INSTRUCTIONS, REHEARSAL, MODELING AND FEEDBACK TO TRAIN CORRECT USE OF DISCRETE TRIAL TEACHING: GENERALIZATION OF STAFF AND STUDENT BEHAVIOR

by

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Abstract

INSTRUCTIONS, REHEARSAL, MODELING AND FEEDBACK TO TRAIN CORRECT USE OF DISCRETE TRIAL TEACHING: GENERALIZATION OF STAFF AND STUDENT BEHAVIOR

by

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A limited number of studies have investigated the effects of behavioral skills training (BST) to improve staff use of discrete trial teaching (DTT). BST was used to improve three staff's use of DTT interactions with four children with autism. In addition, the study examined the collateral effects of the training procedure on student performance for three of the children. A multiple baseline design across participants was used to assess the effects of the intervention on staff and student performance. Results indicated that all three staff demonstrated improved accuracy in their use of DTT following training sessions and during follow-up sessions. Student performance on presented tasks also improved following staff's improvement in implementation of DTT. This study extends the current literature by investigating the effects of BST on novel students, novel tasks, and on the effects of the procedure on student performance. Results are discussed in terms of efficacy of BST on improving staff performance and student performance.

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INSTRUCTIONS, REHEARSAL, MODELING AND FEEDBACK TO TRAIN CORRECT USE OF DISCRETE TRIAL TEACHING: GENERALIZATION OF STAFF AND STUDENT BEHAVIOR

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Stimulus generalization of staff performance from the training context to untrained environments, people and tasks is an important, yet overlooked element of staff training. Sarokoff (2004) identified eighteen papers that assessed generalization of staff performance. In a systematic review of the literature of these studies, 16 revealed generalization to various stimuli (e.g., variety of environments, various self-help skills). Most of these studies however, did not program for generalization, rather they simply assessed performance to non-trained stimuli (known as "train and hope", Stokes & Baer, 1977). Only one of those studies investigated generalization of staff performance with discrete trial teaching (DTT). Since Sarokoff (2004) one additional study has investigated generalization of staff performance with DTT.

DTT is an effective method for teaching children with autism (Green, 1996; Grindle & Remington, 2002; Smith, 2001). A discrete trial is a small unit of instruction implemented by a staff member working individually with a student. This method, derived from applied behavior analysis, individualizes and simplifies teaching. It is based on the three-term contingency as it consists of antecedents (discriminative stimuli), behavior (student's response) and consequences (reinforcers, praise or correction). DTT has been used to teach receptive language, expressive language and academic programs. Beginner programs taught using DTT are often receptive language programs (Taylor &

McDonough, 1996). This is important because about 50% of all children with autism are believed to be non-verbal (Lotter, 1966). During DTT a receptive language program requires a target response that is a nonverbal action corresponding to the verbal instructions given by a staff member. For example, the staff member may instruct the student to "Touch head" and the student's response would be to touch his or her head.

Previous research has demonstrated that behavioral skills training (BST) can be an effective procedure to train staff to implement DTT (Koegel, Russo, & Rincover, 1977; Lerman, Vorndran, Addison, & Kuhn, 2004; Sarokoff & Sturmey, 2004; Ryan & Hemmes, 2005; Leblanc, Ricciardi, & Luiselli, 2005). For example, Ryan and Hemmes (2005) examined a BST procedure to increase the accuracy of DTT in three instructors working with children with autism in their homes. In this study, the experimenters identified 12 DTT instructor responses. Post-training data showed mean percentage of accurate responding across 10 teaching sessions of 94.8%, 92.4% and 89.6% for the three instructors. The authors concluded that the post-training responding in the clinical setting was high, and compared their level of performance to four instructors in a typical special education setting that showed mean accuracy of DTT at 70.5%, 48.8%, 70.9%, and 63%. A limitation of this study was that the experimenters did not record baseline data. With the absence of baseline data, the actual effect of the intervention is unknown.

In a related study, Sarokoff and Sturmey (2004) used a four-step staff training package consisting of instruction, feedback, and rehearsal and modeling to train teachers to correctly implement DTT. Three teachers and one 3-year-old child with autism participated. Each teacher taught the same child in the child's home. Prior to this study all three teachers received training in DTT by service providers other than the

experimenter. The dependent measure was the percentage correct usage of 10 components during 10 consecutive discrete trials. During baseline each teacher received written instructions that described the 10 components of a discrete trial. The experimenter used BST to train teachers while the teachers taught the student a match-to-sample task. A teacher remained in training until she achieved a score of 90% or higher accuracy of presentation of DTT on three consecutive training sessions. Each teacher completed training in three sessions of approximately 20 min. During baseline teachers performed fewer than 50% of the components of DTT accurately. After training, the mean proportion of correct teaching for each teacher was 97% or higher. BST quickly improved all three teachers implementation of DTT. A limitation of this study is that the experimenter conducted the training with only one child with autism and on only one task. This makes it difficult to determine if these teachers would have generalized their new skills to other tasks or while working with other students.

In a similar study, Leblanc, et al. (2005) evaluated an abbreviated performance feedback intervention to improve DTT by three assistant teachers working with three children with autism at a specialized day school. The experimenters identified 10 DTT instructional skills. The dependent measure was percentage correct usage of the 10 instructional skills during a session comprised of 30 trials. The sessions consisted of 10 trials of each of three skill programs. During baseline, the assistant teachers exhibited correct use of skills less than 50% of the time. Each assistant teacher met criterion within five sessions. This performance was maintained at follow-up with 90-100% accuracy for all three assistant teachers. The training and the follow-up consisted of each assistant teacher working with the same student during the same three skill programs.

To date, only two of the five studies published on staff performance in DTT examined student responding and investigated generalization of staff performance (Koegel, et al., 1977; Lerman, et al., 2004). For example, Koegel, et al. (1977) assessed whether BST would increase the accuracy with which a teacher used behavior modification procedures correctly and whether there would be generalization to behaviors and students not taught during training. The experimenters evaluated the behavior of 11 teachers and 12 students with autism in different teaching conditions. The experimenters used a multi-response baseline design. The student dependent measure was percentage correct responding by children. In addition, the experimenters measured teacher use of five categories of behavior modification procedures including the use of DTT. During baseline, teachers taught more than one student. Each student was taught one to four different responses. The teachers completed training within 25 hr. There was an increase in accurate teacher performance after training as compared to baseline measures for 10 out of the 11 teachers. The training procedure resulted in generalization of correct use of the procedures to untrained tasks and students. In addition, when teachers used the procedures with high accuracy, their teaching was effective in producing gains in student responding.

