Instructing university students to conduct discrete-trials teaching with confederates simulating children with Autism

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An essential component of applied behavior analysis programs for teaching children with autism is discrete trials teaching. Experiment 1 investigated the effectiveness of a self-instructional manual for teaching university students to correctly apply discrete-trials teaching to teach three tasks to confederates role-playing children with autism. Experiment 2 investigated a training package consisting of the self-instructional manual combined with accurate scoring of a videotape of an experienced tutor conducting discrete-trials teaching with a confederate role-playing a child with autism. The results suggest that self-instructional strategies have considerable potential for instructing participants to conduct discrete-trials teaching.

As a result of extensive research since the 1960s, applied behavior analysis (ABA) was recognized by the Surgeon General of the United States as the treatment of choice for children with autism (Department of Health, 1999). Intensive early ABA intervention (approximately 35 hours per week for at least two years) can lead to substantial improvements in young children with autism, with significant numbers of children receiving such treatment going on to become indistinguishable from their peers in regular educational settings (Lovaas, 1987, Lovaas, Smith, & McEachin, 1989; Rosenwasser & Axelrod, 2001; Sallows & Pamlynn, 2005; Smith, Groen, & Wynn, 2000; Smith, Eikeseth & Klevestrand, 1997). In such programs, the most common instructional strategy is discrete-trials teaching. With this approach, the teacher presents an antecedent, waits for the child to respond, and then provides an immediate consequence, and repeats these steps many times in fairly rapid succession during a teaching session. However, very few studies have examined methods for instructing tutors and parents how to implement

discrete-trials teaching. This research investigated two strategies for instructing university students to conduct discrete-trials teaching sessions with confederates role-playing children with autism.

In previous research on this topic, Koegel, Russo, and Rincover (1977) assessed the performance of 11 teachers, during baseline and post-training, on their use of discrete-trials, presenting discriminative stimuli, presenting appropriate prompts, shaping, and managing consequences. Training was delivered via a written manual describing correct and incorrect teaching responses, a videotape for the purpose of modeling correct and incorrect applications of procedures, feedback, and practice sessions. The experimenters reported that participants completed their training within 25 hours and were able to achieve mastery of the skills.

Sarokoff and Sturmey (2004), evaluated a behavioral skills treatment package based on its application to three special education teachers, all of whom had received previous training in discrete-trials teaching. Using a multiple-baseline design across subjects, the study indicated that the treatment package, consisting of instructions, feedback, rehearsal, and modeling, produced a significant improvement in all three teachers implementations of discrete-trials teaching. Correct teaching responses for the teachers increased from baseline proportions of 43%, 49%, and 43% to 97%, 98%, and 99% respectively.

Ryan and Hemmes (2005) trained three special education teachers specializing in autism, none of whom had been previously trained in discrete-trials training, using vocal, written, and video instruction, modeling, in vivo practice, and performance feedback. Results of the study indicated that training procedures were useful in training instructors and other paraprofessionals to demonstrate and maintain discrete-trials teaching skills.

Gilligan (2007) taught three female educational staff members to use discrete-trials teaching with children with developmental disabilities in a multiple-baseline design across participants. The intervention consisted of written skill objectives, observation, feedback based on observations, positive reinforcement, error correction, and practice time. Performance

was measured during instructional sessions and analyzed into five components of discrete-trials teaching. All participants demonstrated significant improvement throughout the intervention, achieving nearly 100% accuracy by the end of the study.

Despite the strengths of the studies listed above, they have several limitations. First, although inter-observer reliability checks on the dependent measure were conducted in all studies, none included procedural integrity checks to ensure that the training procedures were carried out as described. Second, training and feedback procedures were described only briefly, making systematic replications difficult. Third, the amount of training was considerable, such as 25 hours in the Koegel et al. (1977) study, and an estimated 30 hours in Ryan and Hemmes (2005). Given the large number of instructors (parents, educators, and tutors) needed to provide intensive ABA early intervention for children with autism, it is important to investigate efficient alternatives for training them. One possibility is the use of self-instructional training methods.

In Experiment 1, we investigated the effectiveness of mastery of a self-instructional manual by itself for teaching university students to accurately apply discrete-trials teaching to confederates role-playing children with autism. In Experiment 2, we investigated a training package that included mastery of the self-instructional manual combined with scoring of a video demonstration of discrete-trials teaching plus feedback on the participants' scoring accuracy.

