Adults with autism spectrum disorder (ASD), who were interested in working as behavior technicians for young children with autism, participated in two experiments. Participants included five adults with Asperger syndrome or pervasive developmental disorder not otherwise specified, 19 to 23 years old, and 11 children with autism, 3 to 7 years old. In Experiment 1, training of the adults focused on the implementation of mand training via incidental teaching. Experiment 2 focused on teaching participants to use discrete-trial training (DTT) with children who exhibited problem behavior. Both experiments showed that behavioral skills training was effective for teaching the adult participants the behavioral procedures needed to teach children with autism. In addition, the children acquired skills as a result of training. Results of Experiment 2 further demonstrated that the DTT skills generalized across untrained targets and children. Social validity ratings suggested that some participants’ teaching was indistinguishable from that of individuals without ASD.

Key words: adults, autism spectrum disorder, behavior technicians, behavior therapists, behavioral skills training

Employment outcomes are particularly poor for individuals with autism spectrum disorder (ASD). Although findings vary widely across studies, recent surveys indicate that only about 50% of young adults with ASD obtain employment after high school (Chiang, Cheung, Li, & Tsai, 2013; Shattuck, Narendorf et al., 2012). Even those who are employed tend to work fewer hours and earn lower wages than individuals with other types of disabilities. Taylor and Mailick (2014) found that vocational outcomes actually declined across a 10-year period for a notable percentage of individuals with ASD in their sample, with the remainder of the participants showing no improvement during that period. Access to services appeared to have only a minor impact on employment outcomes. However, relatively few studies have focused on strategies to improve the vocational skills of individuals with ASD, suggesting that further research is needed to improve employment outcomes for this population (see Bennett & Dukes, 2013; Palmen et al., 2012; Shattuck, Roux et al., 2012, for reviews).

Individuals with ASD who have no intellectual disabilities (ID) are more likely to obtain and maintain employment than individuals with both ASD and ID (Chiang et al., 2013; Taylor & Mailick, 2014). Nonetheless, the employment rate for individuals with ASD and no ID is also low (Baldwin, Costley, & Warren, 2014) even though they are likely to have a larger skill repertoire than individuals with ID. The nature of their vocational difficulties has not been thoroughly explored, but their repertoire of job-related social skills probably is one important determinant of employment outcomes (Chiang et al., 2013). In published interviews, previously employed individuals with ASD reported having inadequate job training and support, intolerant coworkers, and problems interacting with...
supervisors and coworkers (Baldwin et al., 2014; Hurlbutt & Chalmers, 2004; Müller, Schuler, Burton, & Yates, 2003).

One strategy that may alter the likelihood of success on the job is for employment specialists to consider the skills and interests of both the employee and employer when selecting job placements (Bambara, Ager, & Koger, 1994; Morgan & Horrocks, 2011; Nesbitt, 2000; Parsons, Reid, Reynolds, & Bumgarner, 1990). Allen, Wallace, Greene, Bowen, and Burke (2010), for example, examined the effectiveness of video modeling for teaching skills specific to an occupation that might be uniquely suited for certain individuals with ASD. The experimenters taught four adolescents and adults with ASD and no ID, 16 to 25 years old, to perform for shoppers in a retail store while wearing inflatable mascot costumes (a 9-foot tall Rocky-the-Raccoon Walkaround costume). Targeted skills included waving, shaking hands, and jumping or shaking the body. The authors suggested that these skills are ideal for some individuals with ASD because they do not require the employee to interact vocally with others or respond to complex social cues; further, the inflatable costume may shield the wearer from aversive stimuli and unpredictable social demands.

Over the past few years, we have been developing a training program for individuals with ASD and no ID who are interested in serving as behavior technicians for children with ASD. The occupation may be particularly well suited for individuals with ASD and would address the growing demand for applied behavior analysis (ABA) services for young children. Behavior analysts who hire and supervise behavior technicians typically provide highly structured training with clear mastery criteria, regular performance monitoring, and specific feedback about correct and incorrect aspects of responding (Behavior Analysis Certification Board, 2012; Love, Carr, Almason, & Petursdottir, 2009). They also expect behavior technicians to implement behavioral procedures in a consistent manner (Dib & Sturmey, 2007). Research suggests that these instructional strategies are highly effective for individuals with ASD (see Roth, Gillis, & DiGennaro Reed, 2014, for a recent meta-analysis). Employers and coworkers who are knowledgeable of these strategies and are personally interested in working with individuals with ASD should be more tolerant of social deficits and prepared to help shape appropriate behavior in the workplace.

On the other hand, interventions that behavior technicians commonly implement, such as discrete-trial training (DTT) and incidental teaching (IT), contain a complex set of procedures that may need to be modified frequently for individual children. Effective behavior technicians must keep track of multiple events while they work with children (e.g., responding differentially to correct and incorrect responses, fading prompts, collecting data) and adjust procedural components immediately following feedback from supervisors. Research suggests that individuals with ASD may find it particularly difficult to initiate, plan, organize, and monitor behavior; to deviate from repetitive behavioral patterns; and to shift actions or thoughts (see Hume, Loftin, & Lantz, 2009, for a review). Other important procedural aspects of behavioral interventions, such as delivering high-quality praise and responding to subtle social cues (e.g., signs of interest during incidental teaching), may be particularly difficult for individuals with ASD as a result of their own social impairments.

