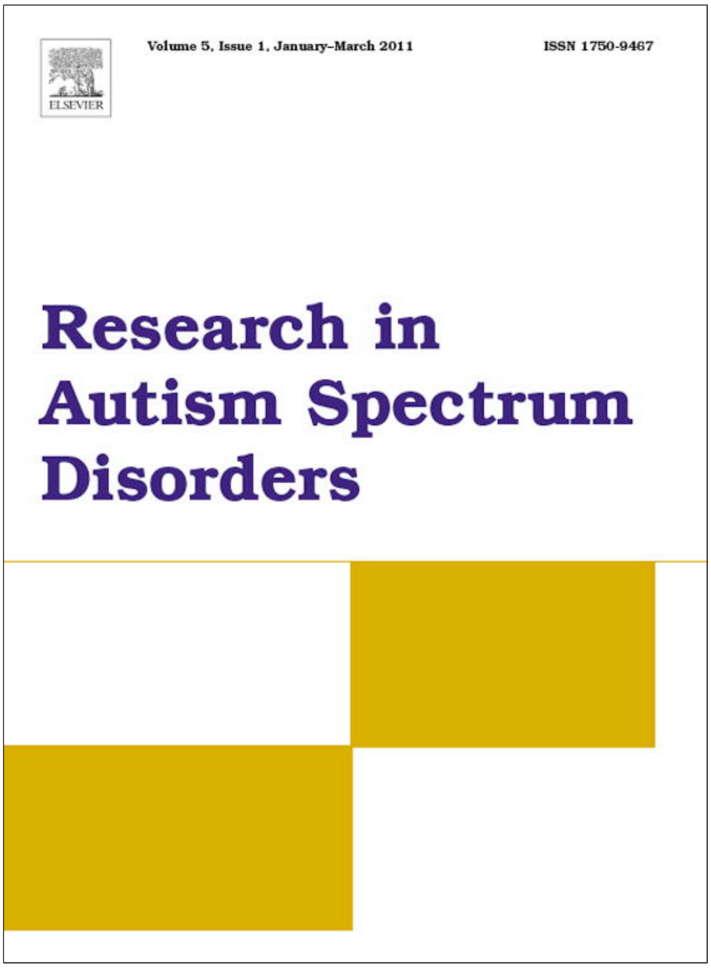
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Effects of a stimulus prompt display on therapists' accuracy, rate, and variation of trial type delivery during discrete trial teaching

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A B S T R A C T

Research on training therapists to deliver discrete trial teaching (DTT) has tended to focus on a limited range of therapist competencies and may have neglected important variables such as the rate and variation of trial types delivered across complete teaching sessions. Stimulus prompting procedures may facilitate the delivery of DTT for the broad range of competencies needed during therapy. In the present study, three experienced therapists were taught to deliver DTT with and without a stimulus prompt. A multiple baseline across participants with embedded reversal design was used to analyze performance during simulated teaching sessions. Results showed that all participants delivered both a higher rate of accurate trials and a greater variety of trials in sessions that incorporated stimulus prompting.

1. Introduction

Early intensive behavioral intervention (EIBI) is the application of methods derived from applied behavior analysis to improve the cognitive, social and communication skills in children diagnosed with autism spectrum disorders (ASD). A number of studies have provided evidence for the effectiveness of EIBI (e.g., Eikeseth, Smith, Jahr, & Eldevik, 2002; Eikeseth, Smith, Jahr, & Eldevik, 2007; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005; Sallows & Graupner, 2005), leading some researchers to recommend it as the treatment of choice for children with ASD (Eldevik et al., 2009). However, the specific characteristics and practices of EIBI programs may often differ in terms of curriculum sources and specific teaching techniques and strategies (Love, Carr, Almason, & Petursdottir, 2009). One common instructional strategy used in EIBI programs is discrete trial teaching (DTT; Smith, 2001), which involves breaking down complex skills and teaching smaller discrete trials or units. Each teaching trial is made up of an antecedent cue or discriminative stimulus, a prompt, a response on the part of the learner, and a consequence delivered on the part of the therapist, in the form of a reinforcer, negative consequence or error correction. This sequence is then followed by an inter-trial interval of between 1 and 5 s before the therapist initiates the next trial (Smith, 2001). The skills acquired through these smaller teaching trials form the basis of larger behavioral repertoires as the learning program progresses.

Given the high number of treatment hours recommended for children with ASD (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009), it is common for EIBI providers and families to hire "therapists" to assist in the delivery of intervention programs. These therapists may have limited formal experience with, or qualifications in, behavior analysis or DTT, and are

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typically trained by a consultant or senior therapist (Bibby, Eikeseth, Martin, Mudford, & Reeves, 2002). Usually, the consultant is responsible for undertaking all relevant training with the therapist and for overseeing the maintenance of therapeutic skills. The key components of effective training practices in DTT delivery have been widely studied (for a review, see Thomson, Martin, Arnal, Fazzio, & Yu, 2009) and one commonly used methodology is behavioral skills training (BST). This involves the delivery of training via instructions, modeling, role-play, and feedback (Miltenberger, 2008). For instance, Sarakoff and Sturmey (2004) used BST to train educators in the accurate application of DTT to teach a picture-matching task to a child with autism. The authors defined trial accuracy using 10 components, including delivering instruction with clear articulation, carrying out the predetermined correction procedure and using immediate reinforcement. Using a multiple baseline across participants design, all three educators demonstrated increased accuracy in trial delivery following implementation of BST compared to a baseline condition in which participants were given a list of the components of DTT. Similarly, Lerman, Tetreault, Hovanetz, Strobel and Garro (2008) showed that BST improved classroom teachers' accuracy (as measured by checklists) in delivering preference assessments and DTT to students with developmental disabilities. Lafasakis and Sturmey (2007) found that BST was superior to written instructions for teaching parents to accurately deliver DTT to teach motor imitation skills to their children.

In most training studies, DTT performance has been evaluated on a trial-by-trial basis rather than across a complete teaching session (Thomson et al., 2009). Existing research also has tended to focus on measuring the accuracy with which therapists deliver discrete trials, with a number of criteria used to define accuracy (e.g., Lerman et al., 2008; Sarakoff & Sturmey, 2004). Although within trial accuracy is important, training therapists to deliver discrete trials within the context of an EIBI program invariably includes a complex set of skills that must be used across the session. For instance, variables such as mixing the delivery of instruction across skill types, interspersing trials of varying difficulty within blocks, and increasing the pace at which instructions are delivered may be important in maximizing learning outcomes (Carbone, Morgenstern, Zecchin-Tirri, & Kolberg, 2007; Weiss, 2005). Therefore, evaluations of therapist competencies during a DTT session should measure not only the accuracy of trial presentation, but the number, type, and pace of trials presented across the teaching session.

Another important skill is the appropriate use of mastered skills as instructional tools for behaviors targeted for acquisition. For example, Sundberg and Partington (1998) suggest that when verbal operants are well established in a learner's repertoire, a stimulus control transfer procedure may be utilized to strengthen other, less well-established operant repertoires (Skinner, 1957). For example, a child's independent *tacting* of a picture of a car may be used to teach an *intraverbal* response to the question, "What drives on the road?" The child's response of "car", while initially only emitted when supplemented by the presence of a picture, later comes under discriminative control of the question only, via a verbal operant transfer procedure. Such verbal operant transfer procedures have been the subject of empirical investigation (Barbera & Kubina, 2005; Goldsmith, LeBlanc, & Sautter, 2007; Sundberg, Edicott, & Eigenheer, 2000) and appear in a variety of texts on operant transfer teaching procedures (Schramm, 2006; Sundberg & Partington, 1998). Despite the widespread application of verbal behavior based programs in EIBI (Love et al., 2009), there are currently no empirical demonstrations of effective procedures to train staff to use DTT-based verbal operant transfer procedures.

A final skill set required of therapists in EIBI programs is the management of materials and collection of data. At the end of each trial delivery, the therapist has a series of functions to perform before the next trial is delivered. The sequence is typically as follows: data are recorded, materials for the trial removed, the next trial selected from the program sheet, materials for that teaching trial are organized and, finally, the next trial is presented. Increasing the speed with which the therapist is able to conduct data collection and stimulus organization may be highly desirable if increasing trial frequency and presenting trial type to a specified criterion are considered important. To date, strategies for assisting therapists in performing these important skills have not been extensively investigated.

In EIBI programs, a well-established method of facilitating the acquisition of target skills involves providing specific antecedent cues or stimulus prompting (Cooper, Heron & Heward, 2007; Wolery et al., 1992). Wacker and Berg (1983) used picture prompts to improve the performance of differing vocational tasks in individuals with developmental disabilities. Pierce and Schreibman (1994) provided stimulus prompts in the form of a sequence of task specific pictures designed to increase participants' accuracy in performing daily living skills in boys diagnosed with autism. Other research has sought to improve task performance with a variety of creative prompting methods including the use of self-delivered auditory prompts to teach transition through a vocational task (Taber, Alberto & Fredrick, 1998) and videotaped instruction aimed at teaching shopping skills to children with autism (Alcantara, 1994). Given the success of prompting procedures in effectively evoking a wide range of behaviours in training situations, it seems reasonable to conclude that such procedures might also be helpful in training therapists to deliver DTT. As previously noted, accurate delivery of trials within a session often involves a range of skills that must occur at the right time and in the right sequence. Given the complexity and precision of teaching skills required by DTT instructors, the effectiveness of a proven antecedent technique such as stimulus prompting, when combined with BST, on DTT delivery has yet to be determined.

In summary, compared with traditional BST methods, there may be benefits to arranging stimuli and providing prompts to facilitate effective DTT delivery across teaching sessions. The purpose of the present study was to evaluate the effectiveness of BST in the presence and absence of a simple, stimulus prompt display for increasing the accuracy, rate, and variability of trials delivered by EIBI therapists during DTT sessions.

2. Methods

2.1. Participants and setting

Three female therapists employed on home-based EIBI programs for children with ASD were recruited via a mailing list call for participants interested in receiving additional training in DTT. Each participant had previously received training in DTT by the lead consultants of their respective home-based programs. None of the participants had any formal training or qualifications in either applied behavior analysis or special education. Monica was 31 years of age and had worked part time as a therapist for 2 years. Katie was 29 years of age and had worked part time as a therapist for 3 years. Vee was 32 years of age and had worked full time as a therapist for 9 years. Sessions were conducted in rooms representative of a typical, home-based DTT setting and contained two chairs, a table and a variety of play stimuli. Depending on participant availability, 3–13 sessions were conducted per day with a minimum of 5 min between sessions.

2.2. Response measurement

All sessions were 3 min in duration and consisted of a role-playing scenario, with the first author playing the part of the learner receiving instruction. Each session was videotaped and responses were scored after the sessions. During each session, participants were asked to deliver as many discrete trials as possible according the criteria and procedures presented during training (see below). Within each session, each trial was scored as either accurate or inaccurate according to the criteria specified in Table 1, although the correct teaching sequence and specific error correction sequence varied for different trial types (see Fig. 1). Four dependent measures were assessed during each session: rate of accurate trial presentation, percentage of accurate trials presented, trial variation by skill type, and trial variation by skill difficulty.

2.2.1. Percentage of accurate trial presentation

To calculate the percentage of accurate trials delivered across an entire session, the number of trials delivered correctly was divided by the total number of correct and incorrect trials and multiplied by 100.

2.2.2. Rate of accurate trial presentation

To provide an indication of the pace at which participants delivered accurate trials, the rate of accurate trial presentation was calculated by dividing the number of accurate trials delivered per session by the length of the session (i.e., 3 min).

2.2.3. Trial variation by skill type

To provide an indication of the degree to which participants varied the types of operants targeted across trials, a frequency count of each trial type (*tact*, *intraverbal*, and *listener receptive*) was conducted for each session. Both accurate and inaccurate trials were included in the calculation.

2.2.4. Trial variation by skill difficulty

Prior to sessions, all skills were arbitrarily designated by the experimenter as either "mastered"(i.e., skills the learner had previously demonstrated proficiency with and would thus be considered less difficult) or "acquisition" (i.e., skills the learner was still attempting to master and would thus be considered more difficult). The percentage of acquisition and mastered trials presented was calculated by dividing the number of the particular trial type (acquisition or mastered) presented by the total number of trials and multiplying the result by 100.

