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## **Efficacy of Discrete Trial Training**

Paula Ahlrich

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**Efficacy of Discrete Trial Training**

Paula Ahlrich

Capstone Project: An Action Research Project

Northwestern College, Orange City, Iowa

**Abstract**

This action research was driven by the researcher's interest in Autism and Discrete Trial Training- specifically the efficacy of implementation and the generalization of skills learned into the classroom. The researcher is a preschool teacher in her 15<sup>th</sup> year of Early Childhood education. The 4-week intervention was conducted during specially designed instruction, but also how those skills taught have been displayed during large and small group time. Throughout the 4 weeks progress was monitored using the CBTU recording sheets and DTT steps. Findings revealed common generalization of skills when the student was presented with the cue outside of the trial time. The largest impact was teacher/ paraprofessional training and consistent cues.

*Keywords: discrete trial training, autism, aba, training*

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### **Efficacy of Discrete Trial Training**

Research shows that early diagnosis of and interventions for autism have significant long-term positive effects on symptoms and later skills (Lord, 2001). Early intervention and quality early childhood programs can have a huge impact on student success for both typical and nontypical peers. Many of these studies have proceeded after teaching social skills to one or more children in quasinaturlistic settings (Kamps et al., 1992; Kohler et al., 1995; Mundschenk & Sasso, 1995; Odom et al., 1999; Odom & Strain, 1986). The early intervention program was established by federal law in 1986 and, subsequently, was reauthorized as Part C of the Individuals with Disabilities Education Act. Starting interventions earlier and having students participate in early learning exposures allow preschool teachers and staff to build positive interactions to support further success. Success from early interventions in the preschool classroom pertains to growing students' social-emotional skills and teaching beginning school skills. This includes knowing how to become ready to learn, using fine motor skills, and growing in early math and literacy skills.

In my own preschool classroom, I have seen the effects of early interventions and how students experience success in the classroom. I have had two of my own children personally go into preschool early, and language and behavior interventions made a huge difference in their classroom participation. Discrete Trial Training (DTT) is a successful intervention that can be used in the classroom, both as a teacher intervention and as a peer-led intervention (Ali & Fazil, 2022). The problem with DTT is students learn skills through a series of discrete steps in an unnatural environment, and it is difficult to employ and use those skills in the classroom setting. The purpose of my action research project is to assess the efficacy of implementing DTT with a student and see how it improves mastery of skills across the preschool program. My action

research project proposal is efficacy in implementing DTT for autistic children in the early childhood education classroom.

In choosing my research topic, I wanted my study to have a significant impact for those students who struggle the most and their peers. As the school district already focuses on social emotional learning, I chose to tailor the project to a specific student. I have a student in my classroom that has been recently diagnosed with autism, and this research would benefit the student and me, as their instructor. The purpose of this research is to ensure the DTT used in the classroom is effective, integrates with other aspects of the classroom, and effects the preschool students' learning. By training staff and implementing DTT both in the unnatural environment and in classroom centers, educators can use the skills being taught during explicit instruction. The impact of teacher and paraeducator training, along with implementing peer-led imitation DTT, is preschool students will have more exposure to play skills and social skills they need to develop and learn how to use in the classroom (Garfinkle & Schwartz, 2002).

Although there are plenty of interventions in place in my classroom (e.g., visual schedules, cube chairs, adaptive writing utensils, labeled shelves, jobs), these students need something more. When researching effective steps for early autism intervention, DTT has shown great success in teaching skills through explicit, modeled, and rewarded behaviors. In the trial, the educator teaches one explicit skill, and, when the student shows mastery of that skill, the educator moves on to the next step. Each trial is 20 exposures to learning the appropriate skill, and, when the student performs the skill correctly following the prompts, the educator rewards them with a highly motivating object (Bolton & Mayer, 2008).

The resources for my action research project were compiled from the DeWitt Library of Northwestern College in Orange City, Iowa. To be considered for inclusion, studies had to be

published in peer-reviewed journals within the last 10 years. Studies regarding paraeducator training, teacher training, DTT efficacy, and peer-mediated imitation were selected based on their relevance to the efficacy of DTT. There were 20 sources selected based on their relevance and support given to the current action research project. I used the resources to gain an understanding of DTT, the importance of educating the team implementing the DTT, classroom-based peer imitation DTT, and the consistency of DTT intervention completed and spaces used.

### **Review of the Literature**

Autism in the early childhood classroom is becoming more prevalent. Research has shown early diagnosis of and interventions for autism have significant long-term positive effects on symptoms and later skills (Lord, 2001). Early intervention and quality early childhood programs can greatly impact student success for typical and nontypical peers. Unfortunately, there has been no curriculum designed or clear guidelines on how to best meet the needs of students with autism. The following literature review addresses the areas of early childhood intervention, teacher training to implement DTT, peer imitation, and communication outcomes. DTT is an educational strategy based on the principles of applied behavior analysis (ABA). Discrete trial teaching involves breaking skills into smaller components and teaching those smaller subskills individually. Teachers conduct repeated practice of skills and may incorporate prompting procedures as necessary. Correct responses are followed by reinforcement procedures to facilitate the learning process (Honsberger, n.d.).

### **Children with Autism**

Autism is not a new diagnosis; according to the World Health Organization (March 29, 2023), 1 in 100 children is diagnosed with autism. The Centers for Disease Control and Prevention (April 4) reported, as of 2023, 1 in 36 children in the United States are diagnosed

with autism. Since the first detailed account of a child with autism (Itard, 1801), each research study about early intervention and autism has created scaffolding for the best practices currently in use (Thompson, 2013). Autism creates challenges in the classroom that can involve communication, social skills, transitions, and routines. Many of these challenges are addressed well in an early childhood environment with the use of visual schedules and daily routine. Other skills can be more difficult to learn but can be made better by the implementation of DTT to teach the child with autism the specific skill.

### **Early Intervention**

In 1968, federal legislators mandated the provision of preschool programs for children at educational risk due to developmental disabilities (Handicapped Children's Early Education Assistance Act, Individuals with Disabilities Education Act, 2004). Since that mandate, early intervention and early childhood special education programs have become more prevalent. According to Wong et al. (2015), "intervention practices are the building blocks of educational programs for children" (p. 1952). Research results have been mixed on the most important aspect of early intervention; however, researchers have suggested several evidence-based approaches for best practices in teaching children with autism. Those approaches are ABA, DTT, embedded instruction, naturalistic instruction practices, and activity-based instruction. Of the research published, the most commonly investigated approaches to early intervention have been ABA and DTT.

