Discrete Trial Teaching and Social Skill Training: Don't Throw the Baby Out with the Bathwater

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Discrete trial teaching (DTT) is a method of instruction that enables highly individualized instruction and the rapid presentation of targets in discrete units. Repetition is a fundamental aspect of DTT, and its formal structure lends itself to the presentation of many learning opportunities in a short period of time. Many learners with autism specturm disorder (ASD) may require repetition, and do not obtain knowledge without multiple learning trials (Smith, 2001). For this reason, DTT has been a foundational instructional technique for teaching students with autism, and has been lauded as an efficient means of imparting knowledge, especially when learner motivation is low (Smith, 2001). However, many people believe that DTT is most relevant to instruction in building compliance, imitation, and appropriate toy play (Lovaas, 1987), and consider going outside of applied behavior analysis (ABA) to address social skill deficits through methods such as cognitive-behavioral therapy (Lopata, Thomeer, Volker, & Nida, 2006), Social Stories™ (Adams, Gouvousis, VanLue, & Waldron, 2004), Relationship Development Intervention® (RDI; Gutstein, Burgess, & Montfort, 2007), Social Thinking® (Leaf et al., 2016), and other types of interventions.

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It is understandable that people might not glean the relevance of DTT for social skill instruction. After all, the ultimate outcomes for social skills instruction are very divergent from the instructional context. Goals often include the spontaneous demonstration of skills in novel, untrained contexts with the hope that the learner will adapt to each context and adjust his or her response accordingly. These are lofty goals for instructors, who may be attracted to interventions that seem more aligned with these outcomes. Behavior analysts may be tempted to explore practices that are not empirically validated to be effective, which dilutes the effectiveness of intervention and erodes the public's perception of the impact potential of ABA.

However, a variety of different skills can be successfully and efficiently taught through the use of DTT, including social skills. Behavior analytic research has investigated teaching of a number of different social skills through the use of DTT. Previously published literature includes teaching affective behavior (DeQuinzio, Townsend, Sturmey, & Poulson, 2007; Gena, Couloura, & Kymissis, 2005), increasing social interactions and initiations (Garcia-Albea, Reeve, Reeve, & Brothers, 2014; Garfinkle & Schwartz, 2002; Groskreutz, Peters, Groskreutz, & Higbee, 2015), teaching children to offer help to others (Harris, Handleman, & Alessandri, 1990; Reeve, Reeve, Townsend, & Poulson, 2007), sharing (Marzullo-Kerth, Reeve, Reeve, & Townsend,

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2011), teaching empathy skills (Schrandt, Townsend, & Poulson, 2009), teaching perspective taking skills (LeBlanc et al., 2003), and increasing joint attention (Jones, Carr, & Feeley, 2006; Kasari, Freeman, & Paparella, 2006; Krstovska-Guerrero & Jones, 2013). While all of these different skills have been taught using DTT, various procedures within discrete trial methodology were utilized, and at times DTT was applied in slightly nuanced and unique ways.

The literature demonstrates the use of a variety of instructional techniques under discrete trial methodology including: modeling (Schrandt et al., 2009), prompting (Pollard, Betz, & Higbee, 2012), error correction (Francisco & Hanley, 2012; Gena et al., 2005; Nientimp & Cole, 1993), multiple exemplar training (Marzullo-Kerth et al., 2011), progressive intertrial intervals (Francisco & Hanley, 2012), priming sessions (Nientimp & Cole, 1993; Zanolli, Daggett, & Adams, 1996), video modeling (Gena et al., 2005; LeBlanc et al., 2003; Marzullo-Kerth et al., 2011), observational learning (DeQuinzio et al., 2007; Garfinkle & Schwartz, 2002; MacDonald & Ahearn, 2015), behavioral skills training (Peters & Thompson, 2015), script fading (Garcia-Albea et al., 2014; Groskreutz et al., 2015; Ledbetter-Cho et al., 2015), and computer-based instruction (Simpson, Langone, & Ayres, 2004). Each of these instructional techniques is individually supported in the behavior analytic research showing positive results in the instruction of a number of different target skills, making these techniques valued components of DTT. Because of the support the literature provides for the success of these methods to teach varying social skills, the use of DTT should be considered when attempting to teach different social targets.

DTT has been applied to social skill deficits for several decades, with a long history of impressive outcomes (Smith, 2001). When social skills are taught exclusively in the natural environment, there may not be enough opportunities for the individual to practice the skill to mastery. Conversely, DTT of social skills allows for additional practice of skills, which can then be trained to generalize into the appropriate settings. For this reason, DTT was applied to these targets, just as it was applied to many learning, academic, and other skills (Smith, 2001). Social responding and social initiations were the initial targets of social skills interventions. Within DTT there are a number of different prompting hierarchies that can be used to facilitate correct responding. This facilitation of correct responding, coupled with the multiple opportunities for responding provided in DTT, can potentially be beneficial for the learning of social skills. Much of the social skills research focuses on the use of different types of prompts to teach skills. However, these prompting strategies are often applied within a DTT format. Hence, these studies are reviewed, as they do illustrate the use of DTT, though the emphasis may be on the strategic application of prompts.