2.3. Interobserver agreement

An additional observer was trained to score the videotapes for each of the dependent measures and assessed 32% of the total number of sessions, which were selected at random. Interobserver agreement (IOA) was calculated for each of the

Table 1
Within trial task analysis used to determine accuracy of all trials delivered during sessions.

Within trial task analysis
1. Correct S^D delivered clearly according to the skill
2. Materials organised
3. Used appropriate error correction strategy for incorrect responses
4. Correct prompt type and level used (For *tact* targets an echoic to tact transfer procedure, for *intraverbal* targets a tact to intraverbal procedure, for *listener receptive* targets a motor imitation to listener receptive transfer procedure)
5. Reinforcement delivered within 2 s
6. Delivered correct reinforcement depending on demand (delivered tangible + social reinforcement (FR1) for acquisition targets, delivered social reinforcement (FR1) for mastered targets)
7. Accurate data collected on data sheet (IND-1 for correct independent responses, IND-0 for incorrect independent responses and ERR for error corrected responses)

Note: FR1 = fixed ratio 1 schedule of reinforcement, IND-0 = data recorded as independent incorrect on data sheet, IND-1 = data recorded as independent correct on data sheet, ERR = data recorded as error, and S^D = discriminative stimulus.

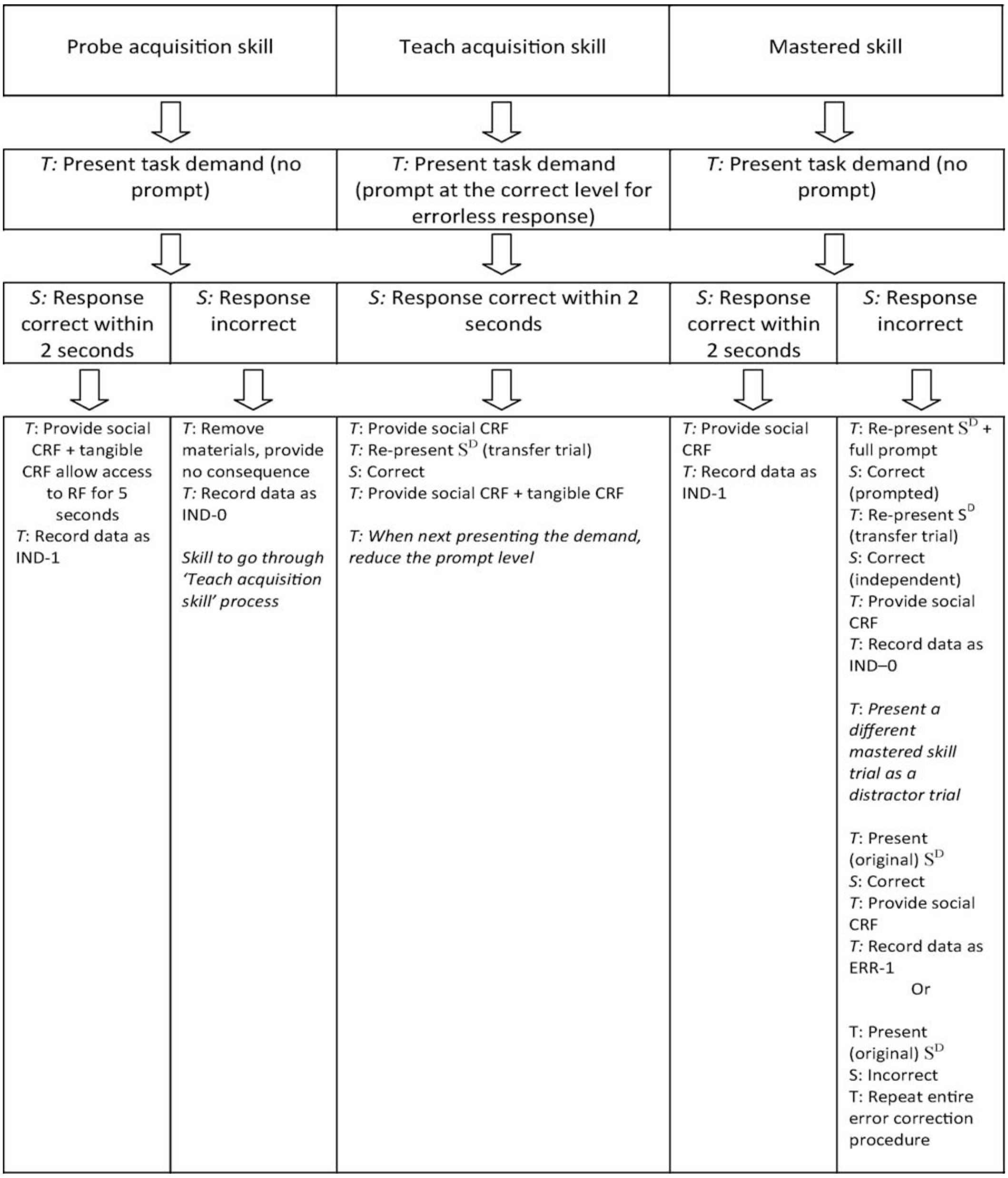

Fig. 1. Teaching sequences for the three skill presentation areas of 'probe acquisition skill', 'teach acquisition skill' and 'mastered skills'. Note: *T* = teacher, *S* = student, S^D = discriminative stimulus, *CRF* = continuous reinforcement, *IND-0* = data recorded as independent incorrect on data sheet, *IND-1* = data recorded as independent correct on data sheet, and *ERR-1* = data recorded as error corrected on data sheet.

dependent measures by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. This resulted in an IOA score of 95% for accuracy (range 75–100%), 98% for skill type (range 88–100%), and 98% accuracy for skill difficulty (range 90–100%).

2.4. Social validity

Social validity of the procedures and outcomes were measured through a structured questionnaire administered following completion of the study. The questionnaire consisted of a 9-item Likert scale administered by the experimenter and assessed how confident participants felt in their teaching skills, as well as the ease with which they were able to deliver accurate trials. The questionnaire also examined the extent to which participants would recommend each of the training conditions and whether each training approach might influence their future teaching performance.

2.5. Experimental design and procedure

A nonconcurrent multiple baseline across participants with embedded reversal design was employed to assess the effects of BST in the presence and absence of the stimulus prompt.