Lerman, et al. (2004) investigated the effects of BST on the teaching skills of four certified teachers and one student teacher. Six children with autism also participated. The components described by the researchers for direct teaching procedures were similar to those of DTT. There were three different prompting procedures for direct teaching techniques. The experimenters used a multiple-baseline across teachers. The experimenter assessed generalization of correct teaching skills to novel students and in a

novel context during generalization sessions. During baseline, the teachers implemented less than 50% of the components correctly for each of three direct teaching techniques. During post-intervention, there were increases in correct role-play implementation of all three techniques by all three teachers. The percentage correct implementation of procedures was similar across the three techniques for each teacher. When the teachers began to teach children in the classrooms, the percentage correct teaching for one or more techniques fell below criterion. This occurred even though those sessions included feedback on their performance. The teachers eventually met criterion, but their performance levels were variable with session scores falling below the criterion throughout the post-instruction sessions. The teachers' percentage correct teaching also fell below criterion during the initial generalization sessions. The teachers' percentage correct during generalization sessions was lower than post-instruction sessions conducted in the main classroom. During generalization sessions, accuracy was very variable and fell below criterion throughout the study for all three techniques. During generalization sessions, the experimenter recorded data on student behavior and presented the mean data for the first three sessions and the last three sessions. For all the children taught during generalization sessions, mean percentage correct responding increased for the last three sessions. The efficacy of this staff training model is supported by the corresponding increases in student correct responses.

The previous two studies reviewed (Koegel, et al., 1977; Lerman, et al., 2004) have limitations with respect to generalization and effects on student responding. Koegel, et al. (1977) presented only one baseline session data point that represented a composite score for seven of the 11 teachers. This short baseline did not provide enough

data to evaluate treatment effects of the training procedure. Of the four teachers who had three or four composite baseline sessions, only three teachers showed an increase in correct use of behavior modification procedures after training. Students taught during baseline were different from those students taught during post-training. As the post-training students have no baseline measures, there were no pre-training student data to serve as comparison for their post-training scores. Lerman, et al. (2004) also used an abbreviated baseline with three or fewer baseline sessions for each teacher, making it difficult to evaluate the effects of the intervention. In addition, the experimenters used the first three sessions of the generalization phase as baseline data for the students. A true baseline measure would have represented student data recorded during the baseline phase and not the post-training generalization phase of the study. BST for both studies lasted from 17 – 25 hrs making it time intensive for trainers. The clinical implications of long training procedures are that trainers may be less likely to implement those training procedures with their staff.

The purpose of the current study was to examine if skills staff learned during efficient BST would generalize to novel students and skill programs. In addition, the study examined changes in performance in student responding as a result of staff participation in training.

Method

Overview

The term ‘training student’ refers to Student T whom staff participants taught only during the training phase, and not at any other time during the study. The ‘Training Program’ used to teach the training student during staff training sessions was a match-to-

sample task that was only taught during the training phase, and at no other time during the study. The 'Generalization Program' was a session of ten discrete trials comprised of five different receptive skill programs, none of which staff implemented during the training phase. The term 'generalization student' refers to Student D who staff participants taught only using the Generalization Program. The term 'target student' refers to the Students A, B, and C whom staff participants taught using both the Generalization Program and the Student Target Program. The 'Student Target Program' consisted of ten discrete trials of a single skill program during a session. The Student Target Program was receptive sight words and staff participants did not teach this program during the training phase or in the Generalization Program.

During baseline and follow-up phases, each of the three staff participants taught the generalization student and a target student. The staff member taught the generalization student (Student D) using the Generalization Program, and the target student (Students A, B, or C) using both the Generalization and the Student Target Program. To assess for generalization across students, staff taught the generalization student and the target student only during the baseline and follow-up phases, and not during the training phase. To assess for generalization to non-trained teaching programs, staff implemented the Generalization Program and the Student Target Program only during baseline and follow-up phases. During the training phase, training occurred while the three staff participants were each teaching the training student (Student T) using the Training Program. Staff participants only taught the Training Program and the training student during the training phase.

The study consisted of three experimental phases conducted in the following order: baseline, training, and follow-up (see Table 1). During each phase, a staff member used DTT to teach a student in ten-trial sessions. During the baseline and follow-up phases, a session consisted of a staff member teaching one of two students using one of two types of programs (Generalization Program or Student Target Program). During the training phase, the staff member taught Student T (training student who was different from the students taught in the baseline and follow-up phases) a matching-to-sample task that was never taught during the baseline and follow-up phases. During the baseline and follow-up phases staff taught Students A, B, and C (target students) both the Generalization Program and the Student Target Program, and taught Student D the Generalization Program. During the training phase, staff taught Student T (training Student) the Training Program.

Participants and Setting

Staff. The experimenter conducted the study at a small school for children with autism. Staff members at the school served as staff participants. Their job included providing one-on-one teaching of the students. A pre-screening procedure was used to identify staff performing DTT below 50% accuracy. The pre-screening identified five eligible staff members. Of the five eligible staff, three were randomly chosen to participate in the study. All three staff participants were female teaching instructors. The staff participants had no training in DTT before working at the school. Mean tenure at the school was 11 months.

Students. Five children with autism who attended this school participated. Students eligible to participate were students who had receptive language programs as

part of their daily educational programming. Six eligible students were identified. Of the six eligible students, five were randomly chosen to participate in this study. All five students were male. Written permission from the parents was obtained. Target students were Students A, B, and C, and did not participate in staff training sessions. Mean age of the target students was five years old. Students A and C had some receptive language, but little to no expressive language. They engaged in little to no appropriate play or social interactions. Student B had both receptive and expressive language, but rarely initiated speech except with adults for highly preferred items. He had some appropriate play and social interactions. The generalization student was Student D. Student D also did not participate in staff training sessions. Student D was five years old and had some receptive language with minimal to no expressive language. He engaged in little to no appropriate play or social interactions. The training student was Student T. Student T participated only during staff training sessions. Student T was seven years old and had some receptive language with minimal to no expressive language. He engaged in some appropriate play, but little to no social interactions. No standardized IQ test scores were available for any of the five children.

Assignment of Students. Each of the three staff participants taught Student D during baseline and follow-up phases, due to the constraints resulting from a small number of eligible students in the school. During baseline and follow-up sessions Staff 1, Staff 2 and Staff 3, taught Students A and D, Students B and D, and Students C and D, respectively. In order to assess generalization of staff skills learned during training to more than one student, all three staff participants taught Student D. By adding Student D

to the study, each staff member had two students to teach during baseline and follow-up. Table 1 shows the assignment of students to staff during the three experimental phases.

It is important to note that Student D received DTT by all three staff members. This differs from Students A, B, and C who each were taught by a single staff member. It is common in schools using the principles of applied behavior analysis to have students taught by many staff members and not just a single staff member. The role of Student D in this study was modeled after a typical teaching environment found in these schools.