10.1 Using Prompting and Modeling Within DTT

Prompting and modeling are essential components of DTT because they allow for errorless learning, which is considered to be important for learners on the autism spectrum (Delprato, 2001). There are many different types of prompts and prompt hierarchies that may be successful in the teaching of social skills. In particular, the use of progressive prompt delays may be beneficial in teaching skills that require verbal modeling (Delprato, 2001). Delaying the provision of the prompt may help reduce dependence on prompting and may facilitate independent responding. In an early demonstration of the use of DTT to address social responding, Nientimp and Cole (1993) used a constant time delay within DTT to teach three participants to vocally respond to social greetings. Schrandt et al. (2009) also used a combination of prompt delays, modeling, manual prompts, behavioral rehearsals, and reinforcement in a discrete trial format to teach empathy responses. Time delay prompts have also been shown to be beneficial in teaching intraverbal responses. For example, Ingvarsson and Hollobaugh (2010) demonstrated the acquisition of intraverbal responses using a discrete trial format and a progressive prompt delay. A

different approach to prompting was utilized by Jones et al. (2006). If responding to the discriminative stimulus during joint attention training did not occur, a gaze alternation or tracing a visual path to the toy with an edible reinforcer was utilized. Both prompting procedures were then faded using a most-to-least prompting procedure paired with a time delay.

In addition to the effectiveness of the progressive prompt delay, experimenters have shown success with different sized blocks of trials when using the discrete trial format to teach social skills (Jones et al., 2006; Nientimp & Cole, 1993; Schrandt et al., 2009). Nientimp and Cole (1993) presented instruction in blocks of 10 trials across five different targeted greetings (e.g., "Hi" and "hello") with generalization probes conducted by typically developing peers following baseline (i.e., no prompting) conditions. Jones et al. (2006) also used 10 trials per session to teach joint attention skills. In contrast, Schrandt et al. (2009) presented training sessions in much larger blocks consisting of 30 trials, seven of which were training, and three of which were nontraining probe trials per response category. Each trial consisted of a discriminative stimulus (i.e., vignette using a doll or puppet), a response from the participant, and a prompt delay sequence to prevent errors from occurring. Starting at a 0-s delay, the prompts were faded to a 1-s delay and then to a 3-s delay. During these training trials reinforcement in the form of token delivery and behavior specific praise were delivered for correct unprompted responses.

Other experimenters have exposed participants to multiple shorter blocks of trials in a given day. In one study, Jones, Feeley, and Takacs (2007) exposed participants to up to six 10-trial sessions per day in which opportunities were contrived for the participants to engage in spontaneous language. Opportunities for each target response were initially presented in isolation and, following mastery, these responses were then interspersed with previously mastered targets. Other experimenters have interspersed training trials with probe trials, such as in Gena et al. (2005) who conducted a series of 14 trials, four of which were probe trials and 10 were training trials. The number of trials used in DTT is an important consideration—the instructor must strike a balance between providing adequate opportunities for practice of the skill and the tolerance threshold of the learner. Perhaps even more importantly, the behavior analyst must ensure that generalization is demonstrated, and that skills transfer to natural environments and contexts.

Behavior analysts must consider not only the amount of trials used in training sessions, but also the type of prompting hierarchy that should be employed. In using a constant time delay prompting procedure, Nientimp and Cole (1993) found that all participants showed increases in accurate responding to social greetings, two reaching 100% accuracy across trials while the third increased to 50% accuracy across trials. The acquisition of manding for information has also been demonstrated through the use of DTT and prompt delay procedures. Ingvarsson and Hollobaugh (2010) taught participants the response "I don't know, please tell me," when presented with a question for which they did not know the answer. All participants acquired the intended response, and the authors concluded that the fast-paced format of DTT may have led to the quick acquisition demonstrated by this procedure.

Other experimenters have targeted empathetic responses such as happiness or excitement, sadness or pain, and frustration. Schrandt et al. (2009) demonstrated increases in empathetic responding as treatment was introduced across response categories when using dolls and puppets to present different scenarios. Most importantly, generalization was demonstrated across training to nontraining probes and from dolls to actual people. Individuals may be required to engage in a number of different empathetic or sympathetic social responses dependent upon the situation in which they find themselves. Jones et al. (2007) demonstrated that children were able to learn a variety of different spontaneous responses including "Bless you", "What?", and "Are you ok?". The participants were able to demonstrate generalized responding in the form of responding to staff members who were not a

part of the initial study in a novel setting (Jones et al., 2007).

Despite the success of DTT in training generalized responding in some studies, others have found the intended response to be acquired by all participants in the experimental setting, but found mixed results across participants during generalization probes (e.g., Ingvarsson & Hollobaugh, 2010). When teaching social skills, it is essential for the instructional methods to encourage and achieve quick acquisition of target skills and the generalization of those skills across settings, people, and time. In the absence of these outcomes, the skill is not likely to be demonstrated within the natural environment.

In addition to the social skills mentioned up to this point, DTT can also be used to teach individuals with autism to engage in spontaneous responses, which is an essential component of reciprocal responding in social situations. Tactile prompts have also been explored for their utility in helping the development of social responses, especially within the response class of social initiations. Shabani et al. (2002) were able to teach three phrases, "Look at this," "I have [object label]," and "Do you want to play?" The tactile prompt was placed in the participant's pocket, and, during training, the adult would activate the tactile prompt and immediately provide a verbal prompt of the initiation statement. If the participant successfully imitated the verbal model, an edible was provided. Across sessions, the verbal model was gradually faded using a progressive most-to-least prompting hierarchy until the participant independently initiated a social interaction following the tactile prompt. Although the tactile prompt was successful in increasing verbal initiations across all three participants, the experimenters were unable to successfully fade the prompt.

Using a multiple probe design across behaviors, Krstovska-Guerrero and Jones (2013) implemented intervention sessions in a discrete trial format with 10 opportunities to respond per session with 1–3 sessions per day. A prompting procedure with a most-to-least hierarchy combined with a time delay was used across trials. Three skills were targeted and each built off the previous (1) smile, (2) look and smile, and (3) gaze shift and smile. Generalization was evaluated with each participant's mother, a novel interventionist, and novel materials. All targeted responses increased with all participants and maintenance and generalization was effectively demonstrated. Whalen and Schreibman (2003) used a behavior modification technique with components of DTT and pivotal response training to target joint attention responding and joint attention initiations. This hybrid intervention consisted of using clear prompts, interspersing mastered tasks with unlearned tasks, allowing the child to choose the activity, taking turns with the child, contingent reinforcement of correct responses, and direct response-reinforcer relationships. This intervention proved to be effective for increasing joint attention for all five participants. In addition, social validation measures completed by naïve observers supported positive changes in each participant.

10.2 Error Correction and DTT

One of the reasons that DTT is so successful is because of the multiple opportunities for practice and reinforcement. Since individuals will be performing a skill many times in DTT, it is essential that they perform that skill correctly, rather than having multiple opportunities to practice the skill incorrectly. This is usually approached through using errorless learning. In other situations, when errorless learning is not used or is used only initially, it is vital that an error correction system be put in place. There are many different types of error correction used in DTT, but nearly all protocols involving DTT include some sort of error correction component.

Some error correction procedures simply involve providing an additional trial of the targeted skill in order to give an opportunity for extra practice following an error (e.g., Francisco & Hanley, 2012). Other error correction procedures involve the use of a model prompt for the targeted response. For example, Gena et al.

(2005) utilized a model prompt to teach children to model the facial expressions of others. When a child emitted an erroneous response, the therapist would state "Look (emotion) like me," and provide a model prompt of the targeted response. In another study various facial expressions were taught to learners with ASD (i.e., DeQuinzio et al., 2007), participants were provided with a verbal prompt, "Do this," and a model prompt. Reinforcement was withheld when an error occurred. If still unsuccessful, the verbal prompt, "Do this," was provided, the model prompt was provided, and two facial motor movements were repeatedly provided (i.e., the model would open and close her eyes). Finally, a manual prompt in which the model physically prompted the action was utilized. During error correction procedures, if the motor imitation sequence was unsuccessful, a manual prompt was used to ensure a successful response.

In some cases, if an error or an echolalic response occurs, an error correction procedure consisting of "No, you should say (correct response)" has been implemented (e.g., Nientimp & Cole, 1993). In addition to traditional error correction procedures, some studies in the area of social skills have used video modeling as an error correction procedure. For instance, LeBlanc et al. (2003) intended to teach perspective taking; correct answers were reinforced, while incorrect responses resulted in replaying a video model and additional prompting. The participants were shown a video, the video was paused, and perspective taking questions were asked. Correct answers were reinforced, while incorrect responses resulted in replaying the video and a prompt to pay attention until the correct answer was achieved.

As mentioned above, error correction is an important component of DTT. There are a number of different error correction procedures that may be selected and can be successful, but it is essential for behavior analysts to be aware of the benefits of errorless learning for learners on the autism spectrum. This can be particularly important in the social domain where children with autism may be stigmatized for social interactions that do not meet social norms.

10.3 Multiple Exemplar Training and DTT

One of the concerns with DTT is that it will promote rote responding that only occurs in the specific instructional setting associated with DTT which can be intensified by teaching with limited materials or in restricted contexts (Miranda-Linne & Melin, 1992). When teaching social skills, it is particularly important that the skills the individual learned generalize to the natural environment so that s/he can engage socially with others. One way to promote generalized responding is the use of multiple exemplar training. When multiple exemplars are used to teach social skills, individuals will not respond to the specific stimulus presented in DTT; but, rather, to a class of stimuli intended to occasion a particular response (Miranda-Linne & Melin, 1992). Thus, it is particularly important to ensure that multiple exemplars are used when teaching social skills to individuals with ASD.

Marzullo-Kerth et al. (2011) used multiple exemplar training to teach children with autism to share. Participants in this study were taught to share across multiple classes of materials (e.g., art, snack, toys) and generalization of skills was assessed. The procedure in the study followed a DTT approach by using a cue, prompting (if required), a response, a consequence, and an intertrial interval. An error correction procedure was used in which the materials were removed, a video model was presented, and then if the appropriate response was still not emitted a physical prompt was used to complete the response. Following intervention, all four participants learned to share and generalized sharing across novel stimuli, novel adults, novel settings, and novel peers. Multiple exemplars were also used by Charlop-Christy and Daneshvar (2003) to teach a perspective taking task using video modeling. This procedure involved using variations of the "Sally-Ann Task," in which participants view a scenario and are asked questions regarding the perspective of the different characters in the scenario. The multiple exemplars used in this study included different characters taking part in different scenarios with similar perspective

taking questions being asked to participants. Finally, multiple peers have been utilized within multiple exemplar training to encourage stimulus generalization when training social skills to learners with autism (Gaylord-Ross, Haring, Breen, & Pitts-Conway, 1984). When using DTT, it is important to program for generalization to avoid rote responding. One of the ways in which this can be completed is through multiple exemplar training (Miranda-Linne & Melin, 1992). This should be an important consideration for behavior analysts who are attempting to train social skills that will easily generalize into the natural environment. Preparing learners for the myriad responses they are likely to encounter in the natural environment is more easily accomplished with the use of multiple exemplars.

10.4 Progressive Intertrial Intervals in DTT

One important component of DTT is the intertrial interval (ITI). Research has shown that short ITIs lead to favorable acquisition of target skills. Francisco and Hanley (2012) compared the effects of the lengths of different ITIs on the acquisition of social skills with two preschool aged children. Using a concurrent multiple baseline design, the use of distributed and progressive ITIs was assessed. In the distributed ITI condition, participants were provided with five trials during the morning session of preschool and five trials during the afternoon session of preschool for each targeted social skill. These trials took place roughly every 30 min during each session. The conditions were identical for the progressive ITIs, with the exception of progressively increasing ITIs following the initial response opportunity. Thus, following the first trial, opportunities were presented 3 s, 10 s, 30 s, 2 min, 4 min, and 16 min after one another. The results of this study indicated no improvement following the distributed ITI condition, but immediate improvement following the implementation of the progressive ITI condition. These results indicate that initially short ITIs can be useful when teaching social skills in a trial-based format.

10.5 Using Priming Sessions Within DTT

Priming is a well-known procedure in which a stimulus is presented prior to the start of sessions to increase the establishing operation and/or the reinforcing effects of the stimulus (Roantree & Kennedy, 2006). Zanolli et al. (1996) used DTT in priming sessions to compare rates of spontaneous initiations of children with autism to their typically developing peers. Priming sessions were conducted prior to the activity with the same materials, in a low demand situation with easy to complete activities and reinforcement delivered on a rich schedule. Target responses included, "Give me that," "Look at me," "Show me yours," "Smile," "Touch," and "Look," in a random order. Two of the participants were exposed to 14 trials per session, while the third participant was exposed to 10 trials per session. Priming sessions had successful outcomes in the subsequent treatment sessions. Moreover, the priming sessions successfully increased spontaneous initiations, produced salient initiations, increased successful responding to initiations, and increased rate of initiation above average rates of typically developing peer's initiations. As previously discussed, Nientimp and Cole (1993) used a constant time delay within DTT to teach three participants to verbally respond to social greetings. To start each training session, participants were provided with two warm up trials for each of the five target greetings (i.e., hi, what's up, hello, yo, and hey). During this priming procedure, the teacher presented the greetings and then immediately prompted the correct response. The results showed that independent accurate social interactions increased while at the same time echolalic responding decreased. This research supports the use of priming as a tool that can be used to promote the success of DTT for social skills targets (Nientimp & Cole, 1993; Zanolli et al., 1996).

Kasari et al. (2006) implemented a slightly different approach to priming. The teaching procedure included 5 to 8 min of DTT to prime the goal of treatment. The least-to-most prompting hierarchy consisted of a verbal, model, then a

physical prompt. This prompting hierarchy was used to achieve a social interaction or a communicative attempt which was then maintained through positive reinforcement. This same skill was then taught in a semistructured session away from the table in a more natural setting. This occurred on the floor, with a child driven, rather than a teacher-directed approach. Imitation of the child's behavior with toys, and incorporating child's activity interests into play routines were two different strategies commonly used on the floor. The target skill was taught using systematic prompting and reinforcement. Results indicated that both the formal and less structured interventions were effective in increasing joint attention among participants.