2.5.1. BST

At the outset of the first BST condition, the experimenter delivered a 2-hour didactic session on discrete trial instruction and relevant behavior analytic principles and procedures (e.g., shaping, prompting, fading) to each participant. Following the didactic session, each participant was provided with a variety of small play items (e.g., a spinning top) to use as stimulus items in teaching sessions. They were also provided with picture card stimuli (6 cm × 4 cm) corresponding to 20 *tact* targets and data sheets for recording responses for *tact*, *intraverbal* and *listener receptive* targets for each skill area. An example *tact* target involved the presentation of a picture of French fries followed by the question "What is this?" with the target response of "Fries". An example *intraverbal* target involved the learner emitting the vocal response "Pajamas" in response to the presentation of the vocal stimulus, "What do you wear to bed?" by the therapist. Finally, the range of *listener receptive* skills consisted of a variety of simple instructions presented by the therapist such as "cover your eyes" which the learner responded to by carrying out the requested action. The skill areas listed on the data sheets consisted of 15 mastered *tact, listener receptive* and *intraverbal* targets and 5 acquisition *tact*, *listener receptive* and *intraverbal* targets.

The individual teaching components for accurate trials (Table 1) and trial teaching sequences (Fig. 1) for all trial types were described and modeled, and participants were given written guidelines outlining the skills addressed in the training (available from the first author upon request). Participants were instructed that, in addition to demonstrating accurate individual trial delivery, they were also required to (1) deliver trials as quickly as possible; (2) deliver 20% acquisition (hard) tasks and 80% mastered (easy) tasks; (3) deliver an equal number of *tact, intraverbal* and *listener receptive* skills in each session; and (4) deliver no more than three consecutive skills from the same skill type (*tact*, *intraverbal*, *listener receptive*) during each session.

Participants were given opportunities to play the role of both the learner (with the experimenter playing the role of the therapist) and the therapist (with the experimenter playing the role of the learner). During practice in which the participant played the role of the therapist, the experimenter provided trial-by-trial feedback on each skill. Following accurate demonstration of all possible prompts, error corrections, and skill delivery for each target, the participant then demonstrated 10 consecutive trials without feedback. Once the testing sessions had begun, no feedback was delivered within or between sessions until testing in that condition had been completed. The participants were able to refer to the written teaching guidelines at any time.

The proportion of incorrect and correct responses made by the experimenter (role-playing the part of the learner) was equated across all sessions and conditions. The experimenter responded on average to every fourth mastered trial incorrectly, with all other mastered trials responded to correctly. Acquisition skills probed for the first time (*probe acquisition*) were responded to correctly on average every third trial, and incorrectly at all other times. Finally, acquisition skills that were previously probed and subsequently taught in the same session (*teach acquisition*) were responded to correctly by the experimenter on every trial.

To ensure a constant interval between the delivery of reinforcers and the next teaching trial, a 5-s period was timed immediately following the participant delivering a tangible reinforcer to the experimenter. Once this interval had elapsed, the experimenter returned the reinforcer to the participant. In addition, the experimenter ensured that all prompts given by the participant were complied with immediately and correctly.

2.5.2. BST + stimulus prompt training

Procedures and materials for the stimulus prompt sessions were identical to those used during BST, although the didactic session was not repeated. In addition to the *tact* cards used during BST, participants were also provided with two additional sets of skill cards. On the front of the first set of cards was printed the individual *listener receptive* targets, while on the front of the second set was printed each *intraverbal* target. On the reverse side of the *intraverbal* cards were printed pictures corresponding to the correct responses.

Participants were provided with a 12″ × 17″ laminated board, on which were printed 9, 6 cm × 6 cm squares (see Fig. 2). Above each individual square appeared printed text indicating nine specific teaching prompts (Fig. 2). Training commenced with a description of the display and the purpose of each square on the board as it pertained to correct teaching trials. During sessions utilizing the stimulus prompt display, the board was placed on the table in front of the instructor.

Participants were trained to organize the acquisition and mastered skill cards into two separate piles. In each pile, participants were asked to arrange the cards so that *tact*, *intraverbal* and *listener receptive* targets appeared in an interspersed sequence (i.e., *tact*, *intraverbal*, *listener receptive*, *tact*, *intraverbal, listener receptive*, etc.). Acquisition cards were placed on the "Acquisition" square and mastered skill cards were placed on the "Mastered" square prior to the teaching session. Participants were then trained to present teaching trials by using the skill cards as stimulus prompts. Following the completion of each trial, participants were required to place the skill card in a place on the prompting board that corresponded to how the learner had responded. The placement of the skill cards on the prompting board served to cue the therapist to the next course of action required for that skill (e.g., performing an error correction after an incorrect response or reducing a prompt level after a correct response). Following responses to presented trials, skill cards from the acquisition square would be moved either to the "Full Prompt & Transfer" square (if the response was incorrect) or the "Tangible Reinforcer" (if the response was correct). Cards placed on the "Mastered" square would be moved either to the "Error Correction" square (if the response was incorrect) or the "Social Reinforcer" square (if the response was correct). Cards

