

## A Self-Instructional Package for Teaching University Students to Conduct Discrete-Trials Teaching With Children With Autism

### Abstract

*There is considerable need for rapid training procedures to teach staff and parents to conduct applied behaviour analysis training sessions with children with autism. We used a multiple-baseline design across participants to evaluate a self-instructional package to train four university students to implement discrete-trials teaching (DTT) to teach a research assistant who role-played a child with autism (a "confederate"). The training package included mastery of a self-instructional manual plus observation of a demonstration video. After an average of 4.5 hours of exposure to the training package, students' average DTT performance improved from 46% in baseline to 78% while teaching a confederate. Two students who performed  $\geq 80\%$  following training were assessed for generalization during subsequent sessions with a child with autism, and their DTT performance averaged 74%. The results suggest that self-instructional strategies have considerable potential for instructing participants to conduct DTT with children with autism.*

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Applied behaviour analysis (ABA) has been recognized as the treatment of choice for children with autism (Department of Health, 1999). Early and intense behavioural intervention (about 35 hours per week for at least two years) can greatly improve the chances that children with autism might progress and become indistinguishable from their peers in a regular educational setting (Eikeseth, Smith, Jahr, & Eldevik, 2007; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Lovaas, 1987; Lovaas, Smith, & McEachin, 1989; Rosenwasser & Axelrod, 2001; Sallows & Tamlynn, 2005; Smith, Groen, & Wynn, 2000; Smith, Eikeseth, Klevstrand, & Lovaas, 1997). A common instructional method in ABA programs for children with autism is called Discrete-Trials Teaching (DTT). A trial of DTT involves an instructor providing instructions and/or prompts, waiting for the child to respond, and then immediately providing a consequence. The consequence is typically a reward for a correct response or an error-correction procedure following an error. Repeated trials typically occur in quick succession. Although early studies (Koegel, Glahn, & Nieminen, 1978; Koegel, Russo, & Rincover, 1977) successfully used a variety of instructional tactics to teach staff and parents to implement DTT, training time, when mentioned, was lengthy (up to 40 hours). While more recent studies (e.g., McBride & Schwartz, 2003; Lafasakis & Sturmey, 2007) had briefer training time for participants, they had a 1 to 1 trainer-to-participant ratio.

Considering that the number of diagnoses of autism has been on the rise and that estimates of prevalence as high as 1 in 166 have been noted (Eggleton & Keon, 2007) and that the demand for early behavioural interventions is high, one of the conclusions of a recent review of research to instruct individuals to deliver DTT to children with autism is that there is a need for research-based, economical, rapid training procedures to train instructors and parents to conduct DTT (Thomson, Martin, Arnal, Fazzio, & Yu, in press). To address this need our research team has been investigating self-instructional strategies as potentially efficient alternatives for training instructors to conduct DTT. Fazzio and Martin (2006) prepared a 21-page self-instructional manual on DTT. Arnal et al. (Experiment 1, 2007) and Fazzio, Martin, Arnal, & Yu (2009) investigated the manual for teaching university students to apply DTT to teach three tasks to a confederate role-playing a child with autism. The confederate was a research assistant (another university student) who followed a script in order to perform like a child with autism. Across the two studies, after an average of 2.4 hours to master the manual, participants improved from a baseline mean of 39% to a post-manual mean of 66% on a 19-item checklist for conducting DTT. Based on feedback from participants in those studies, Fazzio and Martin (2007) revised the self-instructional manual to a total of 37 pages, doubled the number of study questions, and added a practice component in each section that prompted the reader to stop and “practice” the DTT components (in imaginary role-playing sessions). In addition, Fazzio (2007) prepared a brief self-instructional video, to accompany the manual, that showed an experienced instructor conducting several trials of DTT to teach a task to a typically developed child role-playing a child with autism.

In this study, we extended the research of Arnal et al. (2007) and Fazzio et al. (2009) in several ways. First, we evaluated the revised self-instructional manual. Second, the instructional package included mastery of the manual plus observation of the instructional video. Third, our two previous studies used a 19-component checklist for evaluating DTT. Fazzio, Arnal, & Martin (2007) recently revised and expanded that checklist to 21 components. The revised checklist is referred to as the Discrete-Trials Teaching Evaluation Form (DTTEF), and Babel,

Martin, Fazzio, Arnal, & Thomson (in press) recently demonstrated that the DTTEF has high face validity, high interobserver reliability for live scoring of trainees’ DTT performances, and high concurrent validity. The improved version of the DTTEF was used in this study. Finally, participants in this study who achieved at least 80% mastery of DTT while teaching a confederate role-playing a child with autism, were assessed in generalization sessions applying DTT to a child with autism.