Design

To show experimental control, the experimenter used a multiple-baseline design across staff members/students. Two types of sessions were identified. Sessions that the staff implemented the Generalization Program and sessions that staff implemented the Student Target Program. In order to assess generalization of staff performance across a variety of skill programs, the Generalization Program consisted of sessions in which the staff member implemented five receptive language responding programs in sessions of ten trials. The Generalization Program was useful in measuring generalization of staff performance from the single skill program taught during the training phase to the five skills programming taught during the Generalization Program in the baseline and follow-up phases. The student responding data from the Generalization Program, however, were not useful, because the percentage correct for that session did not give any information on responding for any one specific skill. The student responding data from the Generalization Program represented percentage correct responding across all five different skills. In order to control for student responding on one specific skill, it was necessary to implement the Student Target Program. During sessions that the staff

implemented the Student Target Program, only one skill (receptive sight words) was taught. This allowed for comparison of a target student's responding between baseline and follow-up.

Dependent Measures

The dependent measures were staff percentage correct usage of 10 components of DTT on 10 discrete trials and target student percentage correct responding during 10 discrete trials. Table 2 lists the ten components of DTT and are the same as those used in Sarokoff and Sturmey (2004) with the exception of the definition of the inter-trial interval (ITI). In this study the experimenter modified the definition used in the 2004 study to include varying the duration of the ITI from trial to trial in order to prevent the ITI from being the same duration from trial to trial. In this way, a student's attending behavior should not come under the stimulus control of time elapsed between trials, but instead, the instructional control of the staff member.

Student correct responding was defined as when the student correctly identified the target sight word as instructed by the staff member. A field of three words was displayed on the table in front of the student. The student was required to touch the target sight word for that trial to be scored as correct.

Procedure

To clarify the procedure, Table 1 displays for each phase of the study the students who participated, the staff who taught him and which type of program she taught.

Baseline. Throughout baseline, staff used DTT to implement two types of sessions (Generalization Program and Student Target Program). The experimenter gave each staff member a written list of the 10 components of DTT (Table 2) only during the

first session of baseline (Sarokoff & Sturmey, 2004) and not during the remaining sessions of baseline. At the beginning of each session, the experimenter stated, "Do discrete trial teaching to the best of your ability." The staff member then performed ten consecutive trials and the experimenter videotaped the session.

Generalization Program. Staff implemented the Generalization Program during baseline and follow-up. The Generalization Program consisted of sessions in which the staff member implemented five receptive skill responding programs in sessions of ten trials. A staff member taught two discrete trials of each of the five skill programs during a single session. The staff participant presented each skill program twice in a random order for a total of ten trials per session. For Student A, these programs included receptive body parts identification, receptive letter identification, one concept commands, receptive picture identification, and gross motor imitation. For Student B, the Generalization Program consisted of gross motor imitation, receptive color identification, receptive number identification, one concept commands, and receptive letter identification. For Student C, the Generalization Program consisted of gross motor imitation, receptive body parts identification, greeting reciprocation, one concept commands, and action with objects imitation. For Student D, these programs included receptive body parts identification, receptive number identification, one concept commands, receptive picture identification, and gross motor imitation.

For a better understanding of what DTT during the Generalization Program consisted of a few examples will be given. For example, the gross motor imitation program consisted of a staff member facing a student, modeling a simple action such as clapping and stating the command "Do this". The student was required to imitate and

engage in clapping. For the one concept command program, a staff member sat facing the student and gave a simple command, such as “stand”. The student was required to standup. For receptive number identification, on the table was displayed three stimuli, the target number plus two distractor numbers. The staff member stated the command “Touch (target number)”. The student was required to touch and identify the target number from the field of three stimuli.

Student Target Program. Staff implemented the Student Target Program in baseline and follow-up. Only Students A, B, and C participated in the Student Target Program sessions. Student D was not taught using the Student Target Program. This was because all three staff participants taught Student D, making it impossible to determine if increases in accurate presentation of DTT by any one or all staff participants was responsible for changes in Student D’s responding.

The Student Target Program was a single receptive skill program (sight words). As a result, comparison of student correct responding on a single skill between baseline and follow-up was available. Receptive sight words were not addressed in the student’s daily school schedule. The experimenter recorded data on both staff and student behavior when a staff member taught the Student Target Program. Teaching a single skill to a target student allowed for comparison of Student A, B, and C’s responding throughout the study as a staff member’s DTT skills increased in accuracy. The staff implemented the Student Target Program during two out of every six sessions throughout baseline and follow-up phases. The experimenter recorded target student’s responding data only during sessions in which the staff member implemented the Student Target Program.

During receptive sight words, three stimuli were displayed on the table, the target sight word plus two different sight words that served as distractors. The staff member stated the command "Touch (target word)". The student was required to identify the target word by touching or pointing to the correct word from the field of three words.

Scheduling of Sessions. The order in which a staff member taught Students A, B, C, and D and the presentation of the Generalization Program and the Student Target Program were randomly assigned in blocks of six sessions (see Table 3). The experimenter presented each block nine times. Table 3 indicates which student Staff 1, 2 and 3 worked with, and the type of session that was conducted (Generalization Program or Student Target Program).

Training. During training, all three staff performed DTT with Student T only. BST used to train the staff was the same as Sarokoff and Sturmey (2004). The training took place only with match-to-sample receptive language programming (training program). A field of three stimuli was displayed on the table. The staff member handed the student a sample stimulus and gave the command "Put with same". The student was required to place the sample stimulus on top of the corresponding identical stimulus in the field of three comparison stimuli. Table 4 outlines the temporal sequence of the staff training procedure. No data were recorded during the rehearsal phase of training. The training procedure was exactly the same for each training session.

Training probes. Following implementation of training steps one through ten (See Table 4), the experimenter conducted a session of ten training probe trials. The experimenter scored the ten training probe trials that occurred following training (See

Table 4, Step 11) from the videotape. A staff member remained in training until she achieved a score of 90% or higher across three consecutive training probe sessions.

Follow-up. Throughout follow-up, staff used DTT to implement either the Generalization Program or the Student Target Program. The procedure used during follow-up sessions was the same as during baseline with the exception that the experimenter did not provide a written list of components during follow-up. At the beginning of each follow-up session, the experimenter stated, "Do discrete trial teaching to the best of your ability". During the follow-up phase, the experimenter did not conduct any training. During follow-up sessions, each staff member worked with a target student or the generalization student using the Student Target Program or the Generalization Program in sessions of ten trials. Students and Programs were randomized assigned using the same procedure as in baseline.

Data Collection. The experimenter recorded data on staff performance of DTT during every session throughout the study. She also recorded data on each target student's performance during sessions that a staff member implemented the Student Target Program. As a result, the treatment of Student D was different from that of Students A, B, and C because Student D did not receive instruction using the Student Target Program. Thus, Student D did not have responding data recorded on his performance. The experimenter recorded data, however, on staff performance while each staff member was engaged in DTT with Student D. During Generalization Program sessions, data were not recorded on Student D or the target students' responding.

The experimenter also recorded on videotape each observation session of teaching performance and student responding. The session was scored from the videotape. The

experimenter recorded staff performance data on a data sheet listing the ten components with boxes for 10 opportunities per component during each trial. The experimenter recorded a 'plus' representing that component was correct or a 'minus' representing an incorrect component. The experimenter scored a component as correct if the staff member performed that component according to the definition listed in Table 2. The experimenter calculated the total percent correct by dividing the total number of correct teacher responses by the total number of correct and incorrect responses and multiplying the results by 100 percent.

In addition to recording staff behavior, the experimenter recorded target students' responding during sessions that staff implemented the Student Target Program. Staff 1, Staff 2, and Staff 3 taught the Student Target Program to Student A, Student B, and Student C, respectively. The experimenter recorded responding data for the target student during the presentation of ten-trial sessions when the staff participants taught only receptive sight words (Student Target Program). When a student correctly identified the sight word as instructed by the staff member, the experimenter scored the trial as correct. The experimenter calculated correct responding by dividing the total number of correct student responses by the total number of correct and incorrect responses and multiplying the results by 100 percent.

Interobserver Agreement

Interobserver agreement (IOA) data were collected throughout 35% of sessions distributed across baseline and follow-up phases for all three staff and Students A, B, and C. A trained observer recorded data from the videotape of a session. IOA was calculated by dividing total number of agreements by the total number of agreements plus

disagreements, multiplied by 100 percent. Agreement during baseline for Staff 1 use of DTT was 90% with a range of 87-97%, and 98% during follow-up with a range of 96–100%. IOA during baseline for Staff 2 use of DTT was 94% with a range of 93-98%, and 97% during follow-up with a range of 95–100%. Agreement during baseline for Staff 3 use of DTT was 96% with a range of 90-98%, and 99% during follow-up with a range of 98–100%. IOA during both baseline and follow-up for Students A, B and C were 100%.

Treatment Acceptance Assessment

After the final session, each staff members anonymously completed a 7-item Likert-type questionnaire (Reid & Parsons, 1995) to assess her acceptance of the training procedure (Appendix A). The scale was scored from one to seven with a score of seven indicating the highest level of acceptability.

Results

Figure 1 shows the percentage correct presentation of DTT while Staff 1, 2, and 3 taught Student D the Generalization Program and Student T the Training Program. The top panel depicts results for Staff 1, the middle panel depicts results for Staff 2, and the bottom panel depicts results for Staff 3. During baseline, Staff 1's proportion of steps of DTT emitted correctly showed a descending trend with range scores of 39-49%. During training probes, Staff 1 worked with Student T on a match-to-sample task and met criterion in three sessions with three consecutive scores of 97%, 95%, and 98% respectively. During follow-up, the change in level was large, increasing to range 94-100% correct implementation of DTT with no trend and little variability. During baseline, the proportion of steps of DTT that Staff 2 emitted correctly showed a descending trend with range 36-50% correct implementation of DTT. During training

probes, Staff 2 worked with Student T on a match-to-sample task and met criterion in three sessions with 99%, 95%, and 97% correct implementation of DTT respectively. During follow-up, the change in level was large, increasing to range 97-100% correct implementation of DTT with no trend and little variability. The proportion of steps of DTT that Staff 3 emitted correctly also showed a descending trend during baseline with range 22-38% correct implementation of DTT. During training probes, Staff 3 worked with Student T on a match-to-sample task and also met criterion in three sessions with 95%, 97%, and 99% correct implementation of DTT respectively. During follow-up the change in level was large, increasing to range 98-100% correct implementation of DTT with no trend and little variability.

Figure 2 shows the percentage correct presentation of DTT while Staff 1, 2, and 3 worked with Students A, B, and C, respectively. All three staff worked with Student T during the training phase. The top panel depicts results for Staff 1 working with Students A and T, the middle panel depicts results for Staff 2 working with Students B and T, and the bottom panel depicts results for Staff 3 working with Students C and T. Closed circles depict sessions that staff taught the Generalization Program, closed triangles depict data that staff taught the Student Target Program and open circles depict sessions that staff taught the Training Program. During baseline, Staff 1 taught Student A the Student Target Program. The proportion of steps of DTT that Staff 1 emitted correctly showed no trend and little variability with range 33-40% correct implementation of DTT. Also during baseline, Staff 1's proportion of steps of DTT emitted correctly showed a descending trend while she taught the Generalization Program with range 31-36% correct implementation of DTT. During training probes, Staff 1 worked with Student T on a

match-to-sample task and met criterion in three sessions with 97%, 95%, and 98% correct implementation of DTT, respectively. During follow-up, the change in level was large, increasing percentage correct implementation of DTT to a range of 91-100% and 94-99% while she taught the Student Target Program and the Generalization Program, respectively with no trends and little variability. During baseline, Staff 2 while she taught Student B the Student Target Program showed a descending trend with range 35-42% of proportion of steps of DTT emitted correctly. Also during baseline, Staff 2 showed no trend with little variability of proportion of steps of DTT emitted correctly with range 38-41% correct implementation of DTT while she taught Student B the Generalization Program. During training probes, Staff 2 worked with Student T on a match-to-sample task and met criterion in three sessions with 99%, 95%, and 97% correct implementation of DTT, respectively. During follow-up, the change in level was large, increasing to range 98-100% correct implementation of DTT while she taught both the Student Target Program and the Generalization Program with no trends and little variability. During baseline, Staff 3's proportion of steps of DTT emitted correctly showed a descending trend while she taught Student C the Student Target Program with range 26-49% correct implementation of DTT. Also during baseline, Staff 3's proportion of steps of DTT emitted correctly showed no trends and little variability with range 32-39% correct implementation of DTT while she taught Student C the Generalization Program. During training probes, Staff 3 worked with Student T on a match-to-sample task and also met criterion in three sessions with 95%, 97%, and 99% correct implementation of DTT, respectively. During follow-up, the change in level was large, increasing to range 99-100% and 96-100% correct implementation of DTT while she

taught the Student Target Program and the Generalization Program, respectively with no trends and little variability.

Student Performance

Figure 3 shows student percentage correct responding during the Student Target Program for Students A, B, and C. The top panel depicts results for Student A, the middle panel depicts results for Student B, and the bottom panel depicts results for Student C. During baseline, the percentage of Student A's correct responding depicted a descending trend with range 20-40% correct responses. During follow-up there was an increase in level with range 50-100% correct responses with an increasing trend for the first eight sessions followed by a flattening of the function at 60%. During baseline, the percentage of Student B's correct responding also depicted a descending trend with range 30-60% correct responses. During follow-up there was an increase in level with range 80-90% correct responses with no trend and little variability. During baseline, the percentage of Student C's correct responding for the first five sessions showed range 0-30% correct responses with a single session spike of 30 % and then his responding stabilized at 10% for the next six sessions. During follow-up there was an increase in level with range 30-60% correct responses, with a median of 50% with an increasing trend.

Acceptability Questionnaire

The staff member's responses on the acceptability questionnaire showed that staff rated the staff training package as highly acceptable on a scale of 1-7 with a mean score of 6.6, and a median of 7 with a range of 5-7. Acceptability ratings were based on staff responses on three questionnaires consisting of 7 questions for a total of 21 questions.

Discussion

The behavioral skills training package of instructions, rehearsal, modeling and feedback was effective in producing an increase in all three staff member's performance of DTT in a relatively short period of time. These results replicate the results of Sarokoff and Sturmey (2004). Moreover, these findings extend the previous research because the increase in accurate presentation of DTT generalized from the staff working with a training student implementing a training program to two students who did not participate in training. Also, BST resulted in staff's increase in accurate performance in generalized conditions. Furthermore, student's correct responding during the Student Target Program appeared to be a function of staff performance of DTT. When staffs' accurate presentation of DTT increased during follow-up, students' correct responding on the Student Target Program increased from the levels observed during baseline. The increase in accurate student performance was associated with the increase in accurate staff performance.

The staff training procedure was more time efficient as compared to training from previous studies that have examined student responding and generalization of staff performance (Koegel, et al., 1977; Lerman, et al., 2004). In those studies training took approximately 17-25 hrs to complete. In the current study, each staff member completed training in approximately one hour. Thus, the training procedure was more efficient and as a result, trainers may be more likely to use this training procedure when training their staff in clinical settings.

This study extends the current literature on staff training in DTT (Koegel, et al., 1977; Sarokoff & Sturmey, 2004; Ryan & Hemmes, 2005; Leblanc, et al., 2005) by

demonstrating that the skills that staff acquired during training generalized across novel students and to novel skill programs. Few studies have previously investigated the generalization of staff's skill acquisition following staff training using behavior modification procedures including DTT (Koegel, et al., 1977; Lerman, et al., 2004). These studies, however, used abbreviated staff performance baseline measures making it hard to determine the effectiveness of the staff training procedure.

Sarokoff and Sturmey (2004) used the same behavioral skills training package to train staff, however, in that study the experimenters used the same student and the same task during all three phases of the study. During training, in the current study staff taught a training student using a match-to-sample task. During baseline and follow-up, staff taught a target student and Student D using the Generalization Program and the Student Target Program. Student D and the target students did not participate in training, thus the skills acquired by staff during training generalized from the training student to the target students and Student D. Neither the Generalization Program nor the Student Target Program included the match-to-sample task used in training.

All three target students showed increases in correct responding for the Student Target Program during follow-up sessions. This is a contribution to the literature because few studies to date on staff training using DTT (Koegel, et al., 1977; Lerman, et al., 2004) have examined the effects of the staff training package on the performance of the students. These results replicate the findings of Koegel, et al. (1977) and Lerman, et al. (2004) which showed when teachers demonstrated high accuracy in their presentation of behavior modification procedures including DTT, their teaching yielded gains in student responding. This study extends the previous research because student's correct

responding during the Student Target Program appeared to increase as a function of accurate staff performance of DTT. Previous studies did not show experimental control over student responding. This finding adds social validity to the current study. It is important to know that the increase in accuracy of staff performance was associated with increases in student correct performance. Additionally, staff rated the staff training package as highly acceptable during a post-study questionnaire, supporting treatment acceptance of this study.

One possible explanation for the replicable results across all three students on correct responding is that these three students had prior experience with DTT. This experience may have effected the student's responding on the Student Target Program. It is possible that children with no prior experience in DTT may not show the same increase in correct responding. This variable might be of interest for future studies.

It is important to note that Student C did not show the same level of accuracy in responding during follow-up as compared to Students A and B. Student C during baseline showed a range of 0-30% correct responses. During follow-up there was an increase in level with range 30-60% correct responses. Students A and B, however, during follow-up showed a range of 60-100% correct responses. The lower accuracy for Student C may be a result of the staff not being able to identify a tangible that served as a reinforcer for Student C. Student C was only four years old with no mastered pre-requisite skills for receptive sight words. It is plausible that Student C's acquisition curve on the Student Target Program was lower than that of Students A and B because of reinforcer issues or not having previously mastered the pre-requisite skills necessary to

learn sight words. Future research should investigate student performance only for skills that a student has the pre-requisite skills to learn.

Although the experimenter did not program for generalization, there were implicit generalization strategies such as common stimuli and multiple exemplars used in this study. The data sheets used during training were the same as those used during baseline and follow-up, this is an example of programming for common stimuli (Stokes and Baer, 1977). In addition, by increasing good teaching behavior in the classroom, there were multiple exemplars available of models of correct performance. For example, for a staff member in a classroom with other staff accurately performing DTT there are now increased examples of staff getting eye contact before delivering a command. These models may have served as multiple exemplars of correct performance for those staff members participating in the study. Using multiple exemplars is another strategy used to program for generalization (Stokes & Baer, 1977). It is plausible that although the experimenters did not actively program for generalization, there were generalization strategies inherit in the training procedure.

It is important to note that during baseline, the experimenter handed the staff member a list of the definitions of the ten components of DTT. However, this was not done during the follow-up phase of the study, resulting in differences between the two experimental phases. The high level of accurate responding by all three staff members during follow-up suggests that this was probably not an important variable in the follow-up phase.

One limitation of this study was that the author and experimenter of this study was also the Director of the school where the study took place, and in that capacity was

also staff's supervisor. This may limit the external validity of the study. Future research should replicate this study using an experimenter who is not also the staff's supervisor.

It is possible that the presence of the experimenter videotaping the sessions may have acquired stimulus control over of the staff's behavior. Since the experimenter was overtly present during every session there may have been some effect of the experimenter. Future research could minimize such effects by using covert data collection procedures.

The experimenter did not record data on the performance of a staff member during the rehearsal phase of the training procedure. As a result, the training probes do not show an acquisition curve, but a large jump in correct responding between baseline and the training probes. Future research should record data during the training session to show the learning curve of each staff member.

It is important to note that all the programs taught during the course of this study were receptive language programs. There are some similarities amongst many of the programs such as when stimuli were involved in programming. In programs such as number identification, letter identification, color identification, receptive sight words and picture identification, the student's response was to physically identify the target stimulus. The training program was a match-to-sample task requiring one stimulus being placed on top of another stimulus to identify a match. It is plausible that the similarities of these responses resulted in the generalization of staff performance from the training task to the Student Target Program and the Generalization Program.

Another limitation of this study was that although BST was responsible for the increase in accurate DTT, it is not possible to determine what variables were responsible

for those skills generalizing from one student to another or from one task to another. Additional research should investigate potential independent variables responsible for generalization of staff skills. Multiple exemplar training (Stokes & Baer, 1977) or general case training (Horner, Sprague, & Wilcox, 1982) is effective procedures when programming for generalization of staff performance. Additional studies should systematically investigate general case training procedures by analyzing all the discriminative stimuli that control staff behavior and all the responses that staff members are required to engage in during teaching.

In light of the limitations just noted, additional research could program for generalization of skills learned during staff training by using a multiple exemplar (Stokes & Baer, 1977) or a general case training strategy (Horner, et al., 1982). Future studies should investigate the effects of the staff's increased accurate performance of DTT on the students' maladaptive behavior.

This study offers a quick, cost effective staff training package that results in improved presentation of DTT by staff that generalized to novel students and novel tasks and showed a corresponding improvement in students' accurate responding. Future research on training staff to implement DTT correctly should conduct a component analysis to determine which components of the behavioral skills training package are necessary to train staff in DTT effectively. Perhaps to produce a more cost-effective staff training procedure with the same outcomes a trainer can eliminate some components of this package. To disseminate this technology on a large scale, research should continue into methods of staff training in DTT, and as a result trainers will gain technology to

teach staff working with children with autism to be more accurate. This in turn will improve the accuracy of the students with whom they teach.

Table 1

Summary of design

Baseline phase	Training phase	Follow-up phase
Generalization Program	Training Program	Generalization Program
Staff 1 w/ Students A and D	Staff 1 w/ Student T	Staff 1 w/ Students A and D
Staff 2 w/ Students B and D	Staff 2 w/ Student T	Staff 2 w/ Students B and D
Staff 3 w/ Students C and D	Staff 3 w/ Student T	Staff 3 w/ Students C and D
Student Target Program		Student Target Program
Staff 1 w/ Student A		Staff 1 w/ Student A
Staff 2 w/ Student B		Staff 2 w/ Student B
Staff 3 w/ Student C		Staff 3 w/ Student C

Table 2

Definitions of the ten components of a discrete trial

Discrete Trial Components	
Behavior	Definition
Eye contact	The instructor makes eye contact with the student or has the student establish eye contact with the instructional materials for a minimum of 1 sec contiguous to delivery of a verbal instruction.
Readiness response	The instructor gives no verbal instruction until the student's body is oriented toward the instructor and his hands and legs are not moving before each verbal instruction.
Delivers instructions once	The verbal instruction is presented only one time per trial. Any repetition of the verbal direction either in full or in part is an incorrect teaching procedure.
Verbal Instructions	The verbal instruction is delivered with clear articulation, and matches verbatim the specific verbal instruction designated for that program. Each instruction will be a specific set of words defined in each program as the discriminative stimulus.

(Table continued)

Table 2 (continued)

Discrete Trial Components	
Behavior	Definition
Correction Procedure	A predetermined gestural, physical or verbal prompt designated for each program is delivered within 3-5 seconds of the verbal direction after a failure of the student to respond. The predetermined prompt should be used contiguous to any incorrect response that is given.
Appropriate reinforcement	Only correct responses will be consequeted with a tangible reinforcer contingently on a correct response. The tangible reinforcer will be presented simultaneously with verbal praise. No tangible reinforcement will be provided for incorrect responses, or while the student is engaged in inappropriate behavior, even following a correct response.

(Table continued)

Table 2 (continued)

Discrete Trial Components	
Behavior	Definition
Specific praise	The delivery of a behavior-specific statement is provided concurrently with delivery of reinforcement. For example, The instruction "Touch nose," is followed by the student making eye contact with the instructor concurrently providing praise such as "Good, touch nose"
Immediacy of Reinforcement	The instructor states the behavior specific praise within1 s following a correct response and continues to present praise for the correct response until after delivery of the tangible reinforcer.
Data Collection	A plus or a minus is recorded on data sheet after each trial.

(Table continued)

Table 2 (continued)

Discrete Trial Components	
Behavior	Definition
Intertrial Interval	Following the end of a trial (usually represented by the presentation of reinforcer or correction procedure) the teacher pauses for a minimum of 1 sec before delivery of the next verbal instruction, beginning the next trial. The duration of the ITI must vary from trial to trial.

Table 3

Scheduling of sessions for Staff 1, 2, and 3

Staff 1	Session	Generalization Student	Generalization Program	Student Target Program
	1	A		X
	2	D	X	
	3	D	X	
	4	A	X	
	5	D	X	
	6	A		X

Staff 2	Session	Generalization Student	Generalization Program	Student Target Program
	1	D	X	
	2	B		X
	3	D	X	
	4	B	X	
	5	B		X
	6	D	X	

(Table continued)

Table 3 (continued)

Staff 3	Session	Generalization Student	Generalization Program	Student Target Program
	1	C		X
	2	D	X	
	3	D	X	
	4	C	X	
	5	C		X
	6	D	X	

Table 4

Temporal Sequence of Training Procedure

	In Office
1.	The experimenter handed to the staff member a written list of the 10 components of a discrete trial.
2.	The experimenter stated each of the operational definitions of the 10 components of a discrete trial.
3.	The experimenter handed to the staff member a written copy of her current graph and previous session data sheet.
4.	The experimenter stated the score and described the staff member's accuracy on each of the ten components as performed during the last session.
	In Classroom
5.	The experimenter set a timer for 10 min.
6.	In the rehearsal phase of training, the staff member sat with Student T and the experimenter stated, "Do discrete teaching to the best of your ability". The staff member then performed three discrete trials on a match-to-sample task without interruption.
7.	The experimenter provided the staff member with descriptive spoken feedback immediately following the performance based on the staff member's performance of each of the three discrete trials. Feedback included positive comments on target components performed correctly and informative feedback on components that the staff member needed to practice.
8.	During the modeling phase of training, the experimenter sat with Student T and modeled three discrete trials.
9.	Before each model trial, the experimenter verbally identified one or more of the components incorrectly implemented by the staff member and asked her to pay close attention to the model to observe how those component should be performed.
10.	Steps 6 – 9 were repeated until the timer rang indicating that 10 min. had elapsed. A staff member practiced between 15 – 18 trials during the 10 min. rehearsal and modeling phase of the training session.
11.	Following the 10. min rehearsal and modeling phase of the training session, a training probe was conducted. The experimenter stated "Do discrete teaching to the best of your ability". The experimenter then videotaped the next ten uninterrupted training probe trials of the staff member working with Student T on a match-to-sample task.

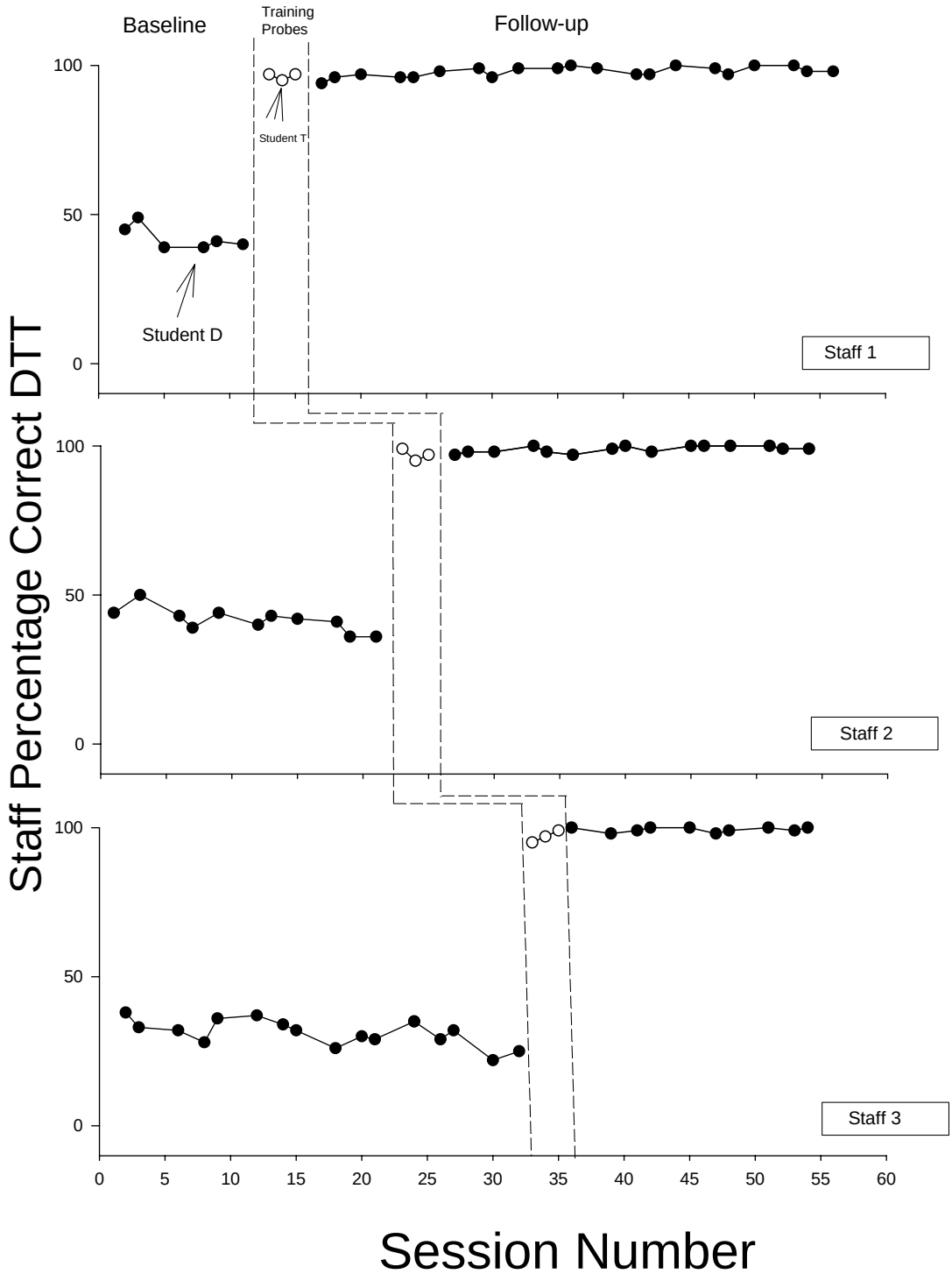

Figure 1. The percentage of correct implementation of discrete trial teaching for Staff 1, 2, and 3 while teaching Student D the Generalization Program and Student T the Training Program.

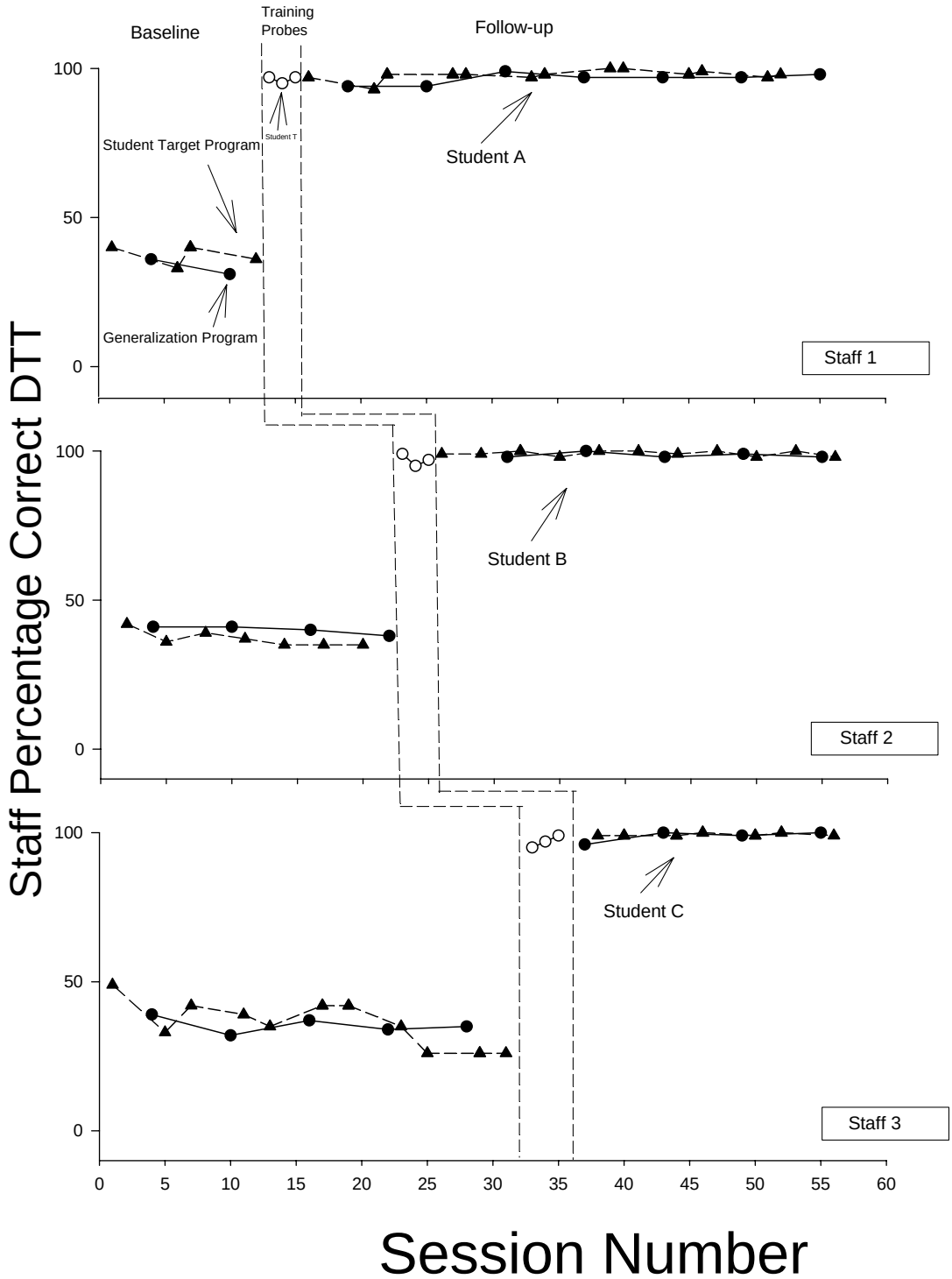

Figure 2. The percentage of correct implementation of discrete trial teaching for Staff 1, 2, and 3 while teaching Students A, B, and C, respectively, the Student Target Program and the Generalization Program, and while teaching Student T the Training Program.

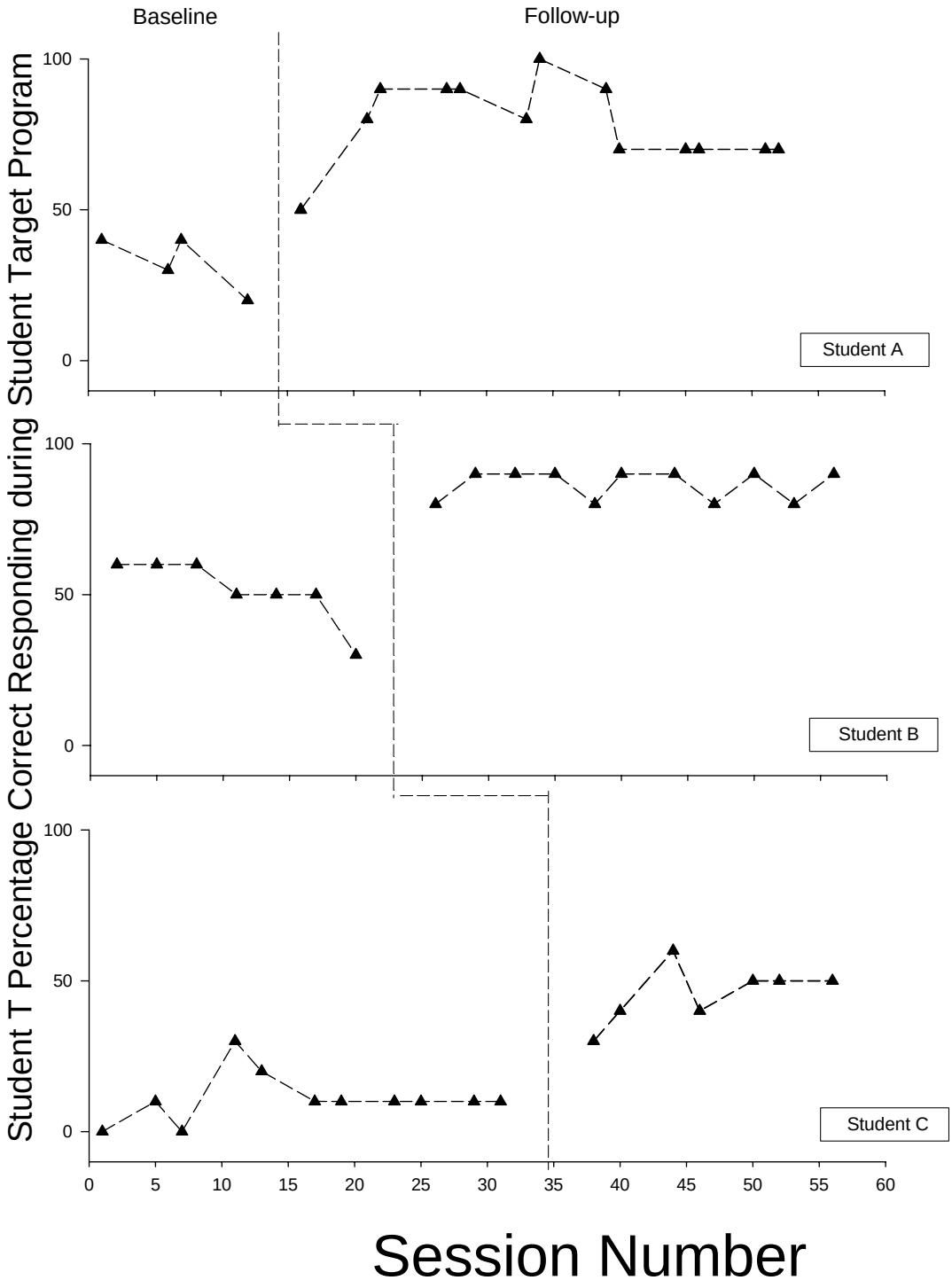

Figure 3. The percentage correct responding for Students A, B, and C while working on the Student Target Program.

Appendix A
Staff Satisfaction Questionnaire

Please write a numeric response for each question.

1. How would you rate the quality of the training you received?
1 (poor) – 7 (excellent)

2. Did you get the type of training you expected and/or wanted?
1 (definitely not) – 7 (most definitely)

3. To what extent has the training you received met your needs in working with children with autism?
1 (none of my needs have been met) – 7 (all of my needs have been met)

4. Would you recommend our training to other staff members or professionals?
1 (definitely not) – 7 (most definitely)

5. How satisfied are you with the amount of training you received?
1 (quite dissatisfied) – 7 (very satisfied)

6. Have the training you received help you work more effectively with other students in the school?
1 (no, made it worse) – 7 (yes, helped tremendously)

7. If this training opportunity was made available to your colleagues, would you recommend they participate?
1 (definitely not) – 7 (most definitely)

Please add any general comments related to the training.

_____
_____
_____
_____
_____
_____
_____
_____

Thank you for participating. Please place in the Clinical Director's mailbox upon completion.

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