10.6 Using Video Modeling Within DTT

Video modeling is a powerful tool that can be used to teach individuals with ASD to engage in a variety of different social skills, such as utilizing appropriate affect (Gena et al., 2005), sharing (Marzullo-Kerth et al., 2011), helping (Reeve et al., 2007), and perspective taking (LeBlanc et al., 2003). There are many potential benefits to the use of video modeling to teach social skills, including the heightened interest that the learner may have in the use of technology. Additionally, when filming video models, behavior analysts are able to focus explicitly on the target of instruction, making it more salient for the learner. There are a number of different types of presentations used in video modeling including showing peers, adults, or even the participant engaging in the target skill. This is generally referred to as first person point-of-view or third person point-of-view. In addition, some video models include voice overs that explain the scenario, while other video models simply include the dialogue relevant to the social skill being taught. Overall, video modeling serves as an effective tool for teaching social skills to individuals on the autism spectrum (Bellini & Akullian, 2007).

One effective strategy for the use of video modeling is the use of a trial-based format which, as previously mentioned, allows for fast-paced instruction and multiple opportunities for responding and reinforcement. Gena et al. (2005) utilized video modeling, in vivo modeling, reinforcement, and error correction procedures to increase the affective behaviors of sympathy, appreciation, and disapproval. All participants demonstrated contextually appropriate affective responding following both the in vivo and video modeling treatments. Additionally, this skill generalized to novel scenarios, and novel therapists. These results maintained at follow up sessions, 1 month and 3 months following the conclusion of treatment. Reeve et al. (2007) used a multiple baseline design across participants to teach a generalized helping repertoire across tasks. In addition, a multicomponent treatment package consisting of a discriminative stimulus, training, consequences, and generalization was implemented across participants. Helping behavior in this study was defined as cleaning, replacing broken materials, picking up objects, sorting materials, locating objects, carrying objects, putting items away, and setting up an activity. In the presence of the discriminative stimuli used in training, all four participants engaged in appropriate helping responses. Novel stimuli were used to assess generalization of helping responses in probe conditions. Generalization trials showed an increase of the target helping response across novel stimuli, novel settings, and novel therapists.

In addition to the absence of the social awareness required to help others when they need it, a lack of empathy displayed by children with autism has been well documented in the literature. Video modeling has also been used in conjunction with reinforcement to teach children with autism the skill of perspective taking, which is a component of empathy. LeBlanc et al. (2003) taught perspective taking to three children with autism using video modeling and reinforcement. The authors evaluated these procedures through the use of a multiple baseline design. The participants were shown a video, the video was paused, and perspective taking questions (about how others might perceive situations or feel about them) were asked. The training sessions were

completed after three consecutive correct trials. All of the participants failed the primary tasks during baseline, and then went on to master the tasks following intervention. Generalization was also demonstrated across novel vocal or motor responses, which all participants also demonstrated. Another important social skill that is sometimes required to be directly taught to individuals with autism, is sharing. Marzullo-Kerth et al. (2011) used multiple exemplar training to teach children with autism to share. Participants in this study were taught to share across multiple classes of materials (e.g., art, snack, toys) and generalization of skills was assessed.

The effects of video modeling have been found to generalize from training conditions to the natural environment for a variety of skills. LeBlanc et al. (2003) found video modeling to be an effective procedure to increase perspective taking skills and generalization was demonstrated with two out of the three participants by successfully answering questions regarding an untrained exemplar. Marzullo-Kerth et al. (2011) were also able to demonstrate generalization with sharing by conducting probes for sharing in novel settings, with novel people, and with novel stimuli. The effects of the treatment package were evaluated using a multiple baseline design, which demonstrated that the treatment package was effective in increasing sharing behavior across all three participants with evidence of skill maintenance and generalization. Gena et al. (2005) were able to demonstrate similar effects in increasing the affective behavior of three participants using video modeling and in vivo modeling. During the in vivo modeling condition, the appropriate response was modeled, and verbal and gestural prompts were used to guide the participant to imitate the model. Reinforcement was delivered following an appropriate display of affective responses. If an error occurred during the in vivo modeling condition, the therapist modeled the appropriate facial expression and provided a full verbal model, that is, "Say 'I am so sorry for you.'" During the video modeling condition the same procedures were utilized; however, the error correction procedure was different. The error correction procedure in this condition consisted of playing a video of a peer modeling the behavior and a verbal prompt from the therapist, that is, "you do it too." All participants demonstrated contextually appropriate affective responding following both the in vivo and video modeling treatments. Additionally, this skill generalized to novel scenarios and novel therapists. These results maintained at follow up sessions, 1 month and 3 months following the conclusion of treatment. It is essential that social skills taught through procedures such as video modeling are able to generalize to a variety of settings and people so that individuals with autism can be taught to be competent in these areas.

Video modeling can be an important tool that can be very successful in the teaching of social skills when combined with the DTT format. When using video modeling in this way, the learner not only gets multiple opportunities to practice the targeted social skill, but s/he also gets multiple opportunities to observe the correct performance of the skill. These components tied together with the traditional parts of discrete trial instruction. Using cues and prompts, either delivered by a person or by a video, is a necessary component of DTT (Smith, 2001). These multiple opportunities for observation and practice may contribute to the learning of skills. Additionally, if a learner is interested in technology, there may be an increased level of attention to the instruction because of the format in which it is presented. Thus, video modeling should be considered when attempting to teach social skills to some learners with ASD.