Early intervention is a key component in helping all children succeed (Azarbehi, 2009). However, it can be more challenging to make those connections when a child has a physical, mental, or developmental delay. The inconsistencies in early childhood intervention research have caused debate about which approach is best and how many trials are needed for



interventions to be effective. However, studies have proven that early access to skill development is still better than not having early access. Several studies have demonstrated that the different DTT methods used in early intervention are similar. When implemented with fidelity, progress is made with DTT using the different approaches. It allows the teacher to build their competency with embedding trials in the classroom using different methods. There are several dimensions in which various methods overlap with regard to developmental or behavioral factors. Thompson (2013) studied these and it included:

1. Adult versus child-directed,
2. Individual versus group learning,
3. High versus low intensity,
4. Parents versus therapists as interventionists,
5. Isolated setting versus embedded within natural daily routines,
6. Specific functional communication, social, and cognitive skills versus relationships

(Thompson, 2013 p 6)

Although there is debate among the different intervention methods (i.e., DTT, naturalistic approach, peer imitation, and activity-based instruction), they are not incompatible (Downs, 2008). Amid the inconsistencies surrounding early intervention and which method is best, studies agree early intervention is better than nothing at all and has a long-term impact on the success of children with autism.

Early intervention allows children to start making gains towards developmental milestones, DTT is one method that can help shape new skills. DTT teaches skills through explicit, modeled, and rewarded behaviors. According to Eikeseth et al. (2007), “early intensive behavioral intervention frequently rely on DTT as the primary service delivery method” (p. 136).

Lovaas (1987) showed 47% of young children treated intensively with DTT achieved normal or above normal levels of intellectual and academic functioning after 2 to 3 years of treatment, and those levels were maintained over several years. As addressed by earlier studies DTT is not performed in the natural environment, which is one of the pitfalls of this approach. McBride et al. (2003) trialed students in an early childhood classroom using ABA along with DTT. Students participated in the multiple-probe design for 3 weeks. The study was designed to incorporate embedded discrete trials into naturalistic classroom activities and environments (McBride et al., 2003). By implementing the trials in the classroom environment, it could also increase the teacher's competency (McBride et al., 2003) and apply the principles of the trials to other explicit instruction instead of just in an isolated setting (Thompson, 2013). Similarly, Downs (2008) collected data during the discrete trial intervention, which allowed the preschool educator to conduct continuous, curriculum-based formative assessment of the students' progress. All of the studies above clearly indicate the success and importance of early childhood interventions.

### **Training for Implementation of DTT**

DTT is a systematic method of instruction consisting of three primary components: (a) the instruction presented by the provider, (b) the response from the learner, and (c) the consequence determined by the learner's response (i.e., reinforcement or error correction). Prior research has established the importance of DTT for children with autism, (Young, 2016, p.507) such as the study done by Clayton (2018). In Clayton's (2018) study he showed paraprofessionals a 10- min procedure video that would show them how to correctly implement DTT and stated that it would result in improved teaching response performance. The participants' conducting the DTT before the video scored 70%, 58% and 66% for correct teaching responses. After the video their baseline when up to 97%, 96% and 99% for correct

teaching responses. The impact of DTT is directly linked to the training to implement the intervention. For the instruction to be effective, the implementation of the trials needs to be consistent across settings, whether that be with licensed ABA therapists, parents implementing trials between formal interventions, or other staff (both teachers and paraprofessionals) in the early childhood or early intervention setting.

Leaf et al. (2018) related the importance of teacher training in DTT to ensure it is used and implemented correctly in the classroom. Leaf et al. found various methods were effective in training individuals to improve and implement DTT in their own setting, which included a university, school, home, agency, and swim school. Although the locations varied, each of the participants administering the DTT received training and feedback on how to implement DTT. There are different procedures for training individuals to implement DTT: (a) lecture, (b) lecture and role-playing, (c) computer-based training, (d) video, (e) peer review, and (f) coaching. The training types and settings were different, but the results showed that a wide variety of individuals had been trained how to effectively implement DTT (Leaf et al., 2018). Although behavior analysts were most commonly implementing DTT, other professionals, teachers, and paraprofessionals were also competent in implementing DTT with training (Leaf et al., 2018). Additionally, the inclusion of parents in the intervention process for individuals diagnosed with autism spectrum disorder (ASD) is common as a means to supplement or enhance intervention (Lovaas, 1987). Parents can be trained and become proficient in administering DTT intervention and should be included so the individual is exposed to quality interventions in more than one setting (Leaf et al., 2018).

From a clinical standpoint, Leaf et al. (2018) found although it is not uncommon for DTT in therapy settings to average 40 hours a week, he wanted to see what would happen with

different amount of time. Participants providing the DTT in the study all had varied time constraints, and some students demonstrated mastery of skills in shorter periods of time, with less trials. One limitation of this implication is that it may not provide an “ecologically valid assessment or mastery” (Leaf et al., 2018, p.37); however, it does support including parents and other professionals to do consistent trials following the model presented in therapy. Lafasakis and Sturmey (2007) had studied what it looked like when parents implemented DTT at home. Three parents were trained and were successful in implementing cues and DTT, and illustrated how DTT can be effective even in the home. Leaf’s (2018) study aligned with that as well but looked at many different professions and settings.

Bolton et al. (2008) reported similar findings, but the primary focus was how training the paraprofessionals impacted the effect of implementing DTT. Paraprofessionals were required to complete a 3-hour training, and it improved their accuracy in trials with three different students with autism to 100%, 100%, and 96% accuracy 3 weeks after completing the training. According to Stahmer et al. (2015), “well-trained staff increases the likelihood that instructional programs will be implemented efficiently and effectively. This, in turn, presumably results in greater educational success by students” (p. 192).

Clayton and Headley (2019) examined the efficacy of different training methods. Staff watched a 7.5-minute video that showed exemplars of DTT with a student, and then they completed 10 trials of DTT to the best of their ability. In the next step of the training phase, staff were presented an implementation handout with 10 different components, which was developed by Sarokoff and Sturmey (2004). Again, they were asked to complete 10 trials to the best of their ability. Each participant was given feedback over four different trials, including positive feedback and corrections that needed to be made to certain components. “The use of performance

feedback has been examined by many researchers and shown to be important for maintaining staff skills (Mortenson & Witt, 1998; Parsons & Reid, 1995; Schepies et al., 2000).’ Participants then began to conduct trials with their students. After a 30-day fidelity check, they continued working with their students. Although students exhibited growth in recognizing sight words in the study over the course of the DTT period, the primary goal of this study was to assess the efficiency and effectiveness with which the staff were able to complete the trial components with the students. Clayton and Headley (2019) concluded the video was more effective than the handout and suggested further research be conducted on components of implementation training for any variation of DTT.

### **Peer Imitation**

Peer imitation aligns with the belief that all children can learn skills in various ways, and it can be used as a variation of DTT. Although DTT teaches children skills through explicit instruction with prompts and a reinforcer, they can also learn through peer imitation and imitate the skill a peer is performing. Peer imitation presents a mixed-methods approach to helping children learn developmentally appropriate skills in various classroom settings. Peer imitation training uses a typical student to model or “teach” the target student a behavior instead of only providing DTT instruction from an adult. Since children with autism tend to struggle with the skill of imitation, it is beneficial to use a peer model to teach them how to imitate. Garfinkle (2002) evaluated studies on peer imitation training and yielded the following conclusions:

1. Children with disabilities can learn to imitate their peers.
2. There may be some increases in social interactions between the target child and the peer model during training.

3. The typically developing child only imitated the target child if the imitation was directly reinforced.
4. There is some increase in social interaction in generalization settings.
5. There is little generalization of peer imitation across settings (p 5).

Many young children diagnosed with autism have ‘deficits in generalized imitation skills’ (Dawson & Adams, 1984; Rogers 1999). Imitation skills are essential building blocks with which a child learns to create a connection as an infant with their caregiver. In the toddler years, imitation skills are used to create strings of sounds that lead to language development. During the preschool years, imitation skills allow children to match their peers and become an observational learner (Garfinkle, 2002). Garfinkle (2002) used a mixed-method approach to teach four young boys with autism through imitation with a peer leader who “leads” the cues for DTT. Peer imitation allows the learner to enhance their ability to observe what is going to happen next because the cue is predictable. Data were then taught and tracked over small groups and free play. When baseline data were collected, none of the four target children exhibited any imitation behaviors. Although there were variations in the children’s exhibited behaviors, all four were able to imitate their peer’s behavior after the 5-month study, with some imitations performed independently (Garfinkle, 2002). One constraint of this study is one of the students had excessive absenteeism; so, his data were inconsistent compared to his peers.

Bravo (2021) evaluated whether effective contingent imitation could be implemented along with the principles of DTT. Contingent imitation is a teaching method that stems from a child’s lead action and has the teacher copy the child’s motor movement (Garfinkle, 2002). Bravo’s (2021) intervention consisted of 30 trials with contingent imitation and followed a most-to-least prompting hierarchy that aligns with DTT. Study participants included three 4-year-old

children who were diagnosed with ASD. The intervention took place over 30 mixed trials. Student 1 could master two actions, Student 2 mastered six actions, and Student 3 mastered all 10 actions. Although two participants mastered over half of the actions, the research was vague on the efficacy of combining the interventions. It should be noted that this study had limitations due to COVID-19 school closures. Due to the school's closure Bravo was unable to follow up with a postintervention assessment using the Unstructured Imitation Assessment (Ingersoll & Lalonde, 2010), which would have measured spontaneous imitation during play (Bravo, 2021). As the study was unable to be completed as originally planned, Bravo (2021) focused on cued imitation instead of cued imitation with spontaneous imitation, which would prove DTT was able to create generalizations.

### **Communication and Learning Outcomes**

Children with ASD are almost universally delayed in the acquisition of spoken language (Paul, 2013). This research area is complicated because studies have primarily focused on increasing social communication. Research has indicated successful ways to improve learning outcomes related to social skills, but communication is more complex than simply responding "hi" to a peer. Leaf (2017) wrote an entire handbook on social skills and autism and emphasized that when autistic children learn social skills it will naturally lead to more language acquisition. One method of training that has shown significant improvement in both acquisition of spoken language and functional use of speech is DTT. Ali and Fazil (2022) focused on using DTT to improve social communication in children with autism. This study proved that when DTT was implemented in children's social interactions, social responding improved. Though Ali and Fazil's (2022) study was conducted in a government school in Punjab, Pakistan, overall, the

results indicated DTT is a practice that should be implemented to help social communication and interaction.

The DTT used to teach classroom behaviors and peer-imitated and social skills can also teach first words. DTT to teach first words follows the Skinnerian principles of operant learning (Skinner, 1957). There are multiple methods of communication for a nonverbal autistic child, such as visuals and core vocabulary words, which make it challenging to use them practically across all settings. Although there is no perfect solution, research has shown that using more than one method to be significant in supporting the development of language skills. There needs to be multiple tools to allow a child and caregiver to communicate their wants and needs. Using trials allows for focusing on a specific request, like “more” or “done,” to make it easier for the child to communicate their need.

Smith (2001) studied the different lengths of DTT, both in the number of trials and the amount of time spent in trials a day. That varied depending on who was prescribing it, and in what setting and where it was to be primarily used. The results from Smith’s (2001) study on DTT aligned with the finding of Carr & Dores study that DTT is the “only method shown to be effective for teaching children their first words and phrases in sign language (Carr & Dores, 1981; Carr et al., 1987),” and skills progresses from there to other forms of communication as skills are built. Although DTT is one of the best methods to teach children with autism in general, a significant limitation from Smith’s study was that students responded mainly to cues from the teacher. It is hard to imitate the learned behavior without the specific cue. In other words, there is a lack of generalization across settings, but, although this study addressed the inability to perform without cues, responding to cues is not an uncommon factor.



Effective communication is an important part of a child's well-being and quality of the overall interactions. According to Rabideau et al. (2018), "a lack of clarity makes the use of behavior and/or gestures ineffective as primary forms of communication" (p. 34). Young et al. studied a preschool child who was using DTT to learn how to use an augmented communication device to make choices and answer questions. The paraprofessional and the teacher used the same method and cue to help generalize the skill across different areas of the classroom, not just in one-to-one instruction. Although preferred reinforcers were used, the student had greater success during the one-to-one trial than using the skills obtained in the center area with the same cue and peers present. These studies indicated, although DTT is evidence-based and can produce improved communication skills in a structured setting, it is still difficult to generalize the use and development of communication skills.

### **Summary**

Given the substantial support for the use of DTT with children diagnosed with autism spectrum disorder, the strategy has been identified as an evidence-based practice (National Autism Center, 2010; National Research Council, 2001). The studies in this review are in agreement that DTT is the best approach; however, researchers' waiver on whether additional interventions should coincide with it. A primary conclusion from this review indicates training of the individual completing the intervention has a positive impact overall. As one of the most effective principles, the studies all pointed out the person needed to be trained to complete DTT. It did not matter whether that individual was a paraprofessional, parent, teacher, or therapist; as long as the cues were the same, the child could be taught effectively.

Unexpectedly, data revealed an irregularity that deems further research: the optimal amount of time that needs to be spent in a trial to teach the skill and allow for generalization of

the cue. Even though studies in this review primarily focused on DTT, they took place in different environments, were completed using different lengths of trials, or had a variation in the length that each child was served. The question remains whether the methodology of implementation of DTT need to become universal (i.e., a certain number of trials or amount of time?). Conversely, allowing variation of implementation of the DTT intervention to meet the needs of the child being served and the environment in which the skill is being taught may also hold value.

This inconsistency was the basis for my action research project proposal. The research literature has proven DTT is effective and integrable into other aspects of the classroom and effects the children's learning. By training the staff and implementing DTT, both in a one-on-one, unnatural environment and in the classroom centers, the skills being taught can be used during explicit instruction. Ultimately, early intervention and quality early childhood programs will greatly impact long-term student success for typical and nontypical peers.

## **Methodology**

### **Research Questions**

In my own classroom, I have seen the effects of early intervention and how students experience success in the classroom. I have had two of my own children personally go into preschool early, and language and behavior interventions made a huge difference in their classroom participation. DTT is a successful intervention that can be used in the classroom, both as an intervention and as a peer-led intervention (Ali & Fazil, 2022). The problem with DTT is the student learns skills in a series of discrete steps in an unnatural environment, and it is difficult to employ and use those skills in the classroom setting. My action research project aimed to

assess the following questions: (a) can DTT be used to improve learning for children with autism? and (b) can DTT be used to generalize skills into the classroom?

### **Setting**

The action research study was conducted in a 4-year-old statewide, voluntary preschool program in a midwestern rural public school district. In the preschool building, there were two sections of morning preschool and an afternoon section of preschool. The program ran 12 hours a week and met on Monday, Tuesday, Thursday, and Friday. Wednesdays were used for professional development. The program used an inclusive classroom setting with two teachers, and both teachers were certified in early childhood special education. There were also two paraprofessionals in the classroom; one had over 21 years of special education experience. Children came into the program at 3 years, 9 months to begin early access services on an Individualized Education Plan (IEP).

### **Participant**

The participant was a 3-year-old male in the afternoon class with 12 other 4-year-old peers. The student entered the program for early access through the area education agency at the beginning of the school year on an IEP. The student was receiving services in areas of reading, literacy, and adaptive behavior. The student was diagnosed with ASD during the 2022–2023 school year. He is nonverbal and was receiving services in the home before becoming eligible to attend the preschool program. He began attending at the beginning of the 2022–2023 school year with an adjusted start: 2 days the 1st week, 3 days the 2nd week, and then all 4 days by the 4th week.

**Intervention**

Before diagnosis, due to lack of typical progress overall, the area education agency and teachers discussed and decided to implement DTT. DTT has been identified as an evidence-based practice for children diagnosed with ASD (National Autism Center, 2010; National Research Council, 2001). Before beginning the trials, a preference assessment was used to identify preferred items for which he would work. His guardians also were asked what items could be motivators to direct the assessment. The preferred items were then purchased, and a room was set up for him to receive the instruction. Both the early childhood special educator and the paraprofessional who work with the child were trained, in person, on how to complete DTT and implement it with fidelity.

He began the DTT as specially designed instruction in a one-on-one environment. Each trial consisted of 20 opportunities to (a) have the instruction or cue (either physical, verbal, both, or none depending on the DTT step) presented by the provider, (b) respond to the cue, and (c) receive the consequence determined by the learner's response: reinforcement or error correction. The reinforcer was a preferred item. To meet the benchmark, he needed to score 90% over two consistent trials to move onto the next DTT benchmark. The benchmarks were labeled A–D with each step broken down and beginning with a full physical and verbal prompt. For instance, the verbal prompt for D1 is “[Name], get ready, hands down, feet down, eyes. Look at me.” When child is ready and looking at the teacher, count to three. The accompanying physical prompt to be completed in tandem with the verbal prompt was to hold the child's chin and point to your eyes. Followed by the consequence or the positive reinforcement. The verbal prompt for D1a is “[Name], get ready, hands down, feet down, eyes look at me.” When the child was ready and looking at the teacher, count to three. The accompanying physical prompt to be completed in

tandem with the verbal prompt was to touch the child's chin and point to your eyes. Followed by the consequence or the positive reinforcement.

Data for this action research project were collected from March 6, 2023 to March 28, 2023. After completing Step B1 of the DTT program, imitation DTT was initiated in the classroom and free play environment along with the one-on-one environment. He was required to complete 10 trials during free play in four of the centers. He was given breaks between the four different centers, and, if he engaged in independent play, it was allowed. Each of the centers followed a consistent play routine that used the same cues (i.e., "get ready"), but the materials changed. For example, "Get ready, [Name]. Put on block." There were visuals for "ready to work" at all of his work stations in the classroom, one-on-one environment, and each center. Because the training used trials, he was required to get 90%. By having him participate with peers in center time activity through scripted trials, he engaged in peer-mediated/peer-participating DTT.

### **Variables**

The independent variable was the DTT benchmark and learning the skill. To meet the benchmark, he needed to score 90% over two consistent trials to move onto the next DTT benchmark. The dependent variable was the procedures executed by presenting physical prompts and verbal instructions, gestures, and visuals of "ready to work" at all his workstations in the classroom, one-on-one environment, and each free play center. There were play visuals, and he had to follow all three steps. The trials in the centers were run the same way as in the specially designed instruction room; however, although the same cues were used, there were different steps to initiate imitation play. The standard assessment in the preschool was the researched-

based Teaching Strategies GOLD, and anecdotal notes were included along with the DTT. The anecdotal notes were used for the dependent variable as well.

### **Measurement Tool**

Data were taken each day and recorded via paper and pencil on the DTT sheet. Data collection followed the DTT program protocol B4d–D1. Data were put weekly into the  $t$  test graph, and growth was compared with data taken outside of the one-on-one training environment. The  $t$  test allowed for tracking his growth and the length of time each trial took before moving onto the next DTT benchmark. The  $t$  test allowed me to analyze the data, discern patterns, and determine where to focus more attention.

### **Statistical Analysis**

I evaluated DTT for a student on the autism spectrum. The purpose of this research was to ensure the DTT in use was effective and integrable into other aspects of the classroom and effects the child's learning. By training the staff and implementing the DTT, in both the unnatural environment and in the centers of the classroom, the skills being taught can be used during explicit instruction. The DTT was built into his IEP; so, it was normal educational practice. I used the Teaching Strategies GOLD reports in addition to the DTT data. Data collected were both qualitative and quantitative. Quantitative data included the DTT training trials completed both in isolation and in the classroom during centers and large group time. Qualitative data included the Teaching Strategies GOLD anecdotal notes and observations collected by me and the paraeducator, taken as part of the researched-based curriculum. The triangulation method was to see how both the interventions and growth were working together and what areas were showing growth and what areas needed more focus.

### **Institutional Review Board**

As my research did not have any identifiable information beyond standard directory-type data. I did not discuss any identifiable study records. I abided by FERPA requirements. The only information that could be used or released were the child's age, gender, and course of study. An application for exemption for this action research project was approved and permission to conduct the study was granted by the Northwestern College Institutional Review Board. This research involved normal educational practices by conducting Discrete Trial Training (DTT) and monitoring how the student passes through the benchmarks. The researcher recognizes the importance of maintaining the confidentiality of data collected, getting informed consent from the students' parents, respecting the research site, ensuring the safety of the participants, and accurately interpreting and presenting the data collected.

### **Data Collection**

The following questions guided the choices for data collection: (a) can DTT be used to improve learning for children with autism? and (b) can DTT be used to generalize skills into the classroom? For this action research project, I used both quantitative and qualitative data collection. The DTT completed in the student's specially designed instruction room represented quantitative data. For him to meet the benchmark and pass to the next step, the student needed to show 90% accuracy and above for two trials in a row. These data allowed me to see if DTT could be used to improve learning for children with autism.

In addition to the trials being conducted in the instruction room, I also conducted trials at free play and in the classroom. At free play, the student was brought to a center and cued the same but followed play intervention trials that mimicked discrete trials. These play intervention trials were used to teach him how to play, involved peers to trigger imitation play, and overall

supported generalization of skills. During large and small group time, qualitative data were collected during the trials, including classroom observation and anecdotal notes, to support generalizability of the skill. Data collected during free play and in the classroom allowed me to answer if the student was able to generalize the skills in the classroom.

Only the paraprofessional I collected data because had been trained in DTT methods and had fidelity checks by the speech language pathologist or early childhood special educator consultant. One-on-one trials took place at 1:05 p.m. in the afternoon for each day the student was at school, consisting of 20 trials. Two of the free play trials (10 repetition) were completed before that time, and the last two sets of trials (10 repetition) were completed after. Classroom data were taken during large and small groups; there was no set number of trials required.

## **Findings**

### **Data Analysis**

For this action research project, the data that was collected was both qualitative and quantitative. The quantitative data includes the DTT benchmark that the student began on with DTT and DTT benchmark that the student ended on. Along with the DTT benchmark trials qualitative data was also collected over 4 weeks to show growth through anecdotal notes and DTT that were ran during free play time for ten trials, and during large and small groups as well.

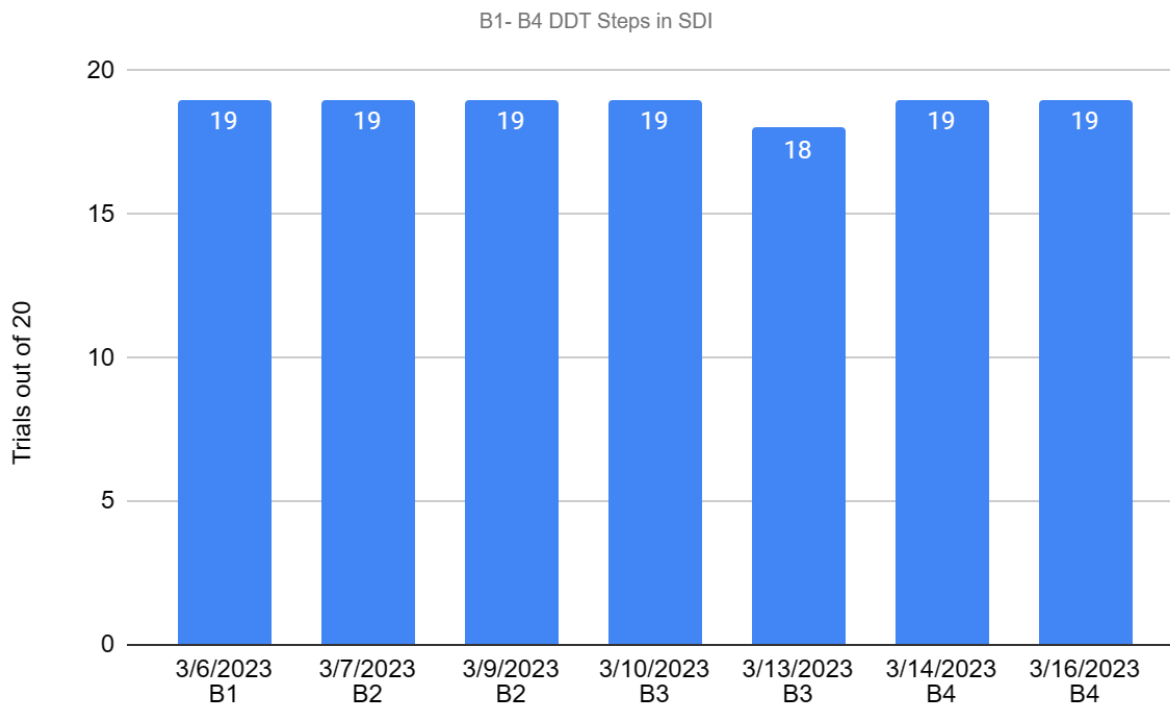
The data collected over 4 weeks did show growth. The student had started on B1 during the last week in February of 2023. In that initial step the student was given the full verbal cue, physical prompt, and physical cue. The anecdotal notes stated that the student was resistant to having hands down, but with the gentle physical prompt and preferred reinforcement it was accomplished. Once it was established there was no issue getting through the rest of the steps with the less of the physical cues.



Step B1 started with the full verbal cue, physical prompt and physical cue. It is “Name, get ready, hands down, feet down, 1-2-3.” The student was able to complete the benchmark B1-B4 in 7 days. For benchmark steps B2, B3 and B4 it follows the model where the verbal cue stays the same, but the physical prompts decrease enforcing how to do the skill. The student completed Steps B1–B4 in 7 days (see Figure 1). Data collection began on March 2, 2023 and the child was on Step B1. He completed Steps B1–B4 in 7 days (see Figure 1).

### Figure 1

#### *B1–B4 DTT Steps in Specially Designed Instruction*



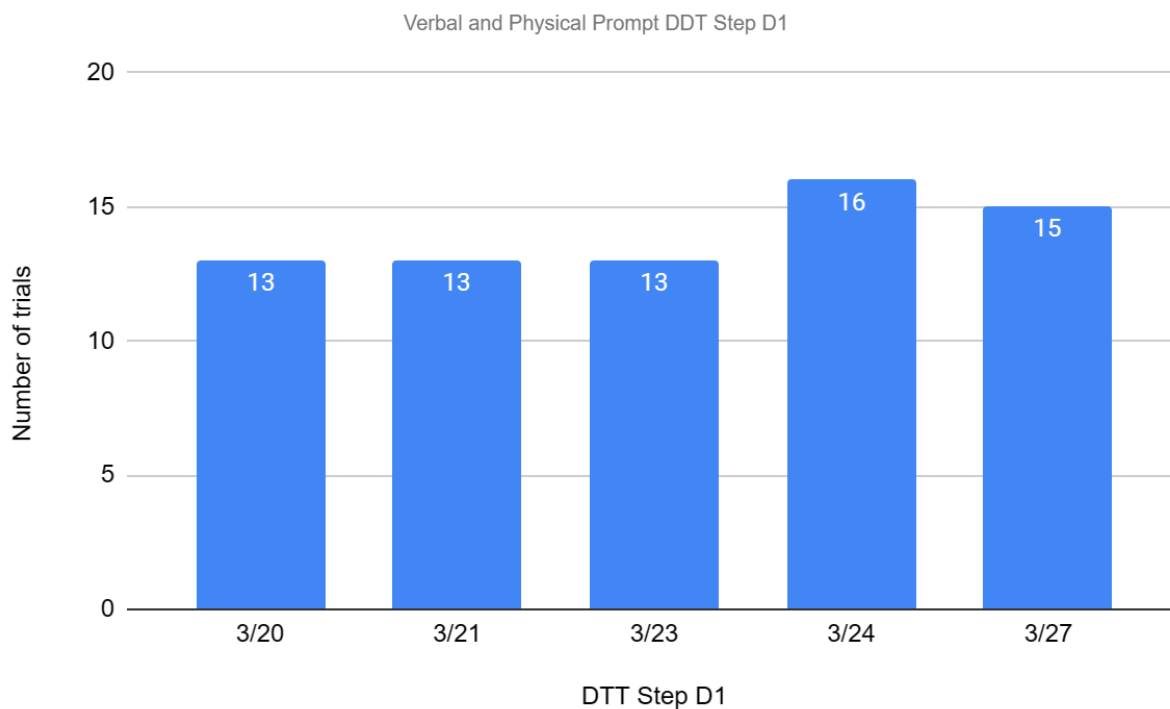
*Note.* The graph depicts the successful trials out of 20.

When the student was moved onto Step D1, the growth slowed (see Figure 2). Data were collected daily in the one-on-one trials, classroom trials, and free play trials. Though results did not show a significant rate of growth in the DTT benchmark of D1, there was significant growth in the generalization of school due to the implementation of DTT over a longer period. The student is resisting the physical prompt and not able to keep eye contact for the count of 3 when

prompted, “Name, get ready. Hands down, feet down, eyes look at me, 1-2-3.” Qualitative data has been taken on this step as well to figure out what is the best physical prompt. The physical prompt calls for hand on chin, pointing to instructors' eyes and holding the chin to support eye contact, but that overwhelmed the student. After getting upset and physically aggressive a different physical prompt was tried. 5 trials were completed with a physical prompt of touching the cheek and pointing to eyes. That also proved unsuccessful. The third physical prompt that was tried was touch the students’ nose and then touch the instructors’ nose and count 1-2-3. That prompt was started on March 24, 2023 and showed increased success.

## Figure 2

### *Verbal and Physical Prompt DTT Step D1*



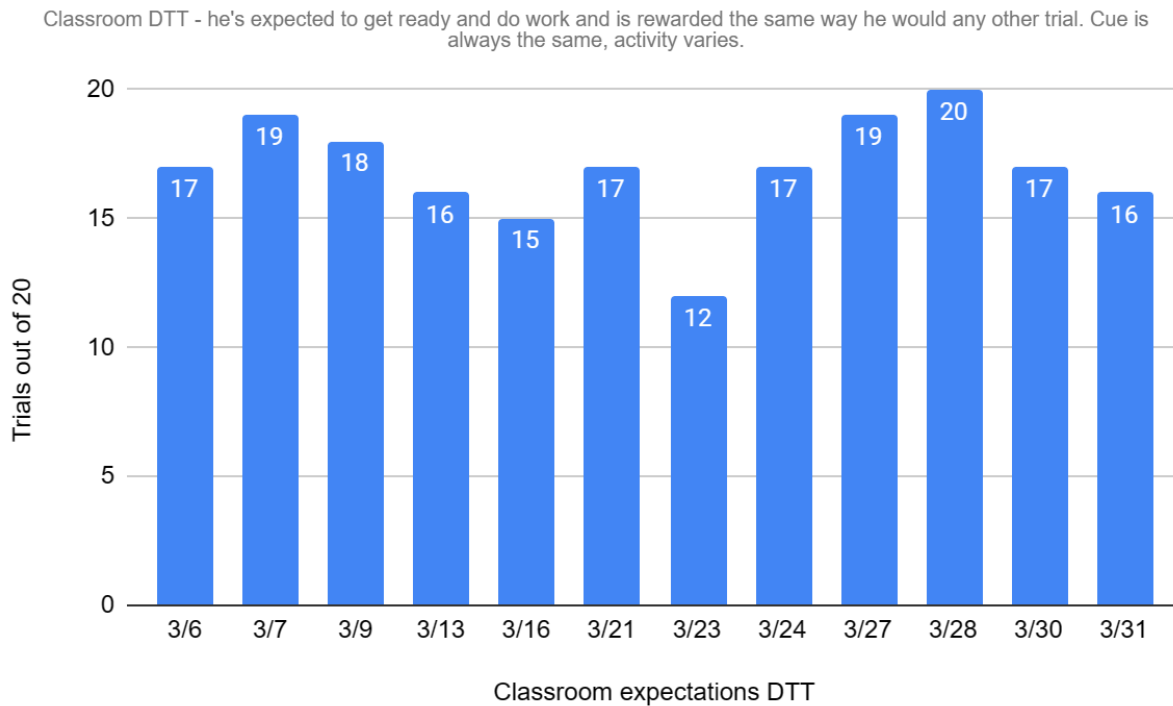
*Note.* The bars indicate successful trials out of 20.

When the student was making progress during specially designed instruction, data then was collected daily focusing on the core word more and classroom expectations. In the classroom the participant was given the same cue and the participant was expected to get ready

and do work and was rewarded the same way he would in any other trial (see Figure 3). Cue was always the same, but the activity varied. This data was collected during large and small groups and the goal was to increase the amount of skill generalization in the classroom. Participant was expected to get ready and do work and was rewarded the same way he would in any other trial. Cue was always the same, but the activity varied.

### Figure 3

#### *Classroom DTT*



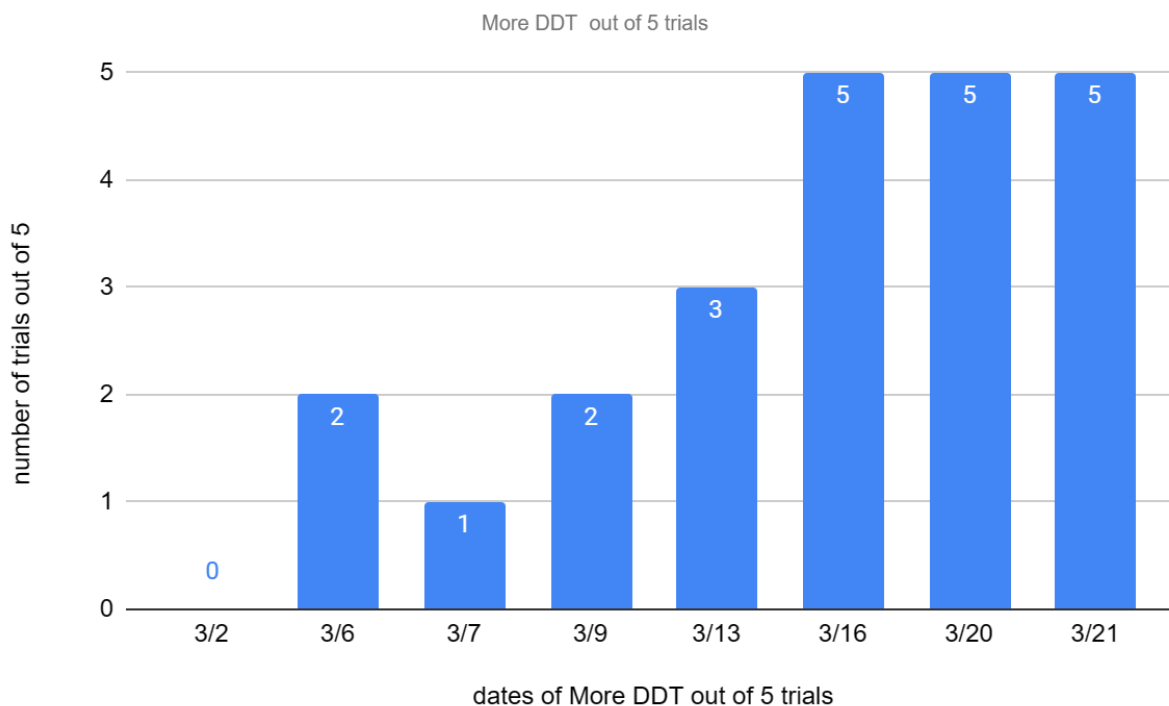
*Note.* The bars indicate how many trials were successfully completed out of 20.

Another skill that was addressed for communication purposes was working on the core vocabulary word 'more'. The student had been working on the sign language for 'more' and we were making no gains in this area. So, each day we were working on it following the DTT model of hand over hand and rewarding with the preferred tangible. After 4 trials the student would be frustrated so as a team it was decided to limit the trials so that there would be success and we

could increase it. There was no progress being made by introducing it and working with the student daily, so the team met to discuss what it would look like if that were presented as a DTT cue. The plan was to start with 20 trials and track the progress made. After 10 days of DTT focusing on more, the data showed that there was no significant improvement, just increased frustration. The team met again and decided that it was best to limit it to 5 trials to track the increase. On March 2, 2023 we began collecting data on the 5 trials (see Figure 4). The data was inconsistent, and as a team it was discussed what an alternative communication device would look like for the student.

#### Figure 4

*“More” DTT out of Five Trials*



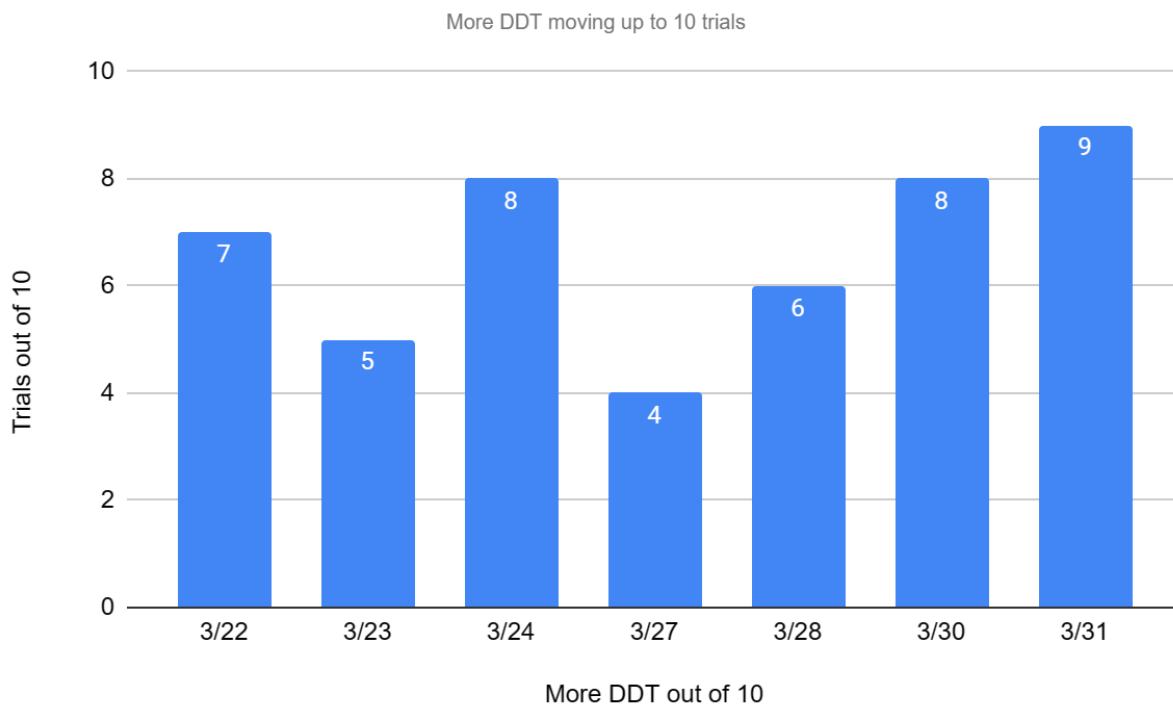
*Note: More DTT trials out of 5*

Based on the team decision, the augmentative and alternative communication (AAC) device was introduced on March 16, 2023. It is a touch talk device with a 4-grid choice that allowed the student to say ‘like’, ‘more’, ‘done’, and ‘I’. The communication device was

introduced as a DTT trial that included a cue, response, and reinforcement as it was being taught to the participant. The data shows such significant growth that trials were increased to 10 on March 22, 2023 (see Figure 5). The AAC device is used to help the student communicate because educators had taught and tried unsuccessfully since the beginning of the school year to communicate using pictures and sign language. “More” was introduced on the AAC device, and educators were able to increase trials. As of March 31, 2023, no “more” trials are being conducted because of successful generalization of the ACC device and communication skills.