Given the lack of research specific to teaching adults with ASD to serve as behavior technicians for children with ASD, we piloted an initial training program with three women and one man with ASD (Lerman, Hawkins, Hoffman, & Caccavale, 2013). We used behavioral skills training (BST) to teach the participants to implement typical components of DTT (e.g., delivering instructions, prompts, and reinforcement; collecting data) during role-play sessions with research assistants. After the participants
learned to teach two targets during role play, we assessed generalization of their DTT skills to two similar but novel targets. The participants taught a new target to a young child with ASD in the final phase, during which the experimenter provided feedback and occasionally asked two participants to modify aspects of DTT (e.g., to employ a position prompt; to withhold reinforcement for prompted responses). The three participants who completed training rapidly acquired the DTT skills and implemented them with a high level of procedural integrity when they taught new targets to research assistants during role-play and to the child with ASD.

These results were considered preliminary for several reasons. First, the arrangement of the DTT sessions was less complex than behavior technicians might typically encounter. The participants taught just one target during each teaching session even though behavior technicians might alternate among multiple targets during DTT. The participants also worked with just one child even though behavior technicians might be expected to work with multiple children, each of whom have individualized targets, prompt sequences, and reinforcement schedules. Furthermore, behavior technicians’ DTT skills should generalize across children with similar targets and schedules. Second, none of the participants worked with a child who engaged in problem behavior during their training and evaluation. Behavior technicians frequently must learn how to manage problem behavior appropriately during instruction. Third, results of a social validity assessment in which experts rated the participants’ performance revealed problems with qualitative aspects of the participants’ teaching, such as the enthusiasm of their praise and tone of voice when delivering instructions. This finding suggests that modification to our training model is needed to produce more normalized interpersonal responding. Fourth, the majority of training was conducted in role-play with experimenters, and the study included no baseline data on the participants’ performance when they worked with an actual child. Finally, we focused on just one instructional approach (DTT). Other commonly used behavioral interventions, such as IT, might be more difficult for behavior technicians because they are less structured, and they require the technician to respond to subtle social cues and to follow the lead of the child. The purpose of the current study was to extend our prior work in several ways. In the first experiment, we taught adults with ASD and no ID to implement mand (i.e., request) training with children using an IT approach. In the second experiment, we taught adults with ASD and no ID to implement a more complex form of DTT with multiple children who engaged in problem behavior, and we assessed the possible emergence of generalization across targets and children during training.

GENERAL METHOD

Participants and Settings

Five adults and 11 children who had been diagnosed with an ASD participated. Adult participants were recruited from area agencies that serve adults with autism, announcements published on a website, and flyers distributed at local events attended by families of individuals with autism. Children were recruited from a university-based early intervention program and two private early intervention programs. Adults were eligible if they (a) showed proof of diagnosis of an ASD (including autism, Asperger syndrome, and pervasive developmental disorder not otherwise specified), (b) had an IQ score above 70, as assessed by an appropriate professional who was not affiliated with the study, and (c) indicated an interest in learning how to work with young children with ASD. Children were eligible if (a) parents consented to their inclusion in the study, and (b) they engaged in moderate levels of problem behavior.
Adult participants included Neal, Kurt, Hayden, Lenard, and Donna. Neal and Kurt participated in Experiments 1 and 2. Hayden participated in Experiment 1 only. Lenard and Donna participated in Experiment 2 only. Neal, age 20, had a high school diploma, was unemployed at the time of the study, and had previously worked with children as a volunteer at his church’s Sunday school. He had been diagnosed with Asperger syndrome, bipolar disorder, and attention deficit hyperactivity disorder (ADHD). His most recently evaluated full-scale IQ at age 10 was 102 as measured by the Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 1991). Kurt, age 21, was a full-time college student working on a bachelor’s degree in sociology at the time of the study. He had been diagnosed with autism, and his full-scale IQ was 100 as measured by the Wechsler Adult Intelligence Scale (WAIS-IV; Wechsler, 2008). He worked part-time selling popcorn at a mall. Hayden, age 23, was unemployed and taking college courses at the time of the study. He had been diagnosed with Asperger syndrome, ADHD, bipolar disorder not otherwise specified (NOS), and generalized anxiety disorder. His full-scale IQ was 100 as measured by the WAIS-IV. He reported no prior work history and no experience working with children. Lenard, age 23, was enrolled full time as a college student working on a bachelor’s degree in psychology. He had been diagnosed with Asperger syndrome, and his full-scale IQ was 164 as measured by the WAIS-IV. At the time of the study, he was working with children at a martial arts school as a volunteer. Donna, age 22, had a high school diploma and was completing course work towards an associate degree in criminal justice at the time of the study. She had been diagnosