted of video clips of an experienced staff running well-paced sessions with a client, in addition there were several clips of trials that were implemented at a slower pace. The video was narrated by the author to highlight and provide some examples and non-examples of the variables that allow for well paced instruction. Some examples of non-examples were, a delayed delivery of reinforcement, prolonged ITIs, or allowing the client extended time to respond. While the instructor participant was reviewing the video model, the author scored the quiz.

The author then reviewed the score of the quiz with the instructor participants and any responses that they answered incorrectly. A line graph representing the rate of learning opportunities (i.e., instructional pacing) that they had presented during baseline was then shown to the instructor participant. The author also reviewed a line graph of the percentage of the DTT components completed correctly with the instructor participant. The author answered any questions that the instructor participant had regarding the components of DTT or instructional pacing during this time and delivered feedback on general trends in behavior observed during the baseline. Potential areas of feedback were how the instructor participant implemented the components of DTT that were outlined in the self-instruction manual and those variables that were identified to affect the pacing of session (session preparation, response latency, feedback delay and intertrial intervals). Once this segment of the training was completed, the self-instruction manual, the quiz and the video model were removed and the instructor participants were not able to review these materials again.

The first rehearsal and feedback component of the training procedure was run later that same day with the instructor participant and the paired client participant. At the start of the instruction period (i.e., direct clinical time), the author set a timer for 15 min and directed the instructor participant to “Run a block of discrete trial teaching.” During the rehearsal component, the instructor participant ran DTT trials until the client participant had earned five tokens. The instructor participant then gave the client access to a highly preferred activity, and the author provided brief feedback on the trials that were observed. This feedback included providing praise for the components of the teaching that were implemented correctly and at a reasonable speed, and constructive feedback for those components that were implemented incorrectly or too slowly. The rehearsal and feedback components were repeated until feedback had been delivered on 20 trials or 15 min has expired.

A post-training video probe was filmed later in the day with the same instructor-client pairing. The post-training video probe was collected in the same manner as the baseline video probes. Each post-training video probe consisted of the instructor participant being instructed to "Run a block of discrete trial teaching," at which point the instructor participant would run a DTT session and deliver reinforcement for a 5-min video probe. This session was videotaped by a college placement student and scored later by the author. During these post-training probes, the author was not present and no feedback was delivered to the instructor participant.

The subsequent training sessions included the rehearsal and feedback components of the BST procedure. The line graphs were updated to include data from the previous session and these were reviewed with the instructor participant prior to each training session in order to illustrate any behavior change that had occurred. A post-training video probe was recorded after each training session. These sessions continued until the instructor participant met or exceeded the mastery criteria for the variable that had been targeted for change (i.e., three consecutive sessions at or above the target rate or percentage). The target rate of learning opportunities for labeling tasks (i.e., 6.8 learning opportunities per minute) and total tasks (i.e., 7.6 learning opportunities per minute) were based on an average from data collected across three 5-min sessions run by an experienced therapist teaching expressive labeling targets to a client who did not participate in the study. The target percentage for accuracy of implementing DTT was three consecutive sessions at or above 90% correct, as this is a standard of accuracy that is generally accepted in the literature (Sarokoff & Sturmey, 2004; Severston & Carr, 2012). Training sessions were conducted one to three times per week.

One month after the instructor participant had met the mastery criteria, a follow-up probe was conducted in order to probe maintenance of the skill. This follow-up probe was conducted in the same manner as the baseline and post-training video probes.

During any of the video probes sessions or training sessions, if the client participant engaged in any maladaptive behaviors, the instructor participant followed through on the initial instruction, when appropriate, and then delivered instructions for well-known or high probability responses while reinforcing compliance. Once compliance was re-established the instructor participant would resume delivering instructions for target tasks.

Chapter III

RESULTS

The results for the participants are summarized in Table 1 and Table 2. The results are also depicted in Figures 1 through 6. During the baseline condition for Mike the rate of labeling learning opportunities presented was consistently below the target rate (see Appendix A, Figure 1). A mean rate of 4.3 labeling learning opportunities per minute (range, 3.4 to 5.7) was presented by Mike. The mean rate of total learning opportunities (i.e., including those for readiness responses and high p responses) presented by Mike during the baseline condition (see Appendix A, Figure 2) was 7.6 total learning opportunities per minute (range, 6.9 to 8.1).

After reviewing the self-instruction manual for the full 15 mins allotted, Mike scored 100% on the 10 question quiz. Once the full training package was implemented (i.e., self-instruction manual, video model, rehearsal and feedback sessions) Mike immediately demonstrated an improved presentation rate of labeling learning opportunities which was above the target rate, this rate was maintained for the subsequent two training sessions thus meeting the mastery criteria. During the training condition, Mike presented a mean rate of 7.3 labeling learning opportunities per minute (range, 7.1 to 7.4). He maintained a rate of 7.1 labeling learning opportunities per minute during a follow-up probe one month after meeting the mastery criteria. The rate of total learning opportunities per minute presented by Mike also demonstrated an immediate increase once the training condition began. In this condition, an average of 9.3 total learning opportunities per minute (range, 9.1 to 9.7) was presented. During the follow-up probe, the rate increased slightly to 10.3 total learning opportunities per minute. During the baseline condition, Mike demonstrated a high and stable trend of implementing the components of DTT correctly, with a mean of 91.6% correct (range, 90% to 93%). Once the training was introduced, his mean performance reduced to a stable trend of 86% of the DTT components implemented correctly, although when a follow-up probe was completed this performance rebounded to 94%.

In contrast, although the baseline for the rate of labeling learning opportunities presented by Diana was initially similar to that of Mike, a sudden increase in the fourth session resulted in a rate that was stable and above the target rate (i.e., 6.8) for three consecutive sessions indicating that training to increase the rate of learning opportunities was unnecessary to meet the mastery criteria that had been outlined. During baseline, Diana presented a mean rate of 6.1 labeling learning opportunities per minute (range, 4.1 to 7.6). The mean rate of total learning opportunities presented in the baseline condition was 12.0 (range, 11.2 to 13.0) which was also well above the target rate (i.e., 7.6). Baseline data revealed that Diana was consistently implementing the components of DTT at a level that was below the mastery criterion (i.e., 90%). She had a mean performance of 82% (range, 75% to 87%) correct during the baseline condition.

The training condition was introduced in order to monitor the effect on Diana’s implementation of the components of DTT and the corresponding effect on the rate of learning opportunities. Diana completed the quiz after reviewing the self-instruction manual for 15 minutes, and scored 90%. After implementing the remaining components of the first training session (i.e., video model, rehearsal and feedback session) an immediate increase was observed in Diana’s performance of the components of DTT and her performance remained stable above 90% correct throughout the training condition. Her mean performance of the components of DTT was 93.8% (range, 92% to 96%), which she maintained during a follow-up probe a month later with a performance of 92% correct. After an initial dip below the target rate for the first two sessions of the training condition, Diana's rate of presenting labeling learning opportunities increased again to above the target rate. Diana's performance met the mastery criteria for rate of labeling learning opportunities while she concurrently maintained her performance implementing the components of DTT. Her mean presentation rate of labeling learning opportunities during this condition was 7.7 learning opportunities per minute (range, 6.1 to 9.8). During the follow-up probe, this rate decreased again to below the target rate to 4.6 learning opportunities per minute. Her rate of total learning opportunities also decreased after the intervention was introduced, but always remained above the target rate. Diana presented an average rate of 10.5 total learning opportunities per minute (range, 8.3 to 12.8) during the training condition, this increased during the follow-up probe with an observed 12.2 total learning opportunities per minute.

During baseline, the rate of labeling learning opportunities that was presented by Beth hovered around the target rate with an average of 6.5 labeling learning opportunities per minute (range, 5.6 to 7.8) although the trend of the data was decreasing slightly. The mean rate of total learning opportunities that she presented during baseline was 8.4 learning opportunities per minute (range, 6.4 to 10) and this data also demonstrated a downward trend after the second session. Similar to Diana, during the baseline condition Beth's performance was consistently below 90% correct for the implementation of the components of DTT. During the baseline, the mean percentage of DTT steps performed correctly by Beth was 79.5% (range, 72% to 85%). It should be noted that several of the initial baseline sessions that had been recorded were not able to be used for data collection due to a recording malfunction.

After the self-instruction manual was reviewed, Beth scored 80% on the quiz. Once the training condition was implemented Beth's performance gradually increased across sessions until she was consistently implementing the DTT steps at above 90% accuracy, the mean percentage of DTT steps that Beth performed correctly during the training condition was 90% (range, 82% to 96%). During the follow-up probe her accuracy of implementing the steps of DTT decreased again to 81% of the components completed correctly. With the exception of one session where the rate of labeling learning opportunities increased sharply, all of the rates that were presented by Beth across the sessions in the training condition were below the target rate that had been set for mastery criteria. Beth's mean rate decreased to 5.3 labeling learning opportunities per minute (range, 3.7 to 9.4) during the training condition. This decreased further in the follow-up probe to 2.6 labeling learning opportunities per minute. The mean rate for her total learning opportunities also decreased to 7.8 total learning opportunities per minute (range, 5.3 to 11.6) during the training condition and demonstrated considerable variability. The rate of total learning opportunities presented during follow up by Beth was 6.4 per minute.

An analysis of the DTT components where errors occurred (see Appendix A, Table 3) during the randomly selected trials indicated some trends across participants. The majority of errors in both baseline and training conditions across all participants stemmed from a failure to secure the client's attention for at least 1 s before delivering an instruction. Of the errors that Mike engaged in during the baseline condition, 64% were in this component, and 63% of errors were in this component during the training condition. Diana's baseline data indicated that 56% of the errors that she made were in this component, and 44% of her errors during the training condition. Beth's data indicated that 29% of the errors that she engaged in during the baseline condition were in this component, and this increased to 59% during the training condition. For Mike and Diana, the second most common error was timely data collection for trials which required data collection (i.e., acquisition targets). For Mike, 18% of his errored responses during baseline were due to either not collecting data or delayed data collection, and 26% of his errored responses were in this component during the training condition. During baseline, 20% of Diana's errors related to promptly collecting required data, during the training condition the errors in this component constituted 44% of the total errors. Although Beth did demonstrate errors in this component of DTT during both baseline (i.e., 14% of total errors) and training (i.e., 9% of total errors), there were other components which constituted a greater or comparable percentage of the total errors (i.e., prompting, error correction). It should be noted that that the errors that Beth engaged in were distributed across a wider range of DTT components (i.e., errors in eight components in both baseline and training conditions) when compared with Mike (i.e., errors in three components during baseline and four components during training) and Diana (i.e., errors in five components during baseline, and four components during training). This resulted in the errors in each component accounting for a lower percentage of the total errors.

All of the clients (Rico, James, and David) who were paired with the instructors across conditions demonstrated a trend in their rate of correct responding (label and total targets) that was similar to the trend of the rate of learning opportunities that were presented to them with a lower level of responding per minute, as illustrated in Figure 4 and Figure 5 (Appendix A). Rico (client paired with Mike) demonstrated a higher rate of correct responding per minute during the training condition compared to baseline for both labeling and total targets. On average, he correctly responded to labeling tasks 3.5 times per minute (range, 2.8 to 4.6) during the baseline condition, and 5.4 times per minute (range, 5.0 to 6.2) during the training condition. This rate of correct responding per minute was maintained during the follow-up probe, with Rico demonstrating 5.5 correct labeling responses per minute. Rico correctly responded to the total tasks presented on average 6.3 times per minute (range, 5.6 to 6.8) during the baseline condition, the average increased to 7.1 times per minute (range, 6.3 to 8.2) during the training condition although a decreasing trend was observed across the three sessions. In the follow-up probe, this rate of correct responding for total tasks increased to 8.1 correct responses per minute.

James (client paired with Diana) demonstrated a mean rate of 5.0 correct labeling responses per minute (range, 3.0 to 6.7) during baseline. In the training condition, his mean rate of correct responding increased to 6.9 labeling responses per minute (range, 4.7 to 9.3). James' rate of correct responding decreased to 4.3 labeling responses per minute during the follow-up probe. During the baseline condition, James' mean rate of correct responding was 10.2 total trials per minute (range, 9.3 to 10.8) which decreased slightly to 9.4 total responses per minute (range, 6.5 to 12.0) once the training condition was implemented. During the follow-up probe, James demonstrated an increased rate of 11.3 correct total responses per minute.

Similar to the other two clients, the rate of correct responding for labeling and total targets for David (paired with Beth) followed similar trends to those depicted by the rate of learning opportunities presented to him at a lower level of responding. His mean rate of correct responding for labeling targets was 5.4 correct responses per minute (range, 3.6 to 7.8) during the baseline condition. During the training condition, his mean rate for labeling targets decreased to 4.3 correct responses per minute (range, 4.2 to 9.1). His rate of correct responding decreased further during follow up to 1.4 correct responses per minute. David's mean rate of correct responding for total targets was 7.0 correct responses per minute (range, 4.2 to 9.7) during the baseline condition. This mean rate for total targets decreased to 6.2 correct responses per minute (range, 4.2 to 10.9) during the training condition. During the follow-up probe, this decreased further to 4 correct responses per minute.

Figure 6 (Appendix A) depicts the clients' (Rico, James, David) maladaptive behavior during the video probe session represented as a percentage of 10-s intervals during which individually defined behaviors were observed. During baseline, Rico was observed engaging in maladaptive behaviors on average in 38.7% of intervals (range, 19% to 57%). In the training condition, he engaged in maladaptive behaviors on average in 27% of intervals (range, 7% to 37%). In the baseline condition James exhibited defined behaviors in an average of 38.3% of intervals (range, 7% to 67%). During the training condition, the overall mean percentage of intervals in which maladaptive behaviors were observed was 24.2 % (range, 7% to 30%). Both Rico and James engaged in maladaptive behaviors at a slightly higher mean percentage of intervals during baseline than during the training condition, although a session by session comparison indicated that the baseline data was highly variable. David demonstrated a low level of maladaptive behaviors during baseline, with behaviors observed in a mean percentage of 7.5% of the intervals (range, 0%-10%). Once the training condition was introduced, the mean percentage increased slightly to 14% of intervals (range, 3% to 30%) although there was considerably more variability in the data during the training condition than during the baseline condition. David engaged in a higher level of maladaptive behaviors during the follow-up probe with behaviors observed in 33% of intervals.

Chapter IV

DISCUSSION

The results of this study demonstrated that the BST package successfully increased the rate of learning opportunities per minute for both labeling and total targets presented by one of the three instructor participants (Mike). A second instructor participant (Diana) demonstrated a moderate increase in the rate of learning opportunities per minute for labeling targets but no increase was observed for the total targets presented in a session, and the third participant (Beth) did not demonstrate an increase in the rate of learning opportunities for either set of targets. While two of the instructor participants (Diana and Beth) did not demonstrate a significant increase in the rate of learning opportunities presented, the implementation of the BST procedure was correlated with an increase in the accuracy with which they implemented the components of DTT to above 90% correct, which is a standard of accuracy that is generally accepted in the literature (Sarokoff & Sturmey, 2004; Severston & Carr, 2012).

The increased rate of labeling and total learning opportunities presented by the first instructor participant (Mike) and the increased rate of labeling learning opportunities presented by the second instructor participant (Diana) corresponded with an increase in the rate of correct responding from the baseline to the training condition for the client participants in these dyads. Those dyads that did not demonstrate an increase in the rate of learning opportunities when training was introduced, demonstrated trends in the rates of correct responding for the client participants (i.e., James and David) that corresponded with the trends of the rate of learning opportunities presented to them (e.g., decreasing, variable). Minimal effect was observed in the occurrence of maladaptive behaviors when the training condition was introduced across the three client participants (Rico, James, David).

Previous research (Dib & Sturmey, 2007; Lavie & Sturmey, 2002; Miles & Wilder, 2009; Sarakoff & Sturmey, 2004) demonstrated that a wide variety of skills (e.g., DTT, preference assessments, guided compliance) have been taught successfully through the implementation of a BST procedure. This study demonstrated that a BST procedure designed to increase instructional pacing was successful at increasing the rate of learning opportunities presented by some of the instructor participants and the accuracy of implementing DTT for certain instructor participants. The differing effects of the BST procedure on the individual instructor participants' rate of learning opportunities was likely related to the differing rate of learning opportunities that they presented during baseline. While the rate of learning opportunities for both labeling and total trials presented by Mike during baseline was significantly below the mastery criteria that had been outlined, the potential to increase the instructional pacing (i.e., rate of learning opportunities) for Diana and Beth may have been limited by the high rates of learning opportunities they presented during baseline.

The high rate of learning opportunities presented by Diana and Beth during baseline may be attributed to reactivity to being observed. The researcher tried to control for this reactivity by collecting data from video probes that were recorded by college students completing their placement in the classroom. These students observed instructors and recorded sessions regularly in the classroom. In addition, the fact that the participants were aware of the purpose of the study and the variables that were being measured may have resulted in an instructional pace during baseline that was higher than the rate of learning opportunities that would have been presented during typical teaching sessions.

Although the high rate of learning opportunities presented during baseline indicated that a training intervention may not have been necessary to increase instructional pacing for certain participants, the baseline data collected on the implementation of DTT indicated that percentage of components completed correctly was less than ideal (i.e., below 90% accuracy) for these same instructor participants (i.e., Diana and Beth). The introduction of the BST procedure correlated with an increase in the percentage of DTT components completed correctly for Diana and Beth. The BST procedure, although designed to increase instructional pacing, appeared to be general and flexible enough to affect the accuracy of implementing of the steps of DTT for these two participants. This was likely due to the fact that the integral components of completing a discrete trial were outlined in the self-instruction manual, these components were modeled in the video model, and individualized feedback was able to target the areas with which a participant was demonstrating difficulty during baseline and the training condition.

It should be noted that after the introduction of the BST procedure and the increase in her accuracy implementing DTT, Diana's rate of labeling learning opportunities initially fell below the rate that had been set for the mastery criteria but increased above the threshold again after two sessions. On the other hand, Beth's data indicated that once her accuracy implementing DTT was stable at above 90% after the introduction of BST, the rate of labeling learning opportunities that she presented was lower than it had been during baseline and well below the threshold that had been set for the mastery criteria. The first instructor participant (Mike) demonstrated above 90% correct during baseline, and his accuracy decreased to slightly below this threshold during the training condition. During the follow-up probe both of these variables were above the thresholds that had been determined as ideal. These different outcomes for the three participants indicate that inverse relationship exists, at least initially, between the rate of learning opportunities presented and the percentage of DTT components that an instructor participant implements correctly.

The error analysis (Appendix A, Table 3) indicated that the highest percentage of errors that occurred across the three instructor participants was a failure to secure the client's attention for at least 1 s before delivering an instruction. Timely data collection for trials which required data collection (i.e., acquisition targets) also constituted a large percent of errors. These errors would allow for an increase in the rate of learning opportunities as failing to implement these components correctly could potentially decrease the duration of each teaching trial.

The results of this study supported previous findings (LaMela & Tincani, 2012; Tincani et al, 2005) by demonstrating that the client participants' rates of correct responding in a session positively co-varied with the rates of learning opportunities that were presented. When the rate of learning opportunities increased a corresponding increase was also observed in the rate of correct responding, and when the rate of learning opportunities decreased concomitant decreases in the rate of correct responding were observed. As discussed in Roxburgh and Carbone (2012), this suggested that increasing instructional pacing may result in more efficient teaching, if only because the client participants were more likely to engage in an increased rate of correct responding and this may assist them to meet their learning objectives in a shorter period of time. It would also potentially increase the number of skills that could be targeted in a finite amount of time.

Interestingly, the results in the study did not replicate previous studies (Dunlap et al., 1983; Roxburgh & Carbone, 2012) which had clearly demonstrated a differential effect between an increase in instructional pacing and the reduction of stereotypic or escape motivated behaviors. Although the mean percentage of intervals in which maladaptive behaviors were observed did decrease slightly for two of the client participants (Rico and James) as instructional pacing increased, there was considerable overlap between the data points in the baseline and training conditions. In addition, the baseline data for Rico and James was highly variable suggesting that factors other than the pace of instruction were likely affecting their levels of maladaptive behaviors. Similar to the modest results reported in LaMela and Tincani (2012), it is questionable whether these results would have been significant enough to be noticed in a typical teaching session. David demonstrated a moderate increase in maladaptive behaviors when the instructional pacing decreased during training, but similar to the other two participants there was considerable overlap between the data points during the baseline condition and the training condition. It is worth noting that the follow-up probe for David produced the highest level of maladaptive behavior and the lowest rate of labeling and total learning opportunities, but without additional probes a trend could not be established. In contrast to suggestions made by Tincani et al. (2005), which proposed that those individuals who did not engage in high levels of maladaptive behaviors may not benefit from brisk instructional pacing, although the effect on the client participant’s maladaptive behavior was minimal this was mediated by the fact that brisk instructional pacing was correlated with higher rates of correct responding, as discussed previously.

The minimal effect of changes in instructional pacing on maladaptive behaviors may have been a result of participant selection. In previous research (Dunlap et al., 1983; LaMela & Tincani, 2012; Roxburgh & Carbone, 2012) the client participants were identified and selected for participation based on reports of maladaptive behaviors (e.g., stereotypy, escape-motivated behaviors). In this study the client participants were volunteered for participation by their guardian after an invitation to participate was distributed. The three client participants did not have behavior support plans as they were not identified by their clinical team as having maladaptive behaviors that interfered with the learning of new skills. The moderate to low average occurrence of maladaptive behaviors in baseline for all of the participants may have limited the possible effect that increasing instructional pacing could have had on decreasing the levels of these behaviors.

It should also be noted that the instructor participants had considerable experience implementing DTT and working with the particular client participants. It is possible that informal antecedent strategies were implemented during sessions that reduced maladaptive behaviors. It was anecdotally observed that on several occasions when the client participants began to engage in potential pre-cursor behaviors (e.g., looking around classroom, lifting hand off table) the instructor they were paired with delivered several instructions to engage in high probability responses. These antecedent strategies may have kept the levels of maladaptive behaviors lower than if the session were run with a novice instructor.

This study added to both the literature on instructional pacing and BST by collecting data on multiple variables of both instructor participant (i.e., rates of learning opportunities presented and accuracy of implementation of DTT) and client participant (i.e., rates of correct responding and occurrences of maladaptive behaviors) responding. This enabled the author to monitor how changes in the instructor participant's behavior after the introduction of BST, corresponded with changes in the individual client participant's behavior. As Koegel et al. (1980) noted, a higher rate of instructional pacing will not necessarily always be superior but rather it may be beneficial for teaching specific skills to certain clients. Monitoring the client participant's behavior in response to changes in the rate of the learning opportunities presented will be key to determining whether brisk instructional pacing was suitable for a particular client. Additionally, by collecting data on the instructor participant's accuracy implementing DTT, the author was able to monitor if treatment integrity was affected by changes in instructional pacing. The results from this study suggested that instructional pacing and treatment integrity were interrelated to some degree. This data allowed the author to monitor the different patterns of responding that were observed across the different dyads.

The video probe and training sessions in this study were designed to reflect a typical teaching session. This resulted in teaching sessions that included the delivery of non-labeling targets to establish learning readiness and behavioral momentum, in addition to the expressive labeling targets. This study recorded and presented the labeling and total learning opportunities separately, as well as the correct responding for labeling and total tasks. This enabled the author to monitor the different patterns of responding that occurred across the individual participants. The number of non-labeling learning opportunities that were presented limited the number of labeling learning opportunities that may be presented. This was important to note as an overall increase in instructional pacing may not have provided the same benefits (i.e., more efficient teaching) to a learner as an increase in the instructional pacing for labeling targets that were in acquisition or maintenance.

The BST procedure used in this study also expanded the variables of teaching that were emphasized as being integral to increase instructional pacing. Previous studies targeted instructional pacing by manipulating a single variable of a discrete trial, such as wait time or response latency (LaMela & Tincani, 2012; Tincani & Crozier, 2008) or duration of intertrial intervals (Dunlap et al., 1983; Koegel et al., 1980; Roxburgh & Carbone, 2012). In contrast, the BST procedure in this study emphasized session preparation, response latency, feedback delay and intertrial intervals (Heward, 1994), as being central to conducting a session with brisk instructional pacing.

There were several limitations to the design of this study. The first limitation was that this procedure was in vivo training with a client who was diagnosed with autism. While in vivo training may be beneficial for generalization of skills to natural settings and produce less reactivity in client participants than a novel environment (e.g., observation room), the author had less control over extraneous variables that may have impacted the rate of learning opportunities that an instructor participant was able to present (Luiselli, 2015). Some of these extraneous variables were behaviors that the client engaged in (e.g., appropriate commenting, requesting to use the toilet) that interfered with the instructor presenting learning opportunities or that influenced the attending of the client (e.g., history, distractions in the environment). In vivo training may have resulted in a setting that made it more difficult for the instructor participant to focus on the skills being taught or resulted in limited opportunities to practice certain skills. For example, few client errors limited opportunities to practice error correction in certain dyads.

Future research should compare training with a confederate (Severston & Carr, 2012) to in vivo training in regards to the duration to mastery and generalization skills learned to clients or other clients.

The second limitation was the fact that the data was collected from a video recording. The process of video recording may have resulted in some reactivity of the instructor participant or the client participant. For example, it was noted that the client participants occasionally attempted to engage the videographer (e.g., saying “cheese” to the camera repeatedly) or turned to look directly at the camera. In addition, collecting data from a video recording was occasionally difficult when the angles of recording were not optimal, although this was usually promptly fixed by the videographer. The audio was recorded using the video camera’s built in microphone which also picked up a lot of the noise in the environment, and was not sensitive enough for some of the client’s responding that was particularly quiet or occurred at the same time as another environmental noise (e.g., scream, crying). Issues regarding the camera angle or audio resulted in the client response being unobservable in 4% of the trials run across the three dyads. Future research should consider implementing a formal training procedure for the videographer to target being discreet in the training setting, and how to reliably capture video shots that allow for data collection. Additionally, future research utilizing video recordings may have the staff and client participants wear individual microphones or use a directional microphone to limit some of the ambient noise.

A third limitation was that the accuracy of implementing DTT for all three of the instructor participants’ approached or was above the target of 90% of the components completed correctly during baseline. Two of the three instructor participants also presented high rates of learning opportunities during the baseline. This may have limited the potential to observe significant increase in these behaviors after the implementation of the BST procedure. Future research should consider implementing this procedure with novice instructors to work on increasing instructional pacing immediately after they pass their provincial evaluation (i.e., demonstrate that they are able to reliably conduct DTT with at least 90% correct). Novice instructors may present a lower rate of learning opportunities during baseline, and this research could monitor the effect of increasing instructional pacing on the implementation of the components of DTT.

Another limitation was that there was only one follow-up probe one month after demonstrating mastery. The follow-up probe for two of the participants indicated that the behavior change was not maintained for rate of labeling learning opportunities presented (Diana) and the percentage of correct completion of the components of DTT (Beth). Future research should include additional follow-up probes and explore using booster sessions when levels of target behaviors are not maintained.

Finally, as the implementation of IBI treatment is individualized to take into consideration the areas of strength and need for each of the clients, the target rate of learning opportunities presented may have been reasonable for some learners and not for others. Future research should consider basing the target rate of learning opportunities on data collected with the individual client with a therapist who demonstrated that they were able to implement DTT with brisk instructional pacing.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Anderson, S. R., Avery, D. L., DiPietro, E. K., Edwards, G. L., & Christian, W. P. (1987). Intensive home-based intervention with autistic children. *Education and Treatment of Children, 10,* 352-366.

Anderson, S. R., Taras, M., & O'Malley Cannon, B. (1996). Teaching new skills to young children with autism. In C. Maurice, G. Green, & S.Luce (Eds.), *Behavioral intervention for young children with autism: A manual for parents and professionals* (pp 181-193). Austin, Tex: Pro Ed.

Birnbrauer, J. S., & Leach, D. J. (1993). The Murdoch Early Intervention Program after 2 years. *Behavior Change, 10,* 63-74.

Bondy, A., Tincani, M., & Frost, L. (2004). Multiply controlled verbal operants: An analysis and extension to the picture exchange communication system. *The Behavior Analyst*, *27*(2), 247-261.

Catania, C. N., Almeida, D., Liu-Constant, B., & Digennaro Reed, F. D. (2009). Video modeling to train staff to implement discrete-trial instruction. *Journal of Applied Behavior Analysis, 42*(2), 387-392.

Centers for Disease Control and Prevention. (2014). Prevalence of autism spectrum disorder among children aged 8 years—Autism and developmental disabilities monitoring Network, 11 Sites, United States, 2010. *MMWR Morb Mortal Wkly Rep, 63*(2), 1-21.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). *Applied behavior analysis* (2nd ed.) Upper Saddle River, NJ: Pearson.

Davis., B. J., Smith, T., & Donahoe, P. (2002). Evaluating supervisors in the UCLA treatment model for children with autism: Validation of an assessment procedure. *Behavior Modification, 33,* 601-614.

Dib, N., & Sturmey, P. (2007). Reducing student stereotypy by improving teachers' implementation of discrete-trial teaching. *Journal of Applied Behavior Analysis*, *40*(2), 339-343. doi:10.1901/jaba.2007.52-06

Dunlap, G., Dyer, K., & Koegel, R. L. (1983). Autistic self-stimulation and intertrial interval duration. *American Journal of Mental Deficiency*, *88*(2), 194-202.

Filipek, P. A., Accardo, P. J., Baranek, G. T., Cook Jr., E. H., Dawson, G., Gordon, B., …….. Volkmar, F. R. (1999). The screening and diagnosis of autism spectrum disorders. *Journal of Autism and Developmental Disorders, 29*(6), 439-484.

Flanagan, H. E., Perry, A., & Freeman, N. L. (2012). Effectiveness of large-scale community-based Intensive Behavioral Intervention: A waitlist comparison study exploring outcomes and predictors. *Research in Autism Spectrum Disorders*, *6*(2), 673-682. doi:10.1016/j.rasd.2011.09.011

Green, G. (1996). Early behavioral intervention for autism: What does the research tell us? In C. Maurice, G. Green, & S. Luce (Eds.), *Behavioral Intervention for Young Children With Autism: A Manual for Parents and Professionals* (pp. 24-44). Austin, Tex: Pro Ed.

Heward, W. L. (1994). Three “low tech” strategies for increasing the frequency of active child response during group instruction. In R. Gardiner III, D. M. Sainato, J. O. Cooper, T. E. Heron,W. L. Heward, J. Eshleman, & T. A. Grossi (Eds.), *Behavior analysis in education: Focus on measurable superior instruction* (pp. 283-320). Pacific Grove: Brooks/Cole.

Hsieh, H., Wilder, D., & Abellon, E. (2011). The effects of training on caregivers’ implementation of incidental teaching. *Journal of Applied Behavior Analysis, 44*(1), 199-203.

Jacobson, J.W. (2000). Early intensive behavioral intervention: Emergence of a consumer driven service-model. *Behavior Analyst, 23*, 149-171.

Koegel, R. L., Dunlap, G., & Dyer, K. (1980). Intertrial interval duration and learning in autistic children. *Journal of Applied Behavior Analysis*, *13*(1), 91-99. doi:10.1901/jaba.1980.13-91

Koegel, R. L, Russo, D. C., & Rincover, A. (1977). Assessing and training teachers in the generalized use of behavior modification with autistic children. *Journal of Applied Behavior Analysis, 10*(2), 197-205.

Lafasakis, M., & Sturmey, P. (2007). Training parent implementation of discrete-trial teaching: Effects on generalization of parent teaching and child correct responding. *Journal of Applied Behavior Analysis*, *40*(4), 685-689. doi:10.1901/jaba.2007.685-689

LaMela, L., & Tincani, M. (2012) Brief wait time to increase response opportunity and correct responding in children with autism spectrum disorder who display challenging behavior. *Journal of Developmental and Physical Disabilities*, *24*, 559-573. doi 10.1007/s10882-012-9289-x

Lavie, T., & Sturmey, P. (2002). Training staff to conduct a paired-stimulus preference assessment. *Journal of Applied Behavior Analysis, 35*(2), 209-211.

Leaf, R., & McEachin, J. (1999). *A work in progress: Behavior management strategies and a curriculum for intensive behavioral treatment of autism* (1st ed.). New York, NY: DRL Books.

Lovaas, O. I. (1987). Behavioral treatment and normal intellectual and educational functioning in autistic children. *Journal of Consulting and Clinical Psychology, 55,* 3-9.

Lovaas, O. I. (2003). *Teaching individuals with developmental delays: Basic intervention techniques.* Austin, TX: Pro-Ed.

Luiselli, J. K. (2015). Review of behavioral training and performance management interventions with autism spectrum disorder (ASD) care-providers. *International Journal of Behavior Analysis & Autism Spectrum Disorders, 2*(1), 9-17.

MacDonald, R., Sacramone, S., Mansfield, R., Wiltz, K., & Ahearn, W. H. (2009). Using video modeling to teach reciprocal pretend play to children with autism. *Journal of Applied Behavior Analysis*, *42*(1), 43-55. doi:10.1901/jaba.2009.42-43

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal of Mental Retardation: AJMR*, *97*(4), 359-372; discussion 373-391.

Miles, N. I., & Wilder, D. A. (2009). The effects of behavioral skills training on caregiver implementation of guided compliance. *Journal of Applied Behavior Analysis, 42*(2), 405-410.

Morgan, R. L., & Salzberg, C. L. (1992). Effects of video-assisted training on employment-related social skills of adults with severe mental retardation. *Journal of Applied Behavior Analysis, 25*(2), 365-383.

National Autism Center (NAC). (2009). *National Standards Report*. Retrieved from http://www.nationalautismcenter.org/pdf/NAC Standards Report.pdf

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

Perry, A., Koudys, J., & Sheese, K. (2008). *The york system of quality assurance for intensive behavioural intervention programs.* Unpublished Manual, York University, Canada.

Perry, A., Prichard, E. A., & Penn, H. E. (2006). Indicators of quality teaching in intensive behavioral intervention: a survey of parents and professionals. *Behavioral Interventions*, *21*(2), 85-96. doi:10.1002/bin.212

Perry, A., Prichard, E. A., & Penn, H. E. (2008). *The York measure of quality of intensive behavioural intervention.* Unpublished Manual, York University, Canada.

Rehfeldt, R., & Rosales, R. (2007). Readiness skills. In P. Sturmey & A. Fitzer (Eds.) *Autism spectrum disorders: Applied behavior analysis, evidence and practice* (pp. 85-101). Austin, Tex: Pro Ed.

Rosales, R., Stone, K., & Rehfeldt, R. A. (2009). The effects of behavioral skills training on the implementation of picture exchange communication system. *Journal of Applied Behavior Analysis*, *42*(3), 541-549.

Roxburgh, C. A., & Carbone, V. J. (2012). The effect of varying teacher presentation rates on responding during discrete trial training for two children with autism. *Behavior Modification*, *37*(3), 298-323. doi:10.1177/0145445512463046

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

Severston, J. M., & Carr, J. E. (2012). Training novice instructors to implement errorless discrete-trial teaching: a sequential analysis. *Behavior Analysis in Practice*, *5*(2), 13-23.

Smith, T. (2001). Discrete trial training in the treatment of autism. *Focus on Autism and Other Developmental Disabilities*, *16*(2), 86-92. doi:10.1177/108835760101600204

Smith, T., Groen, A. D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal of Mental Retardation: AJMR*, *105*(4), 269-285. doi:10.1352/08958017(2000)105<0269:RTOIEI>2.0.CO;2

Smith, T., McAdam, D., & Napolitano, D. (2007). Autism and applied behavior analysis. In P. Sturmey & A. Fitzer (Eds.) *Autism spectrum disorders: Applied behavior analysis, evidence and practice* (pp. 1-29). Austin, Tex: Pro Ed.

Sturmey, P. (2008). Best practice methods in staff training. In J. K. Luiselli (Ed.), *Effective practices for children with autism: Educational and behavior support interventions that work*. New York, NY: Oxford University Press.

Sundberg, M. L., & Partington, J. W. (1998). *Teaching language to children with autism or other developmental disabilities.* Pleasant Hill, CA: Behavior Analysts Inc.

Sallows, G.O., & Graupner, T.D. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal on Mental Retardation*, *55,* 417-438.

Tincani, M., & Crozier, S. (2008). Comparing brief and extended wait time during small group instruction for children with challenging behavior. *Journal of Behavioral Education, 17,* 79-92.

Tincani, M., Ernsbarger, S., Harrison, T. J., & Heward, W. L. (2005). Effects of two instructional paces on pre-k children's participation rate, accuracy, and off-task behavior in the "Language for Learning" program. *Journal of Direct Instruction*, *5*(1), 97-109.

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

Watson, P., & Workman, E. (1981). The non-concurrent multiple baseline across-individuals design: An extension of the traditional multiple baseline. *Journal of Behavior Therapy and Experimental Psychiatry, 12*(3), 257-259.

Weiss, M.J. (2001). Expanding ABA intervention in intensive programs for children with autism: The inclusion of Natural Environment Teaching and Fluency Based Instruction. *The Behavior Analyst Today, 2,* 182-186.

Young, J. M., Krantz, P. J., McClannahan, L. E., & Poulson, C. L. (1994). Generalized imitation and response-class formation in children with autism. *Journal of Applied Behavior Analysis,* 27, 685-697.

Appendices

Appendix A

Tables and Figures

Table 1

Average rate (and range) of learning opportunities per minute and average percentage (and range) of DTT steps performed correctly by instructor participants across conditions

Participants		Learning opportunities per minute		Percentage of DTT Steps Performed Correctly
		Label	Total	
Mike				
Baseline				
	Mean (range)	4.3 (3.4 -5.7)	7.6 (6.9-8.1)	91.7% (90%-93%)
Training (BST)				
	Mean (range)	7.3 (7.1-7.4)	9.3 (9.1-9.7)	86.0% (86%)
Follow up		7.1	10.3	94.0%
Diana				
Baseline				
	Mean (range)	6.1 (4.1-7.6)	12.0 (11.2-13.0)	82.0% (79%-87%)
Training (BST)				
	Mean (range)	7.7 (6.1-9.8)	10.5 (8.3-12.8)	93.8% (92%-94%)
Follow up		4.6	12.2	92.0%
Beth				
Baseline				
	Mean (range)	6.5 (5.6-7.8)	8.4 (6.4-10.0)	79.5% (72%-85%)
Training (BST)				
	Mean (range)	5.3 (3.7-9.4)	7.8 (5.3-11.6)	90.0% (82%-96%)
Follow up		2.6	6.4	81.0%

Table 2

Average rate (and range) of correct responses per minute and average percentage (and range) of maladaptive behaviors for the client participants across conditions

Participants		Correct Responses per minute		Percentage of Intervals Engaged in Maladaptive Behaviors
		Label	Total	
Rico				
Baseline				
	Mean (range)	3.5 (2.8-4.6)	6.3 (5.6-6.8)	38.7% (19%-57%)
Training (BST)				
	Mean (range)	5.4 (5.0-6.2)	7.1 (6.3-8.2)	27.0% (7%-37%)
Follow up		5.5	8.1	17.0%
James				
Baseline				
	Mean (range)	5.0 (3.0-6.7)	10.2 (9.3-10.8)	38.3% (7%-53%)
Training				
	Mean (range)	6.9 (4.7-9.3)	9.4 (6.5-12.0)	24.2% (7%-30%)
Follow up		4.3	11.3	17.0%
David				
Baseline				
	Mean (range)	5.4 (3.6-7.8)	7.0 (4.2-9.7)	7.5% (0%-10%)
Training (BST)				
	Mean (range)	4.3 (2.6-9.1)	6.2 (4.2-10.9)	14.0% (3%-30%)
Follow up		1.4	4.0	33.0%

Table 3

Percentage of total errors observed in components of DTT in the baseline and training plus follow up conditions

DTT Component	Mike		Diana		Beth	
	Baseline	Training	Baseline	Training	Baseline	Training
Positioning materials	0%	5%	0%	6%	4%	0%
Child orienting for minimum of 1 s prior to delivering the Sd	64%	63%	56%	44%	29%	59%
Clear, concise instruction	-	-	-	-	7%	3%
Instruction delivered as per program	-	-	-	-	0%	3%
Appropriate prompting	0%	5%	5%	0%	14%	3%
Error correction implemented as per program	-	-	12%	0%	18%	9%
Behavior specific praise paired with delivery of tangible reinforcement	18%	0%	-	-	7%	6%
Prompt data collection	18%	26%	20%	44%	14%	9%
Intertrial Interval	-	-	5%	6%	7%	6%

Note. Those components that are not listed did not result in errors during any of the randomly selected trials.

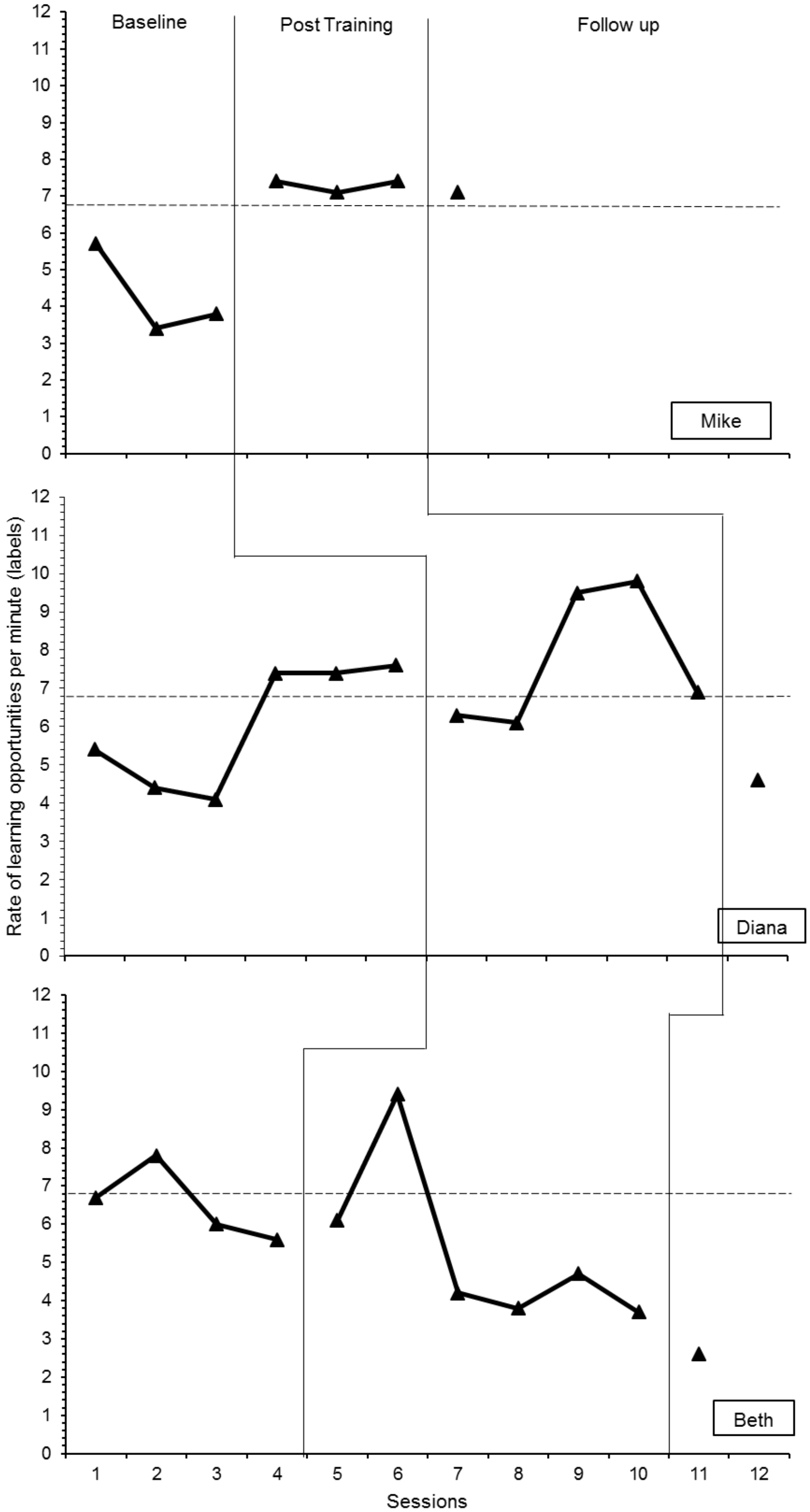


Figure 1. Rate of learning opportunities (labels) presented per minutes by instructor participants.

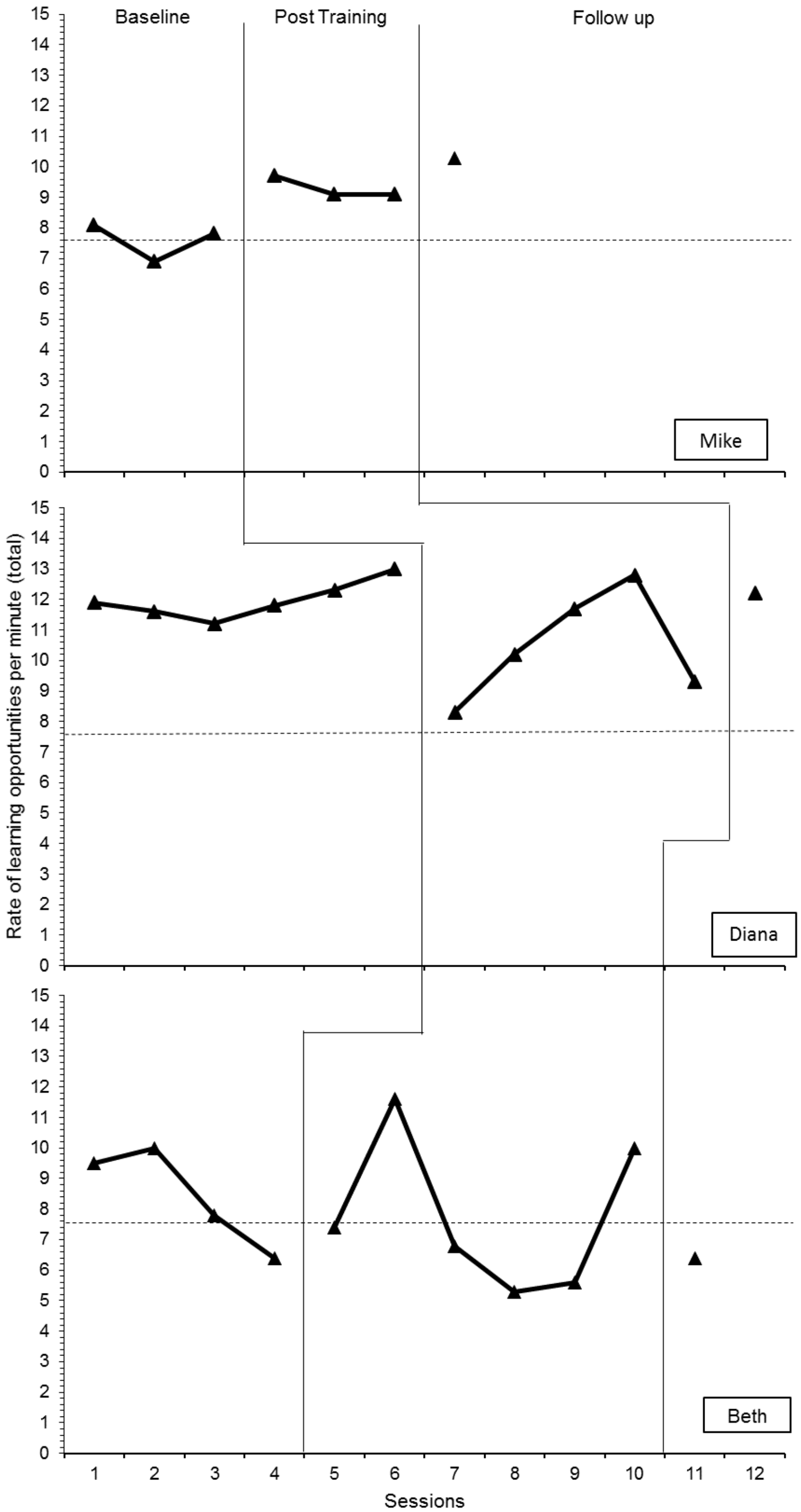


Figure 2. Rate of learning opportunities (total) presented per minute by instructor participants.

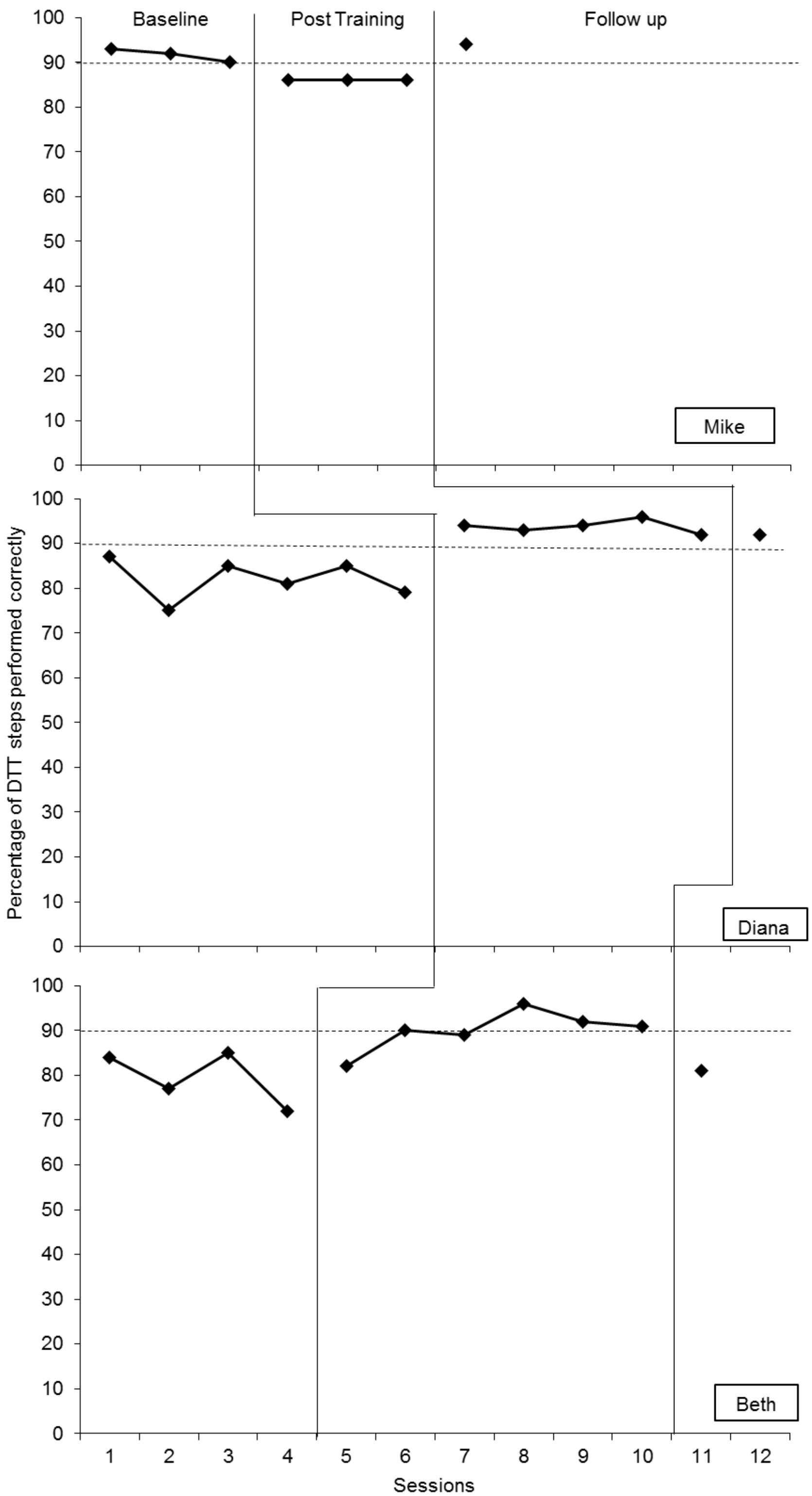


Figure 3. Mean percentage of DTT components that the instructor participant completed correctly during sampled trials.

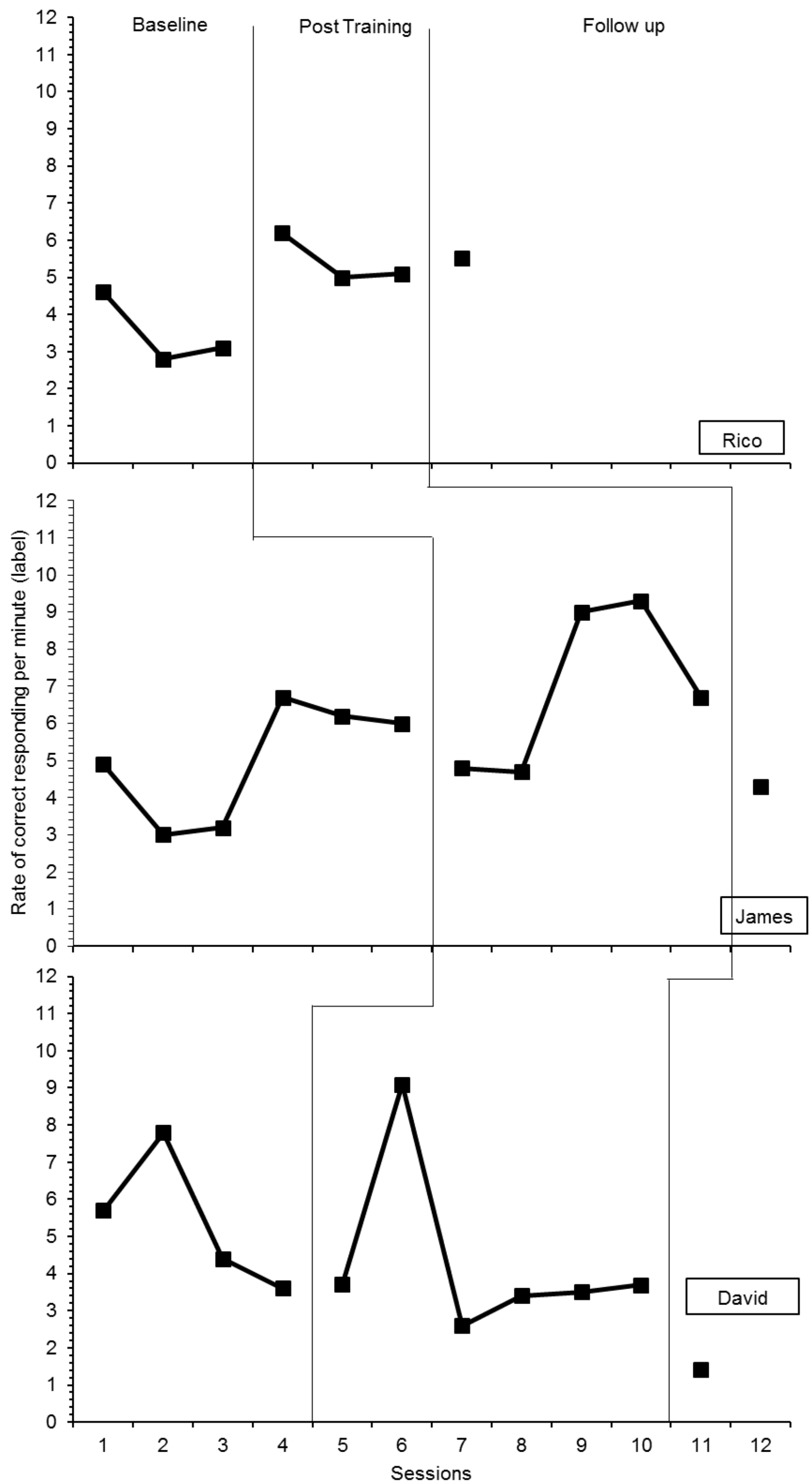


Figure 4. Rate of correct responding (labels) per minute by client participants.

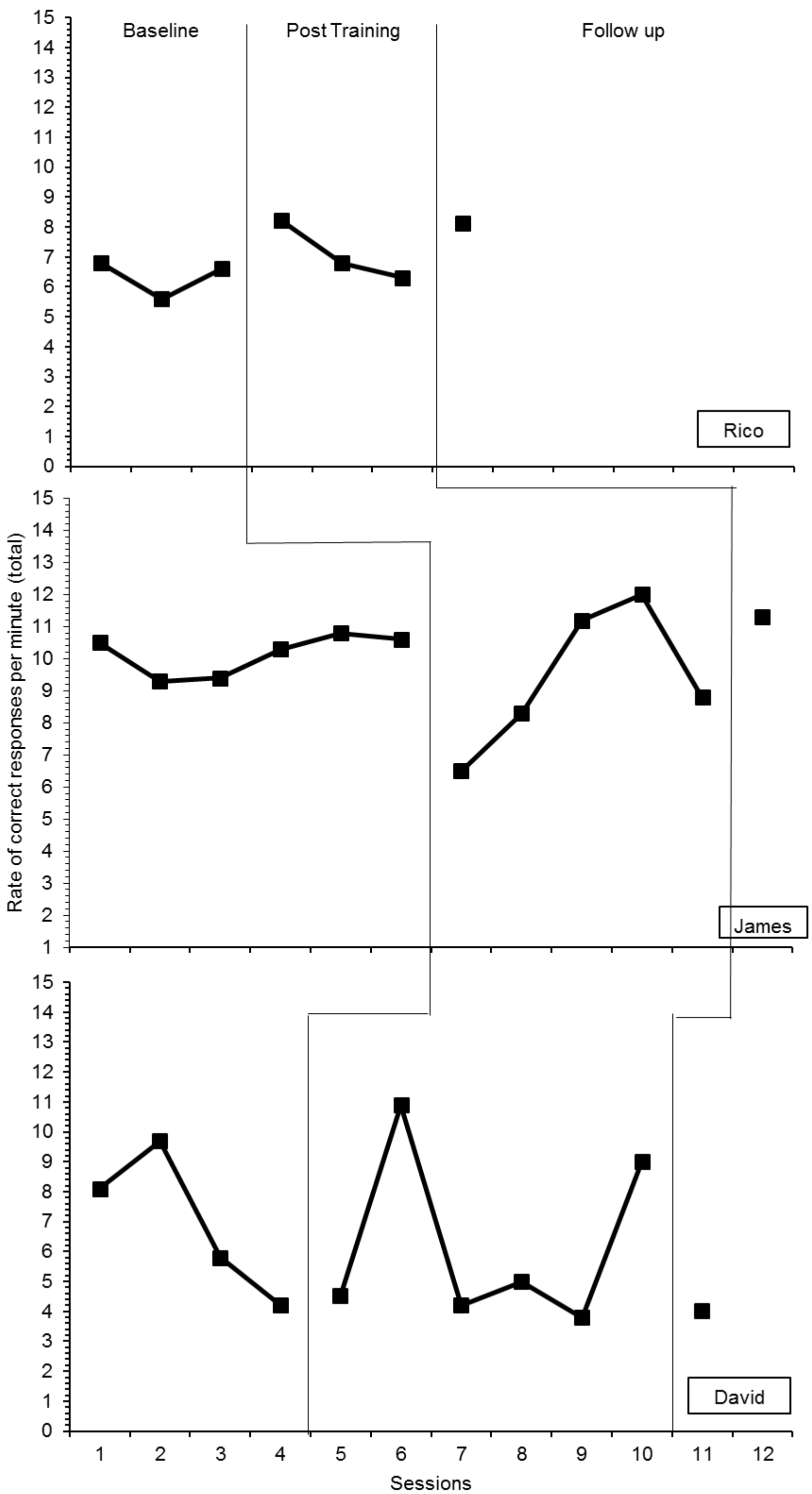


Figure 5. Rate of correct responding (total) per minute by instructor participants.

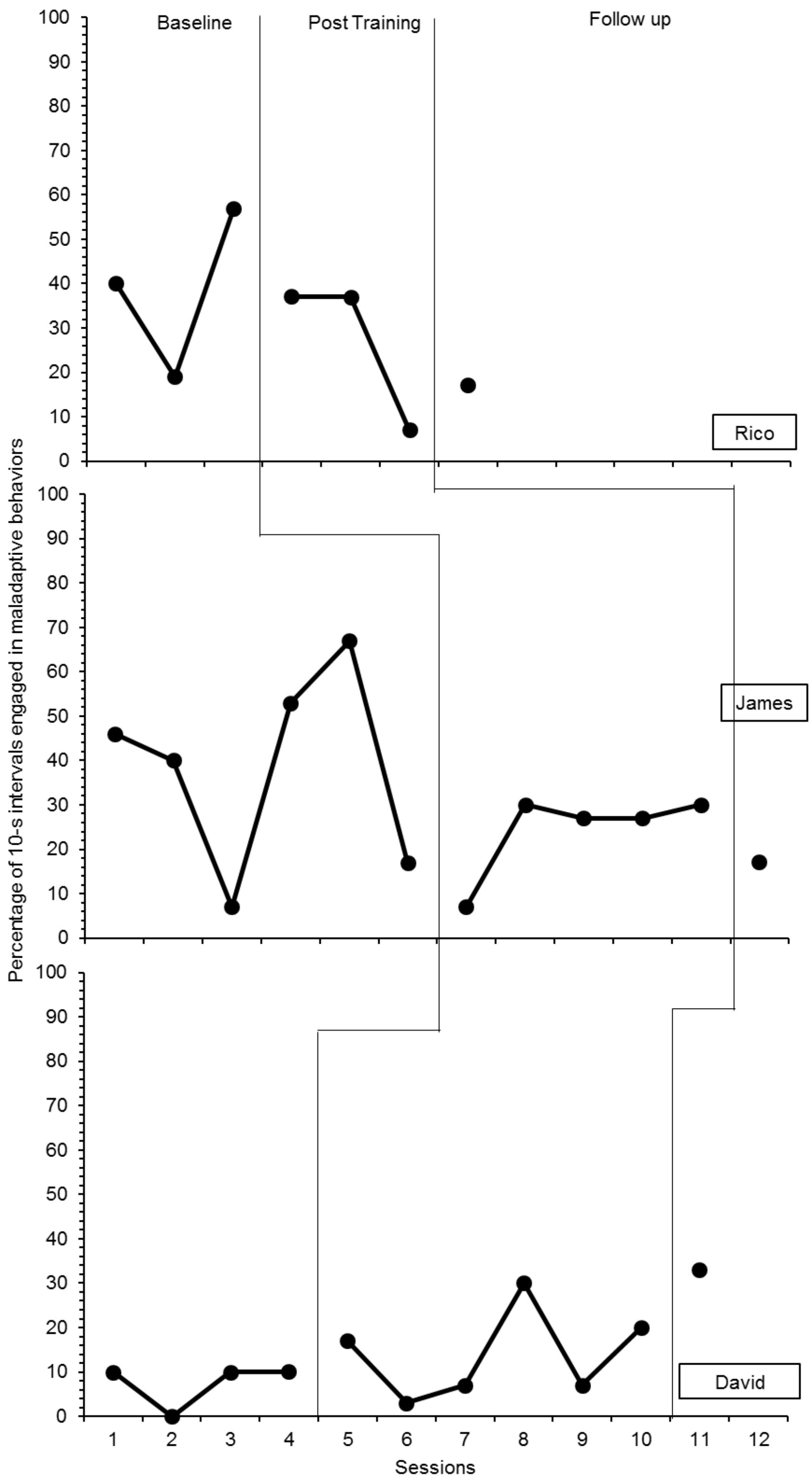


Figure 6. Percentage of 10-s intervals that client participants engaged in maladaptive behaviors.