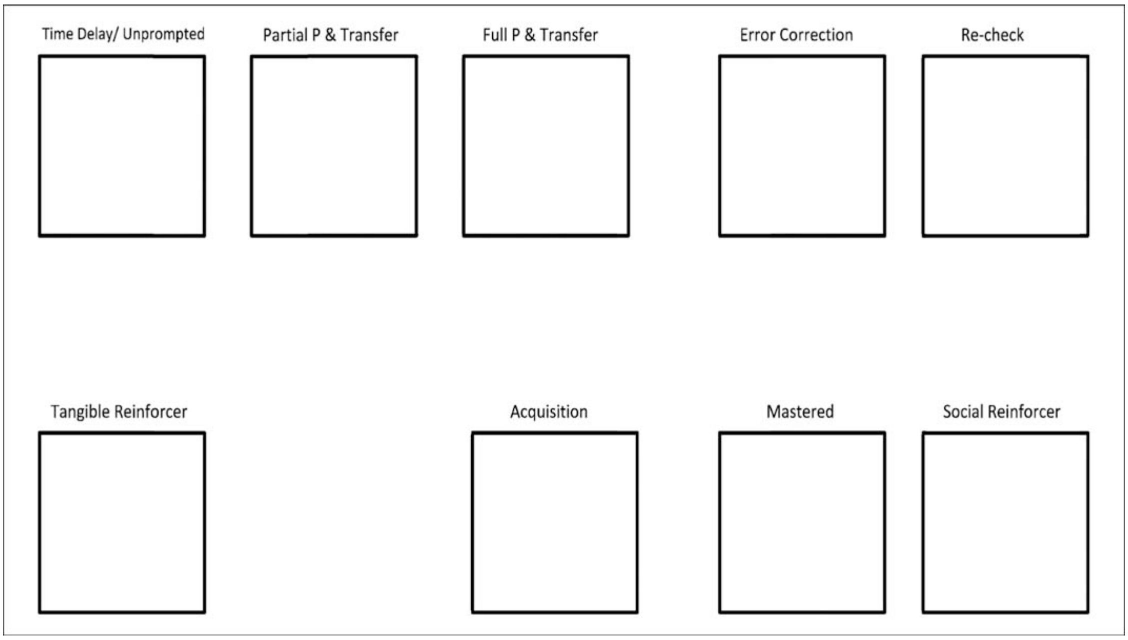

Fig. 2. Illustration of the stimulus prompting board detailing each of the square positions and labels.

placed on the "Social Reinforcer" or "Tangible Reinforcer" square remained in those positions until the end of the session at which point the data was collected. Cards placed on the "Full Prompt & Transfer" square would then systematically be placed on the squares to the left ("Partial Prompt & Transfer," "Time Delay/Unprompted") as the prompt levels during the course of the teaching session were reduced. Cards on the "Error Correction" square were placed on the "Re-Check" square to the right following an error correction procedure.

As with the BST procedures, written guidelines (available upon request) were provided outlining the skills addressed in the training and participants were provided with opportunities to practice as both the learner and the therapist. Procedures for providing feedback and determining each participant's readiness to begin the testing phase were identical to those used in the BST condition.

2.6. Treatment integrity

To ensure that participants could accurately perform the skills taught during both types of training conditions, each participant was required to respond with 100% accuracy across 10 consecutive practice trials at the completion of each training session. If the participants made any errors during the practice trials, they were given immediate feedback on the specific error(s) and allowed to rehearse the task again. Following rehearsal, participants were allowed to decide when they wished to reattempt the 10 practice trials. Participants could not progress to the testing sessions without achieving the mastery criterion.

3. Results

3.1. Percentage of accurate trial presentation

Fig. 3 shows the percentage of trials delivered accurately by each participant across sessions. After the initial BST phase, Katie and Vee presented accurate trials at an average of 92% (*SD* = 7.68) and 92% (*SD* = 5.39), respectively, whereas Monica presented an average of 65% (*SD* = 6.5) trials accurately. Katie and Vee's performance increased slightly with the addition of the stimulus prompt, with means of 97% (*SD* = 0) and 95% (*SD* = 5.24), respectively, whereas Monica improved more substantially to a mean of 89% (*SD* = 1.29). Katie and Vee maintained highly accurate performance during the subsequent BST and stimulus prompt sessions, with accuracy averaging between 90 and 100%. However, Monica's performance decreased when the stimulus prompt board was removed (*M* = 78%; *SD* = 9.63) and again improved when it was reintroduced (*M* = 89%; *SD* = 3.6).

3.2. Rate of accurate trial presentation

Fig. 4 presents the rate per minute of accurate discrete trials delivered correctly during the BST alone and the stimulus prompt conditions. Following the initial BST phase, the rate of accurate trial delivery from Monica, Katie and Vee averaged 3.89 per min (*SD* = 0.51), 5.59 per min (*SD* = 0.74) and 6.67 per min (*SD* = 0.42), respectively. In comparison, the rate of

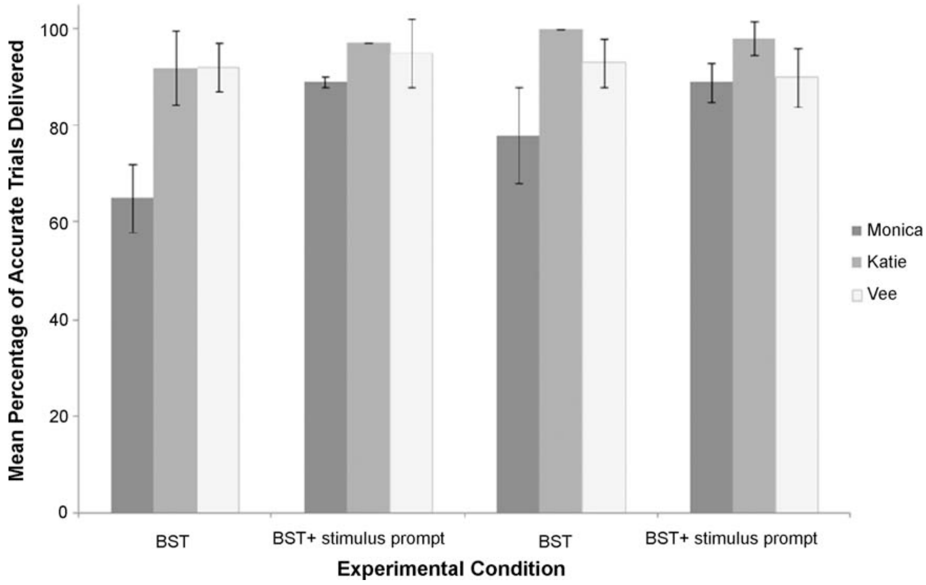

Fig. 3. Mean percentage of accurate trials delivered by Monica, Katie and Vee across conditions. Error bars represent standard deviation.

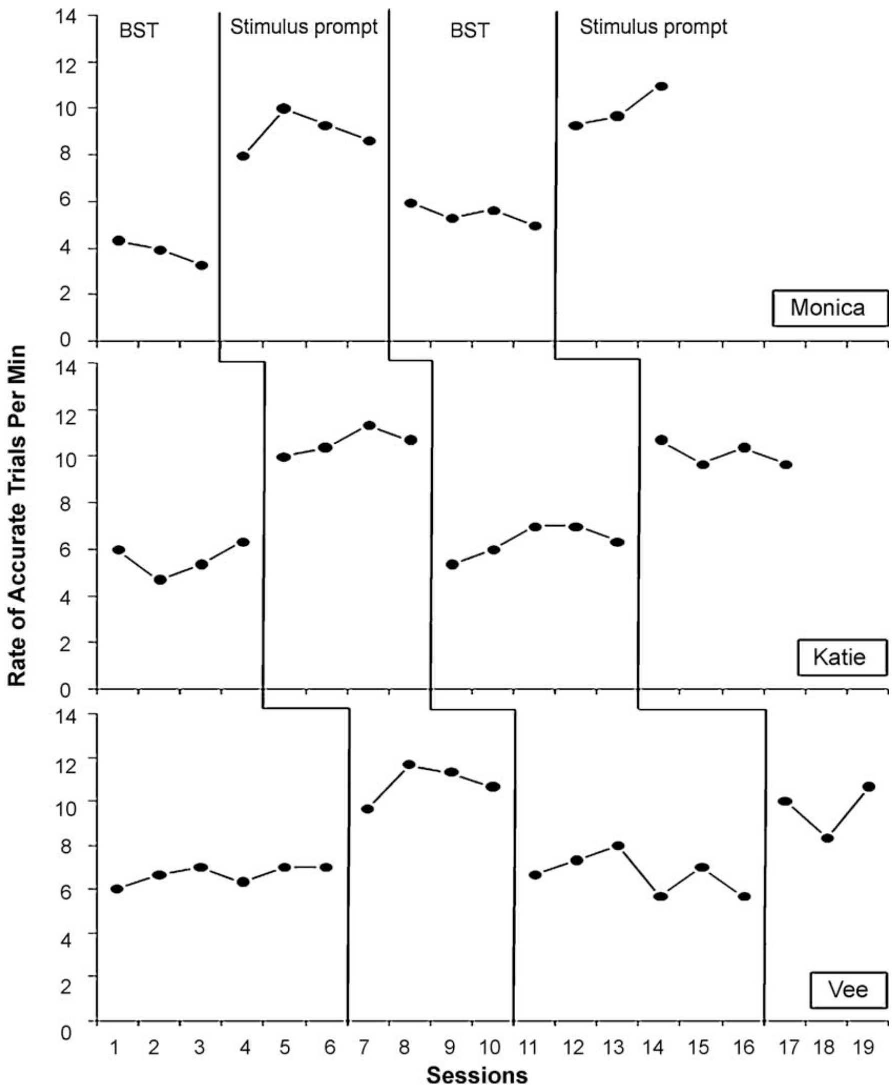

Fig. 4. Rate of accurate trials delivered per minute by Monica, Katie and Vee across all sessions.

accurately delivered trials following the stimulus prompt introduction was substantially higher and averaged 9 per min (*SD* = 0.86) for Monica, 10.58 per min (*SD* = 0.57) for Katie, and 10.92 per min (SD = 0.96) for Vee. Removal of the stimulus prompt board resulted in a decrease in the rate of accurate responding for all participants, with Monica delivering an average of 5.5 accurate trials per min (*SD* = 0.43), Katie, 6.33 trials per min (*SD* = 0.71), and Vee, 6.72 trials per min (*SD* = 0.93). During the final stimulus prompt phase, all the participants' mean rates of responding increased: Monica, 10 per min (*SD* = 0.88), Katie, 10.08 per min (*SD* = 0.50) and Vee, 9.67 per min (*SD* = 1.20).

3.3. Trial variation by skill type

Fig. 5 shows the variation of trial types for all participants collapsed across conditions. All of the participants presented a higher proportion of *tact* targets compared to either *listener receptive* or *intraverbal* targets in the BST conditions compared to the stimulus prompt conditions. Throughout the BST conditions, each participant delivered a greater number of *tacts* relative the *listener receptive* or *intraverbal* targets. Monica delivered a mean of 9.43 (*SD* = 1.72) *tact*, 5.71 (*SD* = 0.95) *listener receptive* and 4.71 (*SD* = 1.11) *intraverbal* targets per session during the BST alone condition. Katie delivered a mean 8.44 (*SD* = 2.07)