**Figure 5**

*“More” DTT Increasing to 10 Trials*



*Note: “More” DTT Increasing to 10 Trials*

Although growth was seen at the beginning of the action research project in the specially designed instruction in Steps B1–B4. In those steps we worked on having the hands down and ready. With that benchmark met D1 was introduced. The D1 step incorporated all the previously learned cues and added eyes- look at me. It was seen and noted that eye contact was difficult for

this individual, which is not abnormal for a child with autism. Based on the previous trial data the first benchmark is the hardest and the others come more easily because of the amount of training that happens with the verbal cue, full physical prompt. The documentation from free play and classroom DTT showed steady gains in the generalization of skills. The biggest area of growth was in the “more” trials after the introduction of the AAC device. The student can communicate ‘more’ and ‘done’ and is able to use it during various parts of the day, no longer in isolation.

### **Discussion**

In this study, the student came into preschool with an IEP, and goals had been set along with minutes for each goal area in specially designed instruction. This could have been a limitation because the student came in with goals set in Early Access, and the preschool setting was completely different from home interventions. During the first 5 weeks of school, I was unable to put in measurable growth in any of the areas. I am not sure if growth was not being seen because there was lack of exposure to skills, or if it was because more scaffolding was needed to teach the student beginning school skills. Something needed to change. At that time, the team met and decided the best course of action would be the implementation of DTT.

One recommendation that I have for teachers or practitioners that serve children with ASD, one of the first steps may be implementing DTT into the routine to teach them the basics that they need. Although the IEP may have originally driven my instruction for the student, when measurable progress was not being made there need to be an adjustment. My research into DTT and team discussion validated the plan. Since starting the trials, there have been measurable gains on the students’ IEP goals. This improvement supports the idea trials can help provide the

scaffolding needed for the generalization of skills but should continually be evaluated to make sure they are effective.

This action research study of the implementation of DTT did result in positive growth in learning capabilities; however, the data significance was not conclusive enough to support the research questions completely. It was evident the student in this study did show an increase in learning capabilities and had begun to exhibit a generalization of skills. Since the learning capabilities were increased it has impacted the learning and how the teaching is taking place for this student. The cue is given first, and then a one- step direction follows. Both the teacher and the paraprofessional are using this approach so that the language is consistent. When the correct response follows the verbal cue given the student is given a tangible preferred reward. The outcome of this research project did reflect and align with Leaf's study on but is an area for future research.

One of the most impactful parts of the process was the paraprofessional and I receiving the training on how to implement DTT, and making sure that consistent language was used. This action research project supported the data from the literature review on training of the person implementing DTT, and aligned with Down's (2008) findings that the amount of times spent in trials was not as significant as once thought. Shorter and more frequent DTT exposures can lead to positive learning outcomes- even generalization of skills into other areas of the classroom. Overall, the most significant growth was seen when the student was given an AAC device, which gave the student a voice.

### **Limitations of the Study**

There are limitations to acknowledge with this study. In the current study, observations and data were collected across different tasks, instead of just a specific task or two per trial,

unlike other DTT studies (Leaf et al., 2018 Young et al., 2016). Another limitation of the study is the student is currently the only 3-year-old in a classroom of 4-year-olds. This is important to note because although the participant is in a classroom of peers, they are 10 to 12 months older, and have a different skill sets they are working on. For instance, 4-year old peers are able to trace or write their name independently and the current skill we are working on is picking up a marker and jabbing the paper. Peers come in hang up their coats, and then proceed to washing their hands. There is currently a first/ then visual being used and the goal is to complete a one- step routine task without adult assistance.

Having one participant limited the results of the study since it was out of 1, but that should not discredit the growth that was seen. The only way to get different results would be to implement this into a classroom or program that had more than one autistic student, but I did not have that opportunity. This process showed that the teacher and paraprofessional were able to take training, implement DTT with fidelity both in isolation and within large and small group, and see some generalization of skills. The student is now able to get ready and sit in a chair to prepare for large or small groups as long as the same cue is used, and there is a preferred reinforcer given when the first step is followed. In free play we see books being picked up and pages turned, that was a DTT skill that was broken down in isolation and is now being completed independently. The student is also using the AAC device to communicate more and like of different sensory wants, snacks and we are progressing with teaching when the student is all done.

### **Further Study**

The results of this study did indicate DTT can be implemented by a trained teacher and paraprofessional. It also supported that DTT can be taught in a relatively short amount of time



and can lead to significant generalization of skill acquisition. As this study was done with both pull-out services and integrated services, the student showed a consistent rate of skill acquisition. The student was able to sit at a table, get ready, and complete tasks hand over hand. This can both be during free play as well as small and large group time. When the que is consistent, even with location change, the getting ready behavior has transferred to other areas of the classroom. Another skill that has not been as consistent is getting ready at the carpet and sitting with peers. Further studies regarding DTT should explore the optimal amount of time DTT needs to be effective.

Additional research is needed to determine what method is most effective to improve communication, generalize skills being taught in isolation, and how to best support learners with ASD. Would that be a tandem strategy using peer imitation and DTT? I am also curious how successful DTT would be in a classroom that has students with other intellectual disabilities such as ADHD, ID, ODD, or is the success of DTT simply consistent for an autism diagnosis. Since the steps are broken down, it could be very successful for both ID and ADHD as long as the reinforcement was preferred. It would be interesting to do a study comparing multiple abilities and seeing what type of progress would be made.

### **Conclusion**

In conclusion, the purpose of this action research study was to see if (a) can DTT be used to improve learning for children with autism? and (b) can DTT be used to generalize skills into the classroom? Ultimately, the research proved that the DTT in use was effective and integrable into other aspects of the classroom and affects children's learning. By training the staff and implementing DTT both in the one-on-one unnatural environment and in the classroom centers, the skills can be taught during explicit instruction. The gain in instruction working one on one

with the student showed that consistent cues and environment allowed the expectation to be taught. Once the cue had been mastered in isolation, it was then introduced into large and small group where it could be practiced and taught less explicitly. The cues were then transferred to other areas of the day such as free play and snack time.

To generalize skills in the classroom that took much more trial and error. It was not as automatic, because there were outside distractions. The longer that DTT was performed, and the cue had been repeated the easier it was to get a response from the student. Once the student connected that there would be a reinforcement given outside of where the specially designed instruction took place the growth began. The areas where growth generalizing the skills to other areas of the classroom, which was one of the main focuses of the study.

The most surprising finding of the research aligned with the study done by Leaf et al. (2018), that studied the amount of time spent in trials. The paraprofessional and I track the time that we spent on trials in DTT with just the student. Depending on what benchmark sometimes it took 12 minutes and other times it took less than 5 minutes to complete the set. Time was not tracked when generalizing the skills into the classroom since it was not as intensive. Out a 12 hour school week, less than 1 hour of time was spent on intensive DTT instruction and gains were still seen. In Leaf's (2018) study it looked at the location and amount of time and came to the same conclusions. Ultimately, early intervention and quality early childhood programs will greatly impact long-term student success for typical and nontypical peers.

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