Appendix B

Self-instruction Manual: Implementing a Well-Paced Discrete Trial Teaching Session
Jessica Connolly

Objective of this manual:
The objective of this manual is to provide the reader with a rationale for implementing discrete trial teaching (DTT) at a brisk instructional pace. It is also to provide the reader with guidance on how to implement the components of DTT in a manner that will optimize the rate of learning opportunities that they present to a client during a teaching session.

Background Information:
DTT is often a large component of teaching in Intensive Behavioural Intervention (IBI) programs, particularly for early learners. The brief nature of discrete trials can allow for a high rate of learning opportunities to be presented during a short period of time. A well-paced DTT session is a way to maximize the number of learning opportunities presented to a learner. This is important as learning, for a child with autism, often requires many trials in order to acquire new skills or reach mastery criteria. In addition, some research (Dunlap, Dyer, & Koegel, 1983; Koegel, Dunlap, & Dyer, 1980; LaMela & Tincani, 2012; Tincani & Crozier, 2008; Roxburgh & Carbone, 2012) has shown that by increasing instructional pacing, participants engaged in increased rates of correct responding and/or less off-task behavior (e.g., stereotypy, escape-motivated behaviors).

Variables that Affect Instructional Pacing
An Instructor Therapist's ability to deliver a high rate of learning opportunities (i.e., brisk instructional pacing) during blocks of DTT relies on:

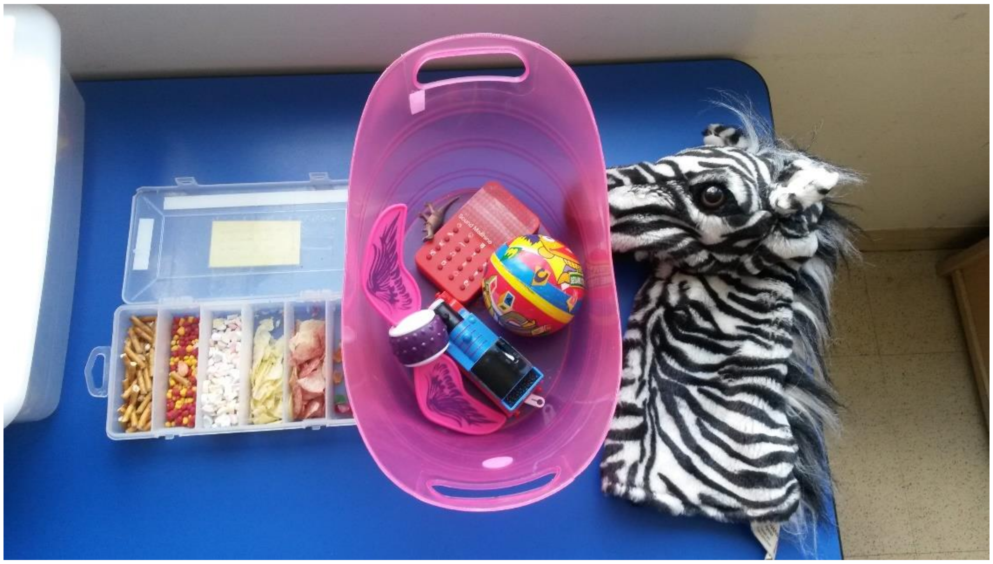
<u>Organization (Pre-teaching)</u>
Reviewing target programs: an Instructor Therapist (IT) should be familiar with the current teaching targets, maintenance targets, and high probability responses for each client that they work with regularly. This requires an IT to regularly review programs, data sheets (including prompt levels) and graphs prior to running programming. An Instructor Therapist should be aware of the appropriate S^d (or instruction) for a target, the current prompt level, prompt hierarchy, error correction procedure, and the mastered targets to intermix within a teaching session. Five to

Photo of staff reviewing programming

ten minutes should be spent during clinical prep time reviewing these materials and clarifying any questions with the primary IT or Supervising Therapist prior to a scheduled session.

Materials being prepared and ready: prior to running a block of DTT, an IT should prepare program materials and data sheets for a variety of tasks, and organize any materials required for mastered targets that will be intermixed with these trials. The programming materials should be set up in close proximity to the IT. The corresponding data sheets should be placed on the top of the clipboard or separately on the table. Spending time retrieving and sorting through the materials or data sheets during a block of DTT will slow down the pace of teaching, which may result in the client engaging in off-task behaviors.

Variety of reinforcers prepared: prior to running a DTT session an IT should identify what stimuli are highly preferred. A variety of types of reinforcers (e.g., edibles, tangibles, sensory, social) should be available at the teaching area during a DTT session in order to deliver reinforcement promptly and vary reinforcement in order to avoid satiation. These reinforcers will likely change from day-to-day, and may even change frequently throughout a session.



Prepare Environment: an IT should scan the environment and remove any distractors prior to starting a DTT session. This may include removing items from the table or surrounding area, placing highly preferred items out of sight (if necessary), and re-arranging furniture or seating arrangements to reduce or eliminate distractors.

<u>During Teaching (i.e., while implementing DTT session)</u>

Minimized response latency (wait time): response latency refers to the amount of time between the delivery of the instruction and the response of the learner. In order to minimize response latency, an IT should deliver any prompts without hesitation, consistently implement the error correction procedure when a response does not occur within 5 seconds, and differentially reinforce quick correct responding (i.e., reduced response latency).

Minimized feedback delay: feedback delay refers to the duration between the response of the learner and the delivery of reinforcement or implementation of the error correction procedure. An IT should ensure that this delay is a maximum of 3 seconds in order to maximize the chances that it will reinforce the target behavior, and minimize chances that another intervening response (e.g., maladaptive behavior) will be inadvertently reinforced.

Brief intertrial intervals (ITI): ITI refers to the duration between the consequence of one trial and the delivery of the instruction (S^d) for the subsequent trial. An IT should arrange teaching so that this interval is a maximum of 5 seconds in order to maintain the momentum of the DTT session and minimize the opportunities for the child to engage in off-task behaviors.

Discrete Trial Teaching:
DTT consists of teaching skills by running blocks of discrete trials typically over a 3-5 minute interval. It is crucial that an IT maintain a high level of accuracy implementing the components of a discrete trial as the instructional pace is increased.

The target behaviors listed below are components of a discrete trial that an IT should implement (where appropriate), in order to accurately run a well-paced DTT session.

Target Behaviors	**Description of behavior**
1. Programming materials are positioned appropriately (where applicable)	-materials are centred in front of child -no other materials (distractors) are in the instructional area -if presented in an array (e.g., receptive id.): • materials are evenly spaced • materials are equidistant from child
2. Child is orienting towards a task or instructor	-child will make eye contact or scan materials for at least one second immediately prior to the delivery of vocal instruction -IT refrains from using inappropriate means of gaining the child's attention (e.g., snapping fingers, tapping table, saying child's name repeatedly or prior to each trial)
3. Deliver a single clear, concise instruction	-instruction does not contain any unnecessary words or descriptors -**examples:** "Find dog," "What's this?" -**non-examples:** "Where's the little doggy?," "Can you tell me what is in this picture?"
4. Instruction is delivered as per program	-the instruction is either varied or is delivered consistently across teaching trials, as outlined in the individual's program -the instruction given by the IT is intended to evoke a response from the child which conforms with the targets as outlined in the individual's programs **-example:** "give me the one that says 'woof'"-child picks up a picture of dog and hands it to the IT **-non-example:** "Which one says 'woof'?"-child says dog, although an array of 3 pictures has been presented for a receptive identification task
5. Appropriate prompting is implemented for task	-during initial teaching trials or trials following an error correction, errorless prompting is used -prompt is delivered without hesitation (i.e., 0-s delay) after instruction delivered -prompt fading is attempted -appropriate prompt topography was used. A physical prompt used for a selection response, while a verbal response used for a verbal response -avoids giving unintentional prompts (e.g., eye gaze, touching cards prior to instruction, mouthing response)

6. Delivers reinforcement contingent on a completed correct response	-IT delivers reinforcement AFTER the target response is complete. For example, the child says the full label for target item -the target response occurs within 5 seconds of the instruction
7. Promptly delivers appropriate reinforcement	-IT delivers reinforcement within 3 seconds of the child's correct response -IT delivers reinforcement according to outlined reinforcement schedule
8. Delivers behavior specific praise appropriately	-behavior specific praise is delivered just before or at the same time as tangible reinforcement, where appropriate -praise describes target response (i.e., "good touching dog")
9. Error correction procedure followed as written, if necessary	-IT will implement an error correction procedure if an child's response is incorrect. An error correction procedure will also be implemented if a child engages in no response within 5 seconds of the instruction.
10. Data recorded, where appropriate	-data is recorded for those targets that are in acquisition or during outlined maintenance probes -data recorded immediately after trial (i.e., within 5 seconds)
11. Intertrial interval was 5 seconds or less	-IT delivered subsequent instruction, where appropriate, less than 5 seconds after the: -consumption of a reinforcer -or removal of reinforcer (tangible) -or completion of the error correction procedure