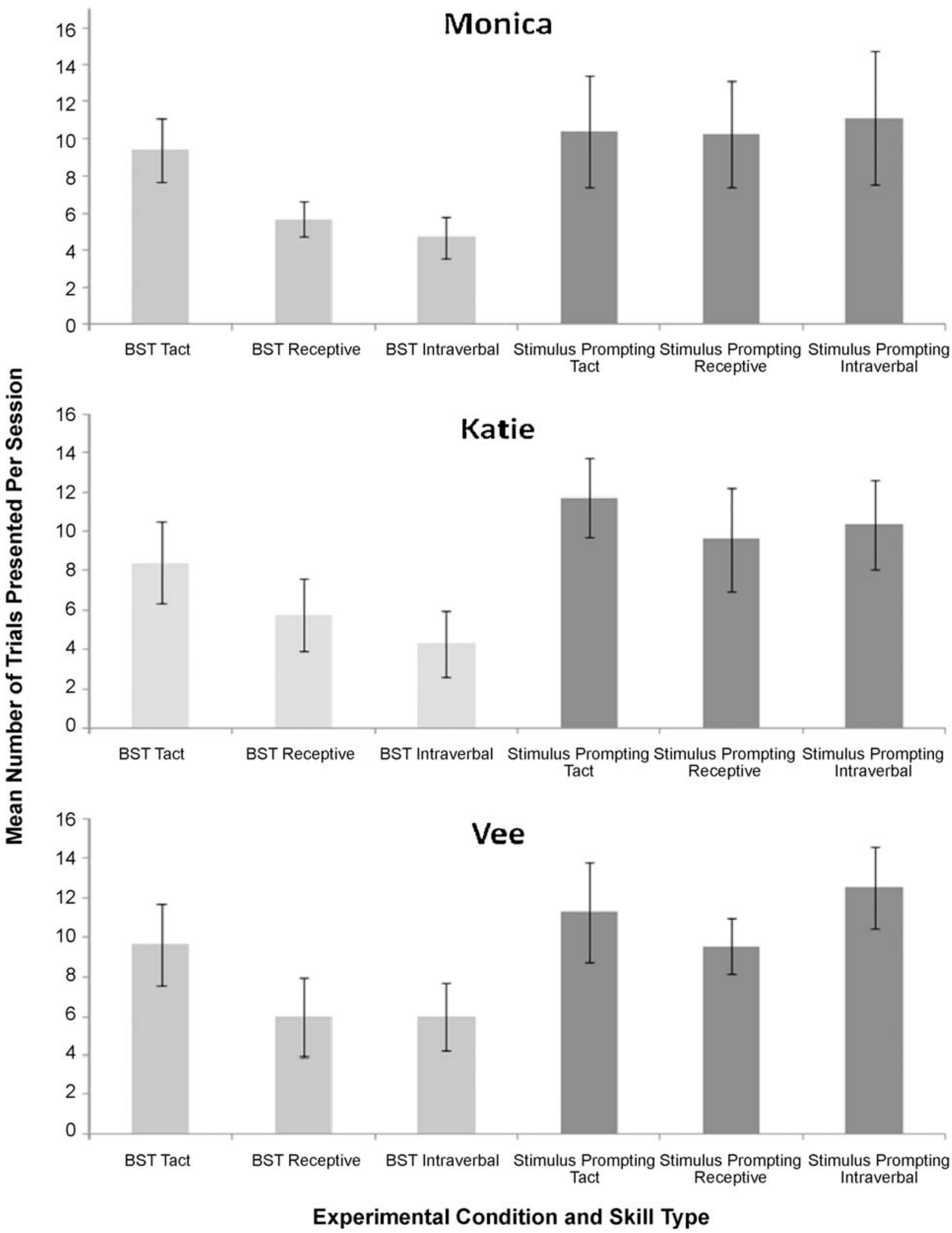

Fig. 5. Mean number of trials delivered according to skill type delivered by Monica, Katie and Vee across conditions. Error bars represent standard deviation.

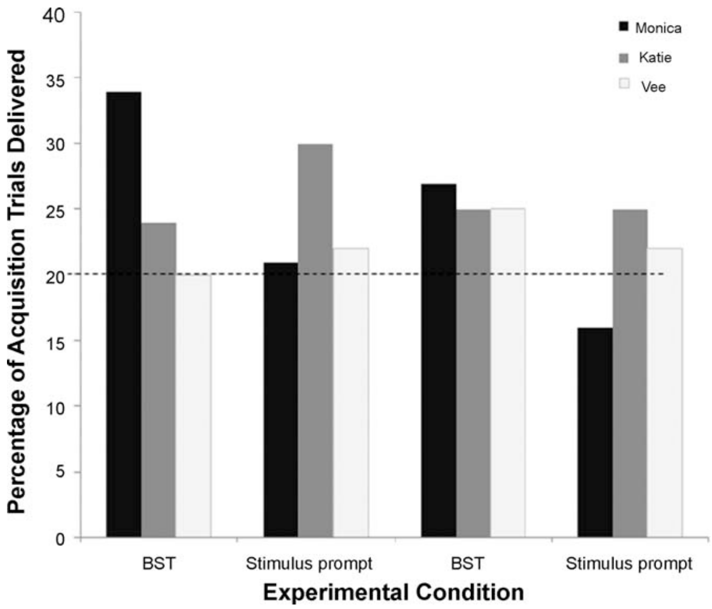

Fig. 6. Mean percentage of acquisition trials delivered by Monica, Katie and Vee across conditions. The dashed line represents the 20% criterion for acquisition trial delivery. Error bars represent standard deviation.

tact, 5.77 (*SD* = 1.86) *listener receptive*, and 4.33 (*SD* = 1.66) *intraverbal* targets over the course of the two BST alone conditions. Continuing with this trend during the BST alone conditions, Vee delivered a mean 9.67 (*SD* = 2.06) *tact* targets, 6 (*SD* = 2) *listener receptive* targets and 6 (*SD* = 1.76) *intraverbal* targets. In contrast, the proportion of teaching targets delivered during the stimulus prompt conditions were more evenly distributed across the skill types. Monica delivered *tact*, *listener receptive* and *intraverbal* targets during the stimulus prompt conditions at a mean of 10.43 (*SD* = 3.05), 10.29 (*SD* = 2.87) and 11.14 (*SD* = 3.63), respectively, per session. Katie presented a mean of 11.75 (*SD* = 2.05) *tact* targets, 9.63 (*SD* = 2.62) *listener receptive* targets and 10.38 (*SD* = 2.26) *intraverbal* targets. Finally, Vee delivered a mean of 11.29 (*SD* = 2.56) *tact*, 9.57 (*SD* = 1.40) *listener receptive*, and 12.57 (*SD* = 2.07) *intraverbal* targets during the stimulus prompt sessions.

3.4. Trial variation by skill difficulty

Fig. 6 illustrates the percentage of acquisition skills delivered during each condition. Both training conditions resulted in presentation of acquisition trials that typically met or exceeded the 20% criterion. Following the initial BST condition Katie, Vee, and Monica presented acquisition skills a mean of 24% (*SD* = 1.73), 20% (*SD* = 4.47) and 34% (*SD* = 13.53) of trials, respectively. Following introduction of the stimulus prompt board, Katie delivered a mean of 30% (*SD* = 0.96), acquisition trials, Vee a mean of 22% (*SD* = 1.82), and Monica a mean of 21% (*SD* = 3.70). During the second BST condition, Katie delivered 25% (*SD* = 8.05) of all trials as acquisition skills, Vee 25% (*SD* = 4.03) and Monica 27% (*SD* = 11.83). In the final stimulus prompt phase, the three participants delivered acquisition trials during 25% (*SD* = 2.22), 22% (*SD* = 1.52) and 16% (*SD* = 3.79) of trials, respectively.

3.5. Social validity

All participants rated their confidence level in delivering teaching sessions with the stimulus prompt board as *very confident,* rated the ease of delivering teaching with the board as *very easy* and rated the board as being either *moderately helpful or very helpful* in positively enhancing their teaching or clinical work outside of the study. All participants indicated that they would *definitely* recommend the training to other therapists and would *definitely* continue to use the board if it was available following the study.

In contrast, participants indicated that they were either *moderately not confident* or *slightly confident* in delivering teaching in the BST alone condition and had found delivering the teaching *slightly difficult* and *moderately difficult*. When asked as to whether they would recommend the BST alone training to others, all participants responded that they would be *very unlikely* to do so. They also reported that the BST alone training was *neither helpful nor unhelpful* or *slightly helpful* in having an effect on their future work outside of the study.

4. Discussion

The purpose of this study was to evaluate the effectiveness of BST with and without a stimulus prompt protocol in increasing the accuracy, rate, and variability of trials used during DTT sessions. Two of the participants (Katie and Vee) were highly accurate in using DTT both with and without the stimulus prompt. One participant (Monica), however, showed substantially better accuracy with the board. Results further showed that all participants delivered accurate trials at a faster rate, and with greater variation of operant types, when using the stimulus prompt.

Perhaps unsurprisingly, all participants delivered trials at moderate to high accuracy in both conditions. This may be partly explained by the participants' history of conducting DTT sessions in their respective home-based programs. Monica's accuracy, however, was higher with the stimulus prompt relative to BST alone. It is noteworthy that Monica was the least experienced of the three therapists; therefore, it is possible that the potentially facilitative effect of the stimulus prompt on trial accuracy may be limited to new or less experienced therapists. Additional research with therapists of differing experience levels or with those naïve to the correct delivery of discrete trials, such as undergraduate students (e.g., Downs, Downs, & Rau, 2008), is needed to further evaluate this possibility. Such findings would be of potential importance due to the often-high reliance by families and behavior analytic consultants on recruiting inexperienced therapists from university undergraduate populations (Smith, Buch, & Gamby, 2000).

By far the most compelling findings of the current investigation were the differences in the rate of accurate trial delivery and increased variation of trial types during the stimulus prompt condition. Comparisons of observations between the BST conditions with and without the board suggest that while therapists might be highly accurate in their delivery of trials, stimulus prompting might enhance their performance on other dimensions. Increasing the rate of trial presentation during sessions has the obvious advantage of presenting more learn units in less time, which appears to be important in maximizing learning outcomes (Albers & Greer, 1991). A likely explanation for why participants were able to present more trials in less time when using the prompt board is that the nature of the stimulus prompting system reduced the duration of time that the therapist spent organizing materials, selecting the target stimuli, and collecting data after each teaching trial. Therefore, inter-trial intervals (ITIs) were ultimately reduced when using the stimulus prompt. The positive effects of shorter ITIs on learning outcomes have been demonstrated empirically (Koegel, Dunlap, & Dyer, 1980), and their importance is highlighted in DTT training materials (e.g., Greer & Ross, 2007). On a more practical level, increasing the number of trials presented during sessions ensures that therapists are spending more time actively engaging children in learning opportunities. Clearly, many factors will influence how much a child learns within a specific session and across the course of an EIBI program. However, to parents who often self-finance the provision of behavior analytic services (Jensen & Sinclair, 2002), knowing that therapists are maximizing the number of trials presented to their children has the potential not only to improve their children's rate of learning, but also to provide some level of confidence that they are getting the best value for their investment.

With regard to varying trial types, one interesting finding was that all participants delivered a greater number of tact targets than intraverbal or receptive targets in the BST conditions. When using the prompt board, however, participants presented a greater range of trial types. Given that the "learner's" program in this study targeted an equal number of target skills of each operant type, participants delivered a more balanced teaching session when the board was used. This might have been due to the fact that during the stimulus prompt condition participants delivered trials from skill cards that had been organized in a predetermined sequence of equal distribution. In other words, the participants did not have to make moment-to-moment decisions about which skills to present. In contrast, when the participants presented trials without the stimulus prompt, they were required to select both the skills and the order of presentation as the teaching session was underway. Although different programs ultimately will require different proportions of particular targets depending on a child's individual needs, the findings of the present study suggest that these proportions will align more closely with the teaching program if a stimulus prompt is employed.

As noted earlier, there is a relative paucity of literature training therapists to mix verbal operant types across discrete trials, despite recommended clinical practice (Sundberg & Partington, 1998). The present findings indicate that significant benefits may accrue when arranging a sequence of mixed teaching tasks in developing complex skills, such as those involved in the formation of equivalence classes. For example, Stromer and Vogt (2009) highlighted the potential teaching benefits for an approach to language intervention that mixes types of stimulus class trials and subsequently generates elaborate and expanded derived stimulus classes. The potential applicability of the present findings on mixing trial types across various teaching domains will be an important consideration for future research.

With regard to the effects of the stimulus prompt on interspersal of easy (mastered) and difficult (acquisition) targets, findings indicated that participants met prescribed ratios reasonably well both with and without the stimulus prompt. However, the least experienced therapist (Monica) met the interspersal criterion more closely when using the stimulus prompt. This finding suggests that the effects of stimulus prompting on therapist interspersal of easy and difficult skills may be functionally related to therapist experience. As with the effects on accuracy, further research should examine the differential outcomes of stimulus prompting across therapist levels of experience.

All participants reported that that they felt more competent and confident during sessions with the stimulus prompt. This is a potentially important finding given the relatively sparse levels of supervision and training individuals employed on home-based EIBI programs often receive (Bibby et al., 2002). Although stimulus prompts are no substitute for formal training and consistent supervision, tools like the stimulus prompt board may prove helpful in supporting therapists to maintain the skills learned during supervision sessions.

Despite the promising results of the current investigation and their implications for promoting best practices in DTT, there are some limitations. First, consistent with previous DTT therapist research (e.g., Arnal et al., 2007), role-play was utilized to simulate teaching conditions. Although it is plausible to assume the performance improvements observed in the present study would generalize to "real world" settings, further research with children with ASD as the learners would be salutary. Second, a potential challenge when transferring the stimulus prompt to other settings concerns the effects of the board on the quality of the learning environment. For instance, it is unclear whether or not the teaching board would prove distracting to both therapist and learner. Future research should consider whether, given initial training with the stimulus prompt, the physical presence of the board could be systematically faded while retaining the improvements in teaching. Third, the present research design made it difficult to discern the absolute effects of BST because no initial baseline assessment was conducted. However, given the previous empirical validation of BST as a training tool (Lerman et al., 2008; Sarakoff & Sturmey, 2004), the purpose of this investigation was not to evaluate the effectiveness of BST per se, but rather to evaluate its effects on various performance domains with and without the stimulus prompt board.

In conclusion, future research should seek to replicate and extend these preliminary findings on the effectiveness of using BST plus stimulus prompting on the efficiency of DTT. Behavior analytic consultants are often faced with the challenge of training a large number of therapists in a relatively short amount of time, particularly when starting a program for a new client or when therapist turnover is high. The continued identification of training strategies that are both efficient and effective is imperative not only for therapists, but for the children they endeavor to teach.

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