10.7 Observational Learning Within DTT

Social skills involve many complex conversational exchanges that may serve a wide variety of functions. Observational learning is an important component of social skills training because individuals must be able to observe the behavior of others and adjust their own behavior to the social situation. Observational learning occurs when an individual is able to observe the response of another individual and then engage in responding

based on this observation. While this is a skill that develops without explicit training within the typically developing population, individuals on the autism spectrum may need to be explicitly taught this skill (Varni, Lovaas, Koegel, & Everett, 1979). Observational learning can be extended into many areas, and becomes increasingly relevant as children age. Many children use it informationally and can use the skill to ascertain what to do in class, to learn new skills, or to solve novel problems.

Despite the importance of observational learning as a skill for learners on the autism spectrum, there are a number of prerequisite skills that are necessary before observational learning can take place. In particular, an individual must attend to the relevant stimuli within the environment in order to appropriately adjust his behavior to the situation. Additionally, the individual must be able to accurately imitate the behavior of others in order for observational learning to take place. Once these prerequisite skills have been taught, individuals with ASD can benefit from observational learning as it pertains to the acquisition of social skills (MacDonald & Ahearn, 2015).

Observational learning can be beneficial for teaching a variety of different skills, including the imitation of facial expressions (DeQuinzio et al., 2007), play skills (MacDonald & Ahearn, 2015), and social interactions (Garfinkle & Schwartz, 2002). In order to establish observational learning, the prerequisite skills must be established, which can be done through the use of DTT. Individuals should be taught to attend, engage in delayed imitation, and discriminate among consequences (MacDonald & Ahearn, 2015). Once these skills have been taught, individuals are prepared to take part in observational learning. Taking the time to adequately train the prerequisite skills will allow the learner to access associated reinforcers more quickly and may reduce the prompting required during observational learning sessions.

MacDonald and Ahearn (2015) taught individuals with autism to engage in observational learning using a trial-based format for a variety of different tasks including a hidden item task, a computer task, an academic task, a construction toy task, and a building toy task. For each of these tasks, skills were taught in blocks of nine trials and least-to-most physical prompting was used to facilitate correct responding. During preassessment, none of the participants performed the observational learning tasks independently. Following training on a specific task, appropriate responses were demonstrated on an untrained task for five of the six participants. Another study targeting the teaching of observational learning, or imitation, Garfinkle and Schwartz (2002) utilized a multiple baseline design across four male participants aged 3 years, 7 months to 5 years, 5 months to teach imitation of a peer's social interactions. Teaching sessions were referred to as small group peer imitation training. Specifically, the training procedure consisted of four steps and was repeated until every child went through the training procedure two times. The training procedure consisted of (1) the teacher provided instructions to the small group, (2) the leader was selected, (3) a prompt was provided to promote initiation, and (4) praise was given for imitative acts. Following intervention participants demonstrated increased social behavior in both the proximity to peers and the amount of peer interactions. Peer imitation behavior also increased in both small group and free play settings.

DeQuinzio et al. (2007) used DTT with modeling, prompting, and the delivery of reinforcement in order to improve children with autism's imitation skills of various facial expressions presented on a model. The authors utilized a least-to-most prompting hierarchy along with an error correction procedure in order to have participants imitate the facial expression on the model. All three participants responded to facial models during 80–90% of training trials. Additionally, through the pattern of responding, it was concluded that facial expression was an effective discriminative stimulus. Reinforcement only occurred following a correct imitative response of the facial model and never following error correction procedures. Harris et al. (1990) taught three adolescent males to offer assistance using prompting and confederate reinforcement. Similarly, Reeve et al. (2007) taught a general-

ized repertoire of helping skills in children with autism. Harris et al. (1990) used a confederate peer by having the peer state their inability to accomplish a task (e.g., "I can't button this jacket") and then verbally prompting the participant to ask, "Can I help you?" After the participant helped, the confederate peer would provide thanks to the participant. The intervention was evaluated in two ways; a multiple baseline design across participants on the first trained task and a multiple baseline across tasks for each participant. Training time varied from a minimum of 5 days to a maximum of 15 days. All three participants showed increases in rate of learning as training progressed, evident by acquisition of tasks two to three in less time than acquisition to task one.

The variety of skills targeted demonstrates the utility of DTT for teaching observational learning and/or the prerequisites in different settings ranging from academics to toy play. Some treatment packages have been found to be effective in teaching observational learning of motor responses (MacDonald & Ahearn, 2015), while other studies have shown effectiveness in the teaching of facial expressions (DeQuinzio et al., 2007) and social interactions (Garfinkle & Schwartz, 2002). Overall, observational learning is an essential component of social interactions because individuals must be able to attend to the actions of others, as well as imitate the behavior of others, if they are going to be socially effective. By directly teaching the skills related to observational learning, behavior analysts are teaching pivotal behaviors that will allow for the performance of a variety of different social skills.

10.8 Behavioral Skills Training Within DTT

Behavioral skills training (BST) is centered around the principles of clear instruction, with multiple exposures of someone practicing the skill who already displays competence (e.g., modeling). The learner who is acquiring the skills then gets to practice the skill with the competent person, while receiving positive and corrective feedback. This procedure has been demonstrated to be an effective teaching procedure for a variety of skills including social skills (Stewart, Carr, & LeBlanc, 2007). A brief overview of BST will be discussed here, and more specific information regarding BST and DTT can be found in the chapter on BST.

BST has been used in a trial based format and was used to teach accurate tacting of listener behavior. Peters and Thompson (2015) taught four children between the ages of 5 and 9 years old to tact listener behavior as an initial component of their experiment. However, the skill of tacting nonvocal listener behavior failed to improve the target response of regaining listener interest. Participants were then taught to ask a question of an uninterested listener in order to regain the interest of a conversation partner. Again, BST was used to teach the skill and a trial-based format was used to determine mastery of the skill. Following this intervention, all participants acquired the skill of asking a question of an uninterested listener in order to regain the interest of the listener within 36 teaching trials. Three out of four participants demonstrated generalization of learned skills at follow up, while the fourth participant required additional training. The experimenters included two subsequent experiments testing the utility of BST which was evaluated in a trial-based format. Specifically, the experimenters examined the teaching of a variety of skills related to responding to the interest of a conversation partner, and all experiments demonstrated positive results.

Conversational exchanges pose many different challenges for individuals on the autism spectrum. Children with autism often demonstrate difficulty with appropriately responding to the interests of their conversation partners, which contributes to the difficulty that these individuals experience in making and maintaining friendships with peers (Peters & Thompson, 2015). Furthermore, it may serve to stigmatize them as they engage in off-task conversation or fail to respond in ways that build natural banter. Teaching the identification of interest and disinterest could make individuals with autism more sensitive to cues emitted from others, and might

reduce conversational difficulty and awkwardness (Peters & Thompson, 2015).

10.9 Script Fading Within DTT

Scripts and script fading procedures have been used in a trial-based format to teach individuals on the autism spectrum to engage in language surrounding social interactions required for play (Garcia-Albea et al., 2014). Trial-based script training procedures have also been used to teach individuals with autism to share toys, which is an essential social skill with which individuals with autism often experience difficulty (Ledbetter-Cho et al., 2015). Social scripts have also been found to be effective in teaching social commenting and other social skills for individuals on the autism spectrum (Groskreutz et al., 2015). Script fading procedures involve providing individuals with a prompt for the language required for a social situation. This may come in the form of a written script or an auditory script, and prompting procedures are used to encourage the learner to imitate the script appropriately. As the learner is successful with the use of a script, the script is gradually faded until the learner independently emits the appropriate response. Script fading procedures have been found to be effective in increasing scripted and unscripted interactions for individuals on the autism spectrum.

Script fading procedures have been modified and used in a variety of ways. Some interactions may occur in the presence of naturally occurring stimuli while others are controlled by a teacher. By varying procedures, a technology has been developed in which script fading has contributed to increases in appropriate meaningful social exchanges. Garcia-Albea et al. (2014) placed a series of toys on shelves in a treatment room and participants could access each toy once per session, allowing for one trial with each toy. Audio buttons containing recorded social scripts were attached to each toy and participants were required to approach the toy they wanted to play with, press the audio button, and accurately repeat the social script to gain access to each toy. Prior to the start of intervention there were no observed responses across any participants. Following intervention all participants demonstrated increases in scripted, unscripted and novel responses. Generalization was demonstrated during multiple exemplar training across untaught stimuli. This intervention was able to successfully demonstrate that control over the response by the participant was maintained by the appropriate environmental stimuli. Groskreutz et al. (2015) taught participants to use multiple exemplars of different script frames to appropriately comment on toys. The script frames were attached to various aspects of each toy and a total of 15 trials of script training took place per session. If participants did not independently engage with the scripts, least-to-most physical prompting was used to guide participants to use the script. The participants met mastery criteria for the script frames in two to seven sessions. Groskreutz et al. (2015) extended the current literature on extended script frame procedures by including a novel script-frame procedure. This novel script-frame procedure may have contributed to stimulus generalization which occurred with untrained play activities, and untrained comments.

Ledbetter-Cho et al. (2015) used script training to teach three boys, diagnosed with ASD, between the ages of 4 and 6 years to initiate peer interactions related to sharing toys. The procedure involved having all three boys sit together at a table in a therapy room. Each boy was provided with a set of toys in a random order and instructed to share the toys with his friends. During the script training phase of the experiment, the child was expected to read the script associated with the toys provided. Each of the participants demonstrated improved communication skills with their peers following the introduction of the script. An area that all participants continued to struggle with throughout the intervention was responding to peer initiations. This could be explained by the fact that responses to a peer were not scripted. Pollard et al. (2012) combined the use of a trial-based format and script fading to teach individuals with autism to make bids for joint attention. Three children between the ages

of 4 and 7 years were taught to make bids for joint attention using this procedure. Scripts stating "Look, it's a _____," were attached to different toys in the experimental setting. Physical prompting was used to orient the child to the script and a 2 s prompt delay was used to prompt the participants to engage in the intended verbal response. All participants independently initiated bids for joint attention following treatment. For two of the three participants an increase in unscripted language was also observed. These results support the hypothesis that scripts are effective for teaching joint attention, and extended the previous literature by assessing generalization in natural environments.

Once the intended response is acquired using a social script, the script must be faded so that the individual engages in the response independently. While all script procedures involve some form of fading, how the script is faded occurs in different ways. When a written script is used, words can be removed from the end of the script as the mastery criterion is met for each phase. Some learners may require a gradual fading of the script, while other learners may be able to learn scripts more quickly. In some cases, an entire script may not be used, but, rather, a script frame (e.g., Groskreutz et al., 2015). Groskreutz et al. (2015) taught children to use different script frames, such as "Look, it's a _____," when engaging in commenting during play. Pollard et al. (2012) used a similar script-frame procedure to teach individuals with autism to engage in joint attention with toys. Participants were taught to request attention using a script frame with this procedure.

Scripts and script-fading procedures can be used to teach a variety of different verbal responses associated with several different areas of social skills such as bids for joint attention (Pollard et al., 2012) and conversation skills about toys (Garcia-Albea et al., 2014). Scripts and script-fading procedures were demonstrated in the articles referenced above to be effective in teaching participants to engage in scripted and unscripted responses and the responses often generalized to novel conversation partners.

10.10 Computer-Based Instruction Within DTT

The discrete trial format of teaching can be administered in many different ways, including by teachers or through the use of a computer program. Some benefits of the use of a computer program include more efficient and accurate delivery of instruction (Ramdoss et al., 2011). Simpson et al. (2004) utilized a computer program to improve social skills for four participants with autism. The computer program provided a video model of different social skills. The students were exposed to four different videos and had the opportunity to watch each video twice. A teacher was present to provide verbal prompts to assist the student in successfully navigating the software. Each student was exposed to three daily sessions consisting of 12 trials per day. Each session was 45 min and the sessions were dispersed throughout the participants' school day. All participants showed gains in the targeted social skills following implementation of the computer-based intervention used in this study. The combination of computer-based intervention and DTT has many advantages. For example, individuals are often very interested in teaching programs that are presented through a computer, which may increase compliance with the intervention (Simpson et al., 2004). Additionally, as previously mentioned, the use of computer-based programs can minimize some of the instructor errors as well as decrease the delay to reinforcement, and regulate the systematic fading of prompts based on student performance (Ramdoss et al., 2011). The combination of the heightened interest levels in computer-based instruction and the fast-paced nature of DTT can lead to beneficial outcomes in terms of increased performance of targeted social skills.

10.11 Conclusion

As previously mentioned, there are many potential benefits of using DTT to teach social skills, including the increased number of opportunities to practice social skills that may occur less

frequently in the natural setting. Additionally, DTT can be brought into the natural setting to promote the generalization of social skills taught through this method. Generalized results remain the essential outcome for these interventions, yet some generalized effects have been documented, including in crucial yet elusive skills such as perspective taking and joint attention. It is important for clinicians to utilize DTT in appropriate contexts, including to address social skill deficits. With a primary focus on efficiency and effectiveness, behavior analysts value evidence-based interventions that lead to socially significant changes. While the field values naturalistic approaches and continues to embrace and assimilate them, we must not be too hasty to abandon effective interventions and approaches.

Within DTT, there are many considerations that can assist clinicians in making intervention as naturalistic as possible. For example, interspersing trials throughout the day in naturally occurring or carefully contrived contexts may be preferable to doing massed trials in a noncontextual manner. Furthermore, varying language used across trials can be helpful in programming for generalization. Using multicomponent packages that incorporate multiple evidence-based elements is also a useful way to target these deficits. Overall, the literature demonstrates that DTT is a useful tool that can be used to teach individuals social skills. Increasing social interactions through DTT has been taught using a multitude of teaching procedures including: peer imitation (Garfinkle & Schwartz, 2002), constant time delays (Nientimp & Cole, 1993), and modeling, prompting, and reinforcement (Shabani et al., 2002; Zanolli et al., 1996). Initiations and responses (Groskreutz et al., 2015), verbal responses to social greetings (Garcia-Albea et al., 2014), eye contact (Jones et al., 2006), in seat and on task behavior, following questions from adults, and imitation skills (DeQuinzio et al., 2007; Garfinkle & Schwartz, 2002) were all taught under the umbrella of social skills using DTT.

There are many formats which DTT can be presented in, including formal and less formal contexts and instruction that is presented by live teachers, video models, and computer programs. The use of DTT should be strongly considered when attempting to teach any of the previously mentioned social skills considering the success of this method reported in the supporting literature. Future research should focus on demonstrating the generality of the skills taught in social skills interventions, as this remains the ultimate and most socially significant outcome of instruction. In addition, more research on the variations of instructional arrangements, the use of a variety of prompts, and on the modalities of instruction (e.g., live, video, and computer models) will help to identify the most efficient approaches to teaching specific skills.

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