Method

Experiment 1

Participants and Setting

 Participants were 4 students (1 male and 3 females) recruited from a psychology course taught at the University of Manitoba. The research was conducted in a testing room at St Amant, a community and residential treatment center for persons with developmental disabilities.

Materials

During baseline assessments, participants were provided with 3 one-page summaries (described later) of steps for teaching three tasks to a child with autism, and data sheets to record the confederates responses for each of the tasks. Items to be used as reinforcers and flash cards to be used as teaching targets were provided on a table beside the participants. A table and two chairs were also used to conduct role-playing sessions. During treatment, a 21 page self-instructional manual (Fazzio & Martin, 2006) describing the discrete-trials teaching method was provided to the participants. A data sheet (described later) was used for data collection of the participant's performance. Paper and pencils were used by the participants.

Target Behaviors, Data Collection, and Interobserver Agreement (IOA)

During experimental phases (described later), participants were asked to attempt to teach a confederate, who role-played a child with autism, to perform three tasks commonly taught to children with autism: pointing to named pictures, matching pictures, and motor imitation, one task per session. The dependent variable in this study was the accuracy with which the participants carried out discrete-trials teaching. All simulated teaching sessions were videotaped. From the videotapes the participants' behaviors were scored using the 19-point checklist shown in Table 1. Each checklist item was recorded as either correct (+), incorrect (-), or not applicable (/) for the task being taught. For example, blocking an error was not applicable when a correct response had been given by the confederate. During a session, data was collected for 12 consecutive teaching trials for one of the 3 teaching tasks. A score of 90% accuracy on the 19 point checklist was considered mastery level performance.

Before assessing IOA, an observer and the experimenter (the first author) practiced scoring a videotaped session of an experienced tutor, who volunteered to apply discrete-trials teaching to a confederate who role-played a child with autism, until at least a 90% agreement for one 12-trial practice session was achieved. The experimenter then scored all of the

Table 1.
Checklist for Scoring Discrete-trials Teaching

	Trials											
	1	2	3	4	5	6	7	8	9	10	11	12
Before Starting Teaching Trials												
1. Determine current targets												
2. Gather materials												
3. Select effective reinforcers												
Provide S^{D}s												
4. Secure the child's attention												
5. Present the stimulus(i)												
6. Present instruction												
Provide Necessary Prompts												
7. Use graduated guidance												
8. Use correct prompt delay step												
Provide Consequence for Correct Response												
9. Praise and deliver reinforcer immediately												
10. Record data immediately/accurately												
Provide Consequence for Incorrect Response												
11. Block gently (or at least attempt)												
12. Remove eye contact and stimulus(i) for 2-sec												
13. Record the error immediately + accurately												
14. Re-present stimuli												
15. Re-present instruction												
16. Prompt immediately to guarantee correct response												

Table 1 cont'd										
17. Praise non-enthusiastically										
18. Record error correction immediately + accurately										
19. Record correct prompt delay step?										

videotaped sessions, and at least 25% of the videotaped sessions were scored independently by the observer. An agreement was defined as both the observer and the experimenter scoring a component on the checklist identically. A disagreement was defined as the observer and the experimenter scoring a component on the checklist differently. An IOA score for a session was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100% (Martin & Pear, 2007).

IOA scores were also obtained for the confederate's script-following behavior on at least 25% of the videotaped sessions. Following a session, an observer and the experimenter would score the confederate's behavior on the videotape to determine the accuracy with which she followed the script on each trial. An IOA score was calculated using the method described previously.

For all four participants, mean IOR scores were 92% (range = 60-100), 96% (range = 60-100), 91% (range = 80-100), and 96% (range = 80-100), respectively. IOR scores for the confederate's script-following behavior averaged 93% (range = 84-100).

Experimental Design and Phases

A within-subject AB design with replication across four participants was used to evaluate the effectiveness of the self-instructional manual for training students to implement discrete-trials teaching.