## Method

### Participants and Setting

The study was approved by the Psychology/Sociology Research Ethics Board of the University of Manitoba. Four female university students, who had never received training in DTT, were recruited from a pool of volunteers from a second year Behaviour Modification course taught at the University of Manitoba. Training of the four participants was conducted in a quiet assessment room equipped with a table and two chairs. A 4-year-old male with autism was recruited for the generalization phase of the experiment. The child was recruited from the St. Amant ABA Preschool Program, which provides ABA services for children with autism in Manitoba. Sessions with this child were conducted in his home, according to parental preference, and were supervised by a Board Certified Behaviour Analyst (the second author).

### Materials

During the Baseline phase, the participants were provided with three one-page summaries describing the application of DTT to teach three tasks commonly taught to children with autism (i.e., matching-to-sample, pointing-to-named items, and imitating actions) and accompanying data sheets, as described in detail in Arnal et al. (2007). For the matching and pointing-to-named pictures teaching sessions, three pairs of identical pictures (two of a house, two of a dog, and two of a balloon) were provided. During generalization, new pictures were used that the child’s mother recommended, and that were based on the child’s skill level. Edibles and toys were provided to be used as reinforcers during all DTT sessions.

Following baseline, the participants were provided with a 37-page self-instructional manual for DTT (Fazzio & Martin, 2007). They were given blank sheets of paper, practice data sheets, and a pen. They were also provided with tests (described later) corresponding to each chapter of the manual. A training video (Fazzio, 2007), mentioned previously, 17 minutes in length, was also shown. The video consisted of a brief review of the material studied in Chapters 2 through 5 of the manual, as well as demonstrations of trials of one of the tasks being trained, the matching-to-sample task. During the video demonstration, participants were asked to follow along with the manual.

A stopwatch was used for timing the participants' activities. A video camera and videotapes were used to record participants' performance while they conducted DTT with the confederate, and later with the child. The DTTEF, a 21-item checklist (see Table 1), was used to score the participants' performance from the videotape throughout the study.

### Target Behaviours and Data Collection

The main target behaviour and the dependent variable of this study was participants' performance while applying DTT during teaching trials,

*Table 1. Components of Discrete-Trials Teaching Evaluation Form (DTEF)*

*Part I: Before Starting a Teaching Session*

1. Determine teaching task
2. Gather materials
3. Select effective reinforcer(s)
4. Determine prompt fading procedure & initial step
5. Develop rapport / positive mood

*Part II: On Each Trial*

*A) Manage Antecedents*

6. Check data sheet for arrangement of materials
7. Secure the child's attention
8. Present teaching materials
9. Present correct instruction
10. Present prompts (indicate M-T-L step: F, P1, P2, NP)

*B1) Manage Consequences for a Correct Response*

11. Praise & present additional reinforcer
12. Record correct response immediately & accurately

*B2) Manage Consequences for an Incorrect Response*

14. Block gently, remove materials, look down (2-3 sec.)
15. Record the incorrect response immediately and accurately
16. Secure the child's attention
17. Re-present the materials
18. Re-present instruction, prompt immediately (guarantee correct response)
19. Praise only
20. Record error correction immediately and accurately

13. Allow brief inter-trial interval (3-5 sec.)

21. Fade prompts across trials

as scored using the DTTEF. A teaching trial was defined as described previously, and during which the participant taught a confederate role-playing a child with autism, or a child with autism (during generalization). Rules for the use of the DTTEF can be found in the DTTEF Scoring Manual (Fazzio et al., 2007).

## Experimental Design and Phases

We used a modified multiple-baseline design across four participants to evaluate the effects of the self-instructional package on participants' DTT performance.

**Baseline.** In baseline a participant was given 10 minutes to read a one-page summary of guidelines for teaching a matching task (see Arnal et al., 2007). After a participant read the summary guidelines for matching, she was asked to conduct 12 teaching trials to attempt to teach the matching task to a confederate role-playing a child with autism. This was repeated for the pointing-to-named pictures and imitation tasks. The confederate role-playing a child with autism followed a script informing her when to attend to the participant, whether to emit an immediate or a delayed response, whether she should wait for a prompt and what prompt level to wait for, and whether to perform a correct response or an incorrect response. The confederate's script was balanced across all sessions in order

to allow for an equal distribution of these characteristics. All sessions were videotaped and scored by the researchers using the DTTEF. These three baseline sessions were repeated from one to four weeks later, according to the modified multiple-baseline design.

**Self-Instructional Package.** Participants were asked to study the contents of the 37-page self-instructional manual, complete mastery tests, watch the corresponding video clip, and engage in self-practice, according to the five steps listed in Table 2. Steps 1 to 3 were accomplished on day 1, and Steps 4 and 5 on day 2. On each mastery test, a participant was required to correctly answer 50% of the study questions from the relevant chapter, randomly selected by the researchers. If they did not answer all of these questions correctly, they were asked to restudy the section(s) of the manual that corresponded to the incorrectly answered question(s). They were then asked to retake the mastery test answering only the questions that they previously answered incorrectly.

For each of the four self-practice assignments listed in Table 2, a participant was prompted to: a) imagine that she was teaching one of the three baseline teaching tasks to a child with autism; b) role-play (with an imaginary client) the relevant items on the checklist for DTT (see Table 1), and c) rate herself on each item that was role-played. The participant was

Table 2. Sequence of steps during Phase 2

Step	Component
1	a. Read and study Chapter 1. b. Take mastery test.
2	a. Read and study Chapter 2. b. Take mastery test. c. Read relevant portion of DTT Checklist. d. Watch relevant part of video. e. Complete self-practice assignment
3	Repeat components of Step 2, but for Chapter 3.
4	Repeat components of Step 2, but for Chapter 4.
5	Repeat components of Step 2, except that Components a and b included study questions for Chapters 5 and 6, and Components c, d, and e were based on Chapter 5 only

then asked to repeat these three steps with the other two teaching tasks. As indicated in Table 2, this self-practice occurred after studying Chapter 2 (Preparing to Conduct a Teaching Session), Chapter 3 (Managing Antecedents and Consequences for a Correct Response), Chapter 4 (Managing Antecedents and Consequences for an Incorrect Response), and Chapter 5 (Fading Prompts Within and Across Trials).

Following completion of the five steps in Table 2, participants were asked to repeat the three teaching sessions of the baseline, with a confederate role-playing a child with autism. During the sessions participants were allowed to use a two-page summary of DTT, which listed the components in Table 1, and which was contained in the self-instructional manual. These sessions were videotaped and subsequently scored by the researchers using the DTTEF. If a participant's score was at least 80% accurate (according to the DTTEF) in the post-self-instructional sessions, he/she was allowed to move on to Generalization.

**Generalization.** In this phase, participants conducted the three DTT sessions (described previously) with a child with autism. These sessions were also videotaped and subsequently scored using the DTTEF (as described previously).

### Inter-Observer Agreement (IOA)

Before assessing reliability, an observer and the experimenter (the first author) practiced scoring role-played sessions until they scored a novel session at greater than or equal to 90% IOA, computed as described below. Reliability checks were conducted by the observer and the experimenter independently scoring a videotape of a session using the DTTEF. Their scores were then compared. An agreement was defined as both the observer and the experimenter scoring a component on the DTTEF identically. A disagreement was defined as the observer and the experimenter scoring a component on the DTTEF differently. An IOA score for a session was then calculated by dividing the number of agreements by the total number of agreements plus disagreements and then multiplying by 100% (Martin & Pear, 2007). IOAs were conducted for 76.9% of the sessions and averaged 95.1%.

### Procedural Integrity (PI)

A checklist was created that described each step that the experimenter was to carry out for each phase of the study. An observer used this checklist to independently score the experimenter's behaviour during all of the sessions. This was done to ensure accuracy and consistency across all phases and participants. The PI score for a session was determined by dividing the number of steps done correctly by the total number of steps and multiplying by 100%. PIs were always 100%.

PI checks were also performed to assess the accuracy with which the confederate followed a script for role-playing a child with autism. PIs for the confederate role-playing a child with autism were done for 36.4% of the sessions with an average score of 97.3%.

### Social Validity

Social validity was assessed by asking participants to independently answer a brief questionnaire and to indicate their degree of agreement/disagreement with statements about the acceptability of the procedures used in the study (2 questions) and its effects (4 questions).

## Results

As described previously, while completing the self-instructional package, participants were asked to study the contents of the self-instructional manual, complete mastery tests, watch a corresponding video clip, and engage in self-practice. Participants averaged 190 minutes to complete studying the manual (this includes, reading the manual, watching the videotape, completing the study questions, and any restudying required for retesting) with a range of 171 to 217 minutes. In addition, total test time (including testing and retesting) averaged 53 minutes with a range of 44 to 72 minutes. In addition, total practice time including reading the self-practice instructions, practicing, and completing the required practice sheet, averaged 25 minutes, with a range of 18 to 36 minutes. The total study time, test-taking time, and practice time averaged 4.47 hours per participant.

As can be seen in Figure 1, baseline data points for all the participants remain relatively stable across time, suggesting that the participants improved only slightly in performance from the first three to the last three baseline sessions. After three baseline sessions were completed, Participant 1 decided to drop out of the study for personal reasons. A new Participant 1 was selected randomly from the list of volunteers and recruited for the study. Due to time considerations, only three baseline sessions were conducted with the new Participant 1. During baseline, Participant 1 averaged 41.6%, Participant 2 averaged 42.4%, Participant 3 averaged 43.9%, and Participant 4 averaged 54.2%, for an overall average of 45.5%.

When comparing baseline data to post self-instructional package data, all participants improved following treatment and there were very few overlapping data points between adjacent phases, suggesting strong internal validity. For three of the four participants, the effect of the self-instructional package can be seen immediately with a relatively large jump in DTT performance directly following the last baseline session.

Following the self-instructional package, DTT performance was as follows: Participant 1 averaged 68.5% (improvement of 27% over baseline), Participant 2 averaged 95.6% (improvement of 53%), Participant 3 averaged 67.3% (improvement of 23%), and Participant 4 averaged 81.9% (improvement of 28%). Across all four participants, mean post-self-instructional performance averaged 78% (improvement of 33%).

Of the four participants, two reached the requirement of 80% accuracy in order to proceed to the generalization phase in which they attempted to teach all three tasks to the child with autism. During this phase, Participant 2 averaged 74.8% and Participant 4 averaged 73.9%

Social validity questionnaires were completed by all the participants and revealed an average score across items of 4.9/5. Thus, participants evaluated that the goals of the study were important and that the procedures were effective. One participant noted that more practice would have been helpful.

## Discussion

All four participants showed clear improvement in DTT performance after receiving the self-instructional package. Participants showed an average improvement over baseline of 33% while applying DTT to teaching a confederate who role-played a child with autism. Two of the participants improved sufficiently to proceed to generalization sessions with a child with autism. The DTT performance of these two participants averaged 88.8% while teaching the confederate, and 74.4% while teaching the child with autism.

Some decrease in performance from teaching the confederate to teaching the child with autism was expected. The child did not follow a script like the confederate role-playing a child with autism. Moreover, because of scheduling difficulties, Participant 2 had not encountered the material for almost four weeks prior to the generalization phase. To compensate for this time gap, some extra review time and material (Chapter 7 of the manual) was given to Participant 2 just prior to teaching the child.

Comparing the results of this study in which the instructional package included a self-instructional manual plus an observational video, versus our studies that included the self-instructional manual alone (Arnal et al., 2007; Fazzio et al., 2009), Participants 1 and 3 performed approximately the same as participants in the two previous studies, whereas Participants 2 and 4 performed much better than participants in the two previous studies. At this point, it's not clear why the added video was correlated with improved performance for just two of the four participants. During the post-treatment phase, Participants 2 and 4 performed better than Participants 1 and 3 on DTTEF Items 3 (select effective reinforcer), 4 (determine prompt fading procedure and initial step), 14 (block gently, remove materials, look down for 2-3 seconds), 17 (re-present the materials), and 21 (fade prompts across trials). Perhaps the instructional video could be revised so that correct performance of these DTEF items is illustrated more clearly.

Another variable that should be explored in future research is the opportunity to practice. Although participants were prompted to engage in role-playing practice by themselves within

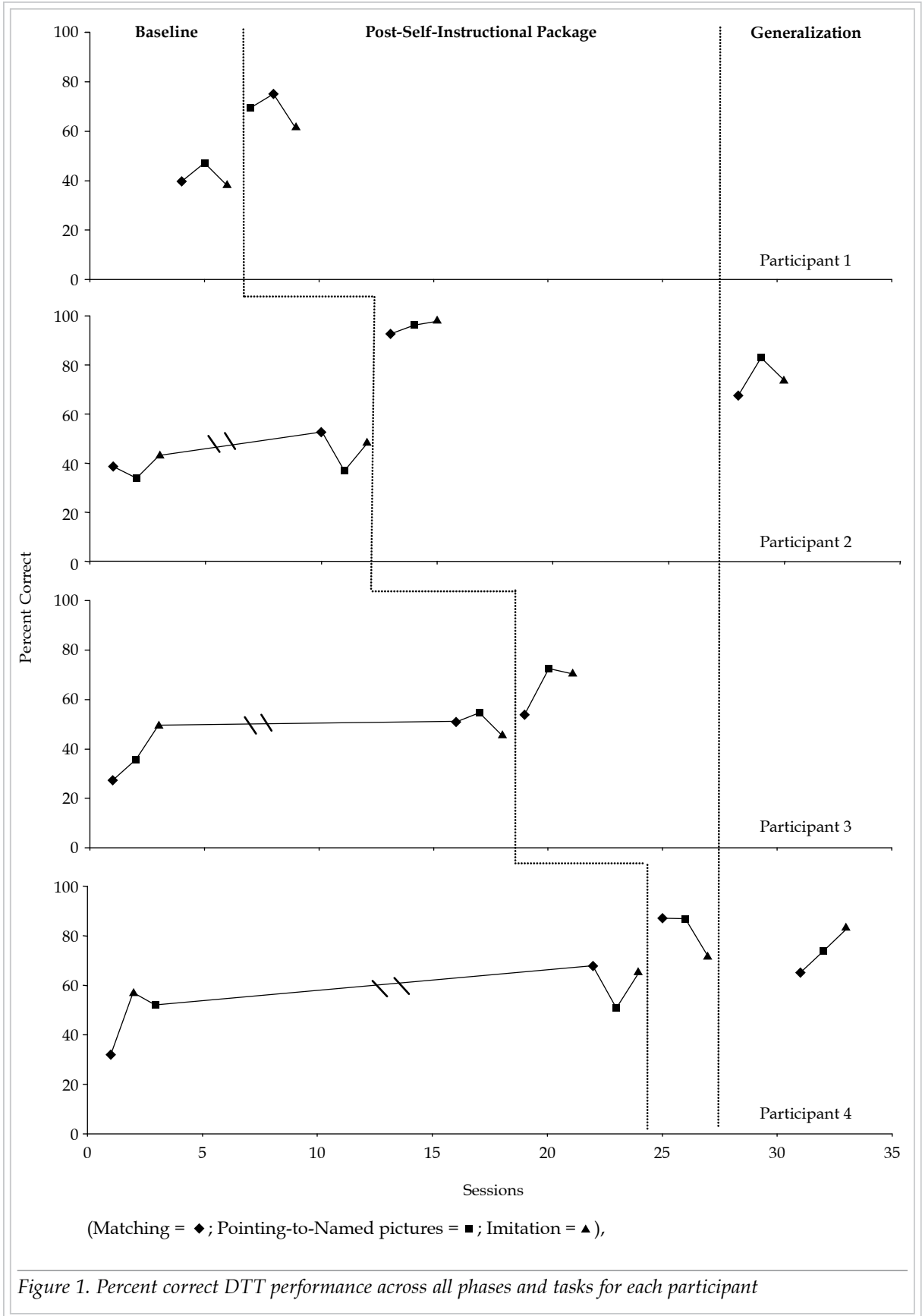


Figure 1. Percent correct DTT performance across all phases and tasks for each participant

each chapter, most participants remained still for a couple of minutes with their eyes closed. One of the participants suggested that more practice with a partner would have been more helpful and would have made them feel more comfortable. One way of accomplishing this would be to allow participants to study and practice in pairs. Role-playing DTT in pairs may better prepare participants for post-treatment sessions than did the imaginary role-playing activities attempted individually by the participants in this study.

Several limitations of this study should be noted. First, the use of students in the Behaviour Modification course as participants is not necessarily representative of many staff or parents who need training in conducting DTT. Obviously, this research needs to be replicated with newly-hired tutors and new parents to ABA programs with children with autism. Second, only three instructional tasks were targeted. Additional instructional tasks should be incorporated into future investigations of this training package. Third, it was not possible to obtain baseline sessions with the child with autism prior to the exposure of the participants to the self-instructional package. Ideally, such sessions would be incorporated into future research projects in order to more reliably assess generalization. Fourth, the modified multiple-baseline design did not allow for the examination of the effects of repeated exposure to different numbers of Baseline sessions.

Because of the considerable growth in ABA training programs for children with autism, there is a great need for evidence-based, economical, rapid training procedures to teach tutors and parents to conduct DTT to children with autism. The improved performance of all four participants following exposure to the self-instructional package, and the positive generalization results for teaching a child with autism for two of the participants, are encouraging. Nevertheless performance was not as high as expected for two participants, and the generalization performance of the two participants who taught a child with autism could have been better.

Although this package has potential to be of considerable benefit, research demonstrating its efficacy with existing agency staff in ABA training programs is clearly needed.

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