Phase 1: Baseline. A participant was asked to study a 1-page summary of guidelines for teaching a child with autism to point to named pictures

(see Table 2). The participant was then asked to attempt to apply discrete-trials teaching to the best of his/her ability to teach a confederate role-playing a child with autism (as described previously), based on the summary that they had just read, and to record the results on a data sheet (see Table 3). The confederates' behaviors were guided by a script and standardized across participants. This procedure was then repeated for two other tasks, motor imitation and matching identical pictures, with a one-page summary of guidelines and a data sheet provided for each task (similar to the guidelines and data sheet in Tables 2 and 3).

Table 2.
Baseline Instructions for Teaching Pointing to Pictures When Named

▪ For this task you will role-play a tutor who is attempting to teach a child with autism who has minimal language skills. Do your best at providing what you think would be appropriate instructions, prompts or cues, and consequences while attempting to teach the "child", based on the guidelines listed below.

▪ Here are three pictures. Your task is to teach this person (who will be role-playing a child with autism) to point to the correct picture after you place the three pictures on the table and name one of them. Across trials, try to teach the "child" to point to all 3 pictures when they are named.

▪ After each response by the "child", record on the attached Data Sheet if the "child" responded correctly independently, responded correctly with prompts or cues, or made an error. Place a checkmark like this ✓ in the appropriate column.

<u>Summary of Steps</u>
1. Arrange necessary materials.
2. Decide what you will use as consequences for correct and incorrect responses
3. On each trial:
    a. Secure the child's attention.
    b. Present the correct materials
    c. Present the correct instruction.
    d. Provide whatever extra help (i.e., prompts or cues) you think are necessary for the child to respond correctly.
    e. Once the "child" responds, provide what you consider to be an appropriate feedback or reward for a correct response, or provide an appropriate reaction for an error
    f. Across trials gradually provide less and less prompts or cues (i.e., fade out the extra prompts)
        i. By prompting less
        ii. By delaying your prompts
    g. Record the results on the data sheet.

Table 3.
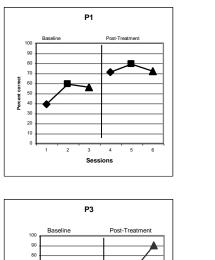**Data Sheet for Teaching Pointing to Named Pictures**

Date: _____
Teacher: _____
Targets: **Banana**

                            Dog
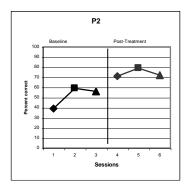   **Balloons**
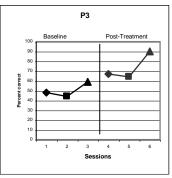
Record ✓ in the appropriate column for each trial

Trials	Prompt Delay Step	Correct Independent	Correct Prompted	Error	Correct On Error Correction
1. Banana					
2. Balloons					
3. Banana					
4. Dog					
5. Balloons					
6. Dog					
7. Banana					
8. Balloons					
9. Balloons					
10. Dog					
11. Banana					
12. Dog					

Phase 2: Treatment. The participants were asked to read and study a 21-page self instructional manual on discrete-trials teaching (Fazzio & Martin, 2006), and to master the answers to the study questions provided in the manual. Mastery of the study questions was determined by a test comprised of 40% of the total number of study questions, randomly selected from a bag. Participants were asked to study the questions until performance on the mastery test was 100%.

Following mastery of the study questions, participants were again asked to attempt to teach a confederate the three tasks, as in Baseline. However, instead of reading a one-page summary of the teaching procedures such as those for matching pictures shown in Figure 1, participants were allowed to use the one-page summary of discrete trials teaching outlined in Chapter 7 of the self-instructional manual, which contained the 19 items listed in Table 1.
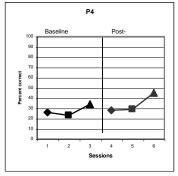
Figure 1.
Mean percent correct performance per session of Participants 1, 2, 3 and 4 while conducting discrete-trials teaching to teach three tasks: pointing to named pictures (●), matching (■), and motor imitation (▲). P stands for participant.

Procedural Integrity (PI)

For the purpose of PI, checklists specific to each phase were prepared describing the steps to be followed by the experimenter. For some of the sessions, an observer was assigned to monitor the experimenter's behavior using the checklist. The percentage of steps recorded by the observer as accurately followed by the experimenter for a session yielded a PI score for that session. PI scores were obtained for at least 25% of the sessions across all participants, and PI was always 100%.

Social Validity

To assess the social validity of the study, the participants were given a questionnaire to answer and complete anonymously. The questionnaire evaluated the participant's view of the extent to which the training and goals of the research were important, the procedures used were acceptable, and the training procedures used were effective.

Results

The session-by-session data for each participant is presented in Figure 1. Mean performance of the four participants across the three baseline sessions was 52 %, 48 %, 50 %, and 27 % respectively, with an overall mean of 44%. Following baseline, the participants required an average of 2 hours and 14 minutes (range of 1 hour and 50 minutes to 2 hours and 57 minutes) to achieve mastery on the self-instructional manual. As can be seen in Figure 1, following mastery of the manual, three of the four participants showed clear improvement in discrete-trials teaching performance. However, of the three who showed clear improvement following the manual, only one participant achieved the mastery level of 90%, and that was only on one of the three tasks. Following mastery of the manual, the participants discrete-trials teaching performance averaged 75 %, 71%, 74% and 49% respectively, for an overall average of 67%.

Experiment 2

The results of Experiment 1 indicated that mastery of the self-instructional manual alone did not produce mastery when carrying out discrete-trials teaching. In Experiment 2, we investigated a training package that included mastery of the self-instructional manual combined with scoring of a video demonstration of discrete-trials teaching plus feedback on the participant's accuracy when scoring.

Participants and Setting

Participants were 3 female students recruited as described in Experiment 1. The research was conducted at St Amant, as described for Experiment 1.

Materials

Participants were provided with the same materials as described for Experiment 1. In addition, a videotape was prepared that showed an experienced tutor applying discrete-trials teaching to teach a confederate (role-playing a child with autism) to point to named pictures (Task 1 in Experiment 1). Only the teaching of that task was demonstrated on the videotape. The behavior of the confederate was scripted so that the confederate would respond correctly on some trials, and incorrectly on some trials. Also, the behavior of the tutor was scripted so that her performance was 90% accurate when using the Checklist for Scoring Discrete-Trials Teaching, shown in Table 1. The errors made by the tutor on the videotape were scripted so that they were typical of the errors made by the participants in Experiment 1.

Target Behaviors, Data Collection and Interobserver Agreement (IOA)

Target behaviors, data collection, and IOA assessments were identical to those described for Experiment 1. Mean IOA scores of the performance of the three participants were 93% (range = 82-100), 93% (range = 82-100), and 99% (range = 94-100), respectively. IOA scores for confederate script following averaged 93% (range = 84-100).

Experimental Design and Phases

A multiple-baseline design across 3 participants (Martin & Pear, 2007) was used to evaluate the effects of the training package on discrete-trials teaching performance.

Phase 1: Baseline. Baseline sessions were similar to those carried out in Experiment 1. During a session, a participant was asked to study a 1-

page summary of guidelines for teaching pointing to named pictures to a child with autism. The participant was then asked to attempt to apply discrete-trials teaching to the best of his/her ability to a confederate role-playing a child with autism, based on the summary that he/she had just read. This procedure was then repeated for two additional sessions, one session for teaching matching identical pictures, and one session for teaching motor imitation. Each session consisted of twelve teaching trials as in Experiment 1. On another day, these three sessions were repeated, for a total of six baseline sessions.

Phase 2: Treatment. As described for Experiment 1, the participants were asked to read and master the study questions in the 21-page self-instructional manual on discrete-trials teaching. The procedure for determining mastery of the study questions was identical to that described for Experiment 1.

Following mastery of the manual, a participant was given the Checklist for Assessing Discrete-Trials Teaching (see Table 1). The components in the checklist had been described in the self-instructional manual that had just been mastered. With the checklist in hand, the participant watched the video, described previously, of a skilled tutor conducting discrete-trials teaching to a confederate role-playing a child with autism. Based on the knowledge that he/she accumulated from the manual and mastery of the study questions, the participant was asked to use the 19-point checklist to score the first trial on the videotape.

In order to evaluate the participant's accuracy when scoring the videotape, the experimenter scored the videotape ahead of time using the 19-point checklist. Once the participant had scored the first trial, the experimenter compared her checklist to that of the participant. The participant was praised if there was agreement on the scoring of that trial. If there was a disagreement in the scoring of that trial, the experimenter explained to the participant why she scored the trial the way that she did. The participant then proceeded to score the next trial. This process continued for 12 trials.

Following the treatment phase, that included scoring of the video of the tutor teaching the pointing-to-named-pictures task to the confederate, each participant once again attempted to apply discrete trials teaching to the three tasks to a confederate who role-played a child with autism, as described for the Baseline phase. However, instead of reading a one-page summary of the teaching procedures such as that shown in Table 2, participants were allowed to use the one-page summary of discrete trials teaching outlined in Chapter 7 of the self-instructional manual, which contained the 19 items in Table 1.

Procedural Integrity (PI)

This was as described for Experiment 1. PI was always 100%.

Social Validity

This was as described for Experiment 1

Results

The session-by-session data for each participant is presented in Figure 2. As can be seen in Figure 2, baseline performance was relatively stable across the last four baseline sessions for Participant 5, the last three sessions for Participant 6, and all six sessions for Participant 7. Mean baseline performance across the three participants was 42% for Participant 5, 38% for Participant 6, and 28% for Participant 7.

Following baseline assessment, the participants required an average of 2 hours and 49 minutes (range 2 hours to 4 hours) to achieve mastery on the self-instructional manual. They required an average of an additional 55 minutes (range 45 minutes to 1 hour) to observe the video demonstration of discrete-trials teaching combined with feedback on their scoring of the video. The participants scored the video demonstration of an experienced tutor, teaching the confederate to point to named pictures, with an accuracy of 94%, 90% and 89% respectively.

Following treatment, as can be seen in Figure 2, all three participants showed a dramatic improvement in the accuracy with which they used discrete-trials teaching following implementation of the training package. Following treatment, Participant 5 achieved 100% accuracy while teaching the pointing-to-named-pictures task, 98% while teaching
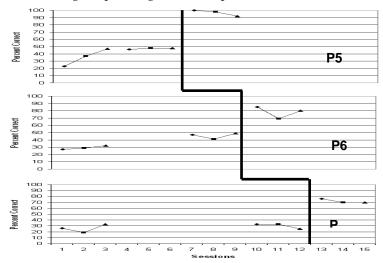

Figure 2.
Mean percent correct performance per session of Participants 5, 6, and 7 while conducting discrete-trials teaching to teach three tasks: pointing to named pictures (●), matching (■), and motor imitation (▲). P stands for participant.

the matching task, and 92% while teaching motor imitation. Participants 6 and 7 both showed clear improvement in comparison to their Baseline performance (see Figure 2). However, unlike Participant 5, they did not achieve mastery level performance for any of the tasks following implementation of the training package. Following treatment, while teaching the pointing-to-named-pictures task, the matching task, and the motor imitation task, Participant 6 averaged 85%, 70% and 80% respectively, and Participant 7 averaged 76%, 70% and 70% respectively.

Discussion

Following each experiment, participants were asked to rate, on a five-point scale, the effectiveness of the self-instructional manual. Six of the

seven participants returned their social validity questionnaires, and they rated the self-instructional manual as 4 out of 5. All three participants in Experiment 2 rated the effectiveness of scoring a videotape of an experienced tutor as 5 out of 5.

Following mastery of the self-instructional manual in Experiment 1, one participant achieved mastery (greater than 90%) of discrete-trials teaching while teaching one of the three tasks. Following the treatment package in Experiment 2, one of the three participants achieved mastery while teaching all three tasks. While results of these exploratory experiments are promising, more research is needed to compare these and alternative training packages for teaching individuals to correctly implement discrete-trials teaching.

Several weaknesses of this research should be noted. A weakness of Experiment 1 was the use of an AB design, which has limited internal validity. Both experiments had a small number of participants, and need to be replicated. Experiment 2 provided a video demonstration of one of the three tasks. Video demonstration of more than one task may be beneficial. Neither experiment attempted to examine generalization of discrete-trials teaching with children with autism. Future research should assess whether participants who master discrete-trials teaching while teaching confederates role-playing children with autism, are able to generalize to children with autism.

In summary, across the two experiments, six out of seven participants showed considerable improvement in discrete-trials teaching after less than four hours of exposure to a self-instructional manual or a self-instructional manual plus an observational and feedback intervention, and two of the seven participants demonstrated mastery-level performance. Considering the large turnover of tutors in training programs for children with autism, and the large demand for tutors and parents to learn discrete-trials teaching procedures, future research should examine rapid training components that might be added to the instructional strategies examined in these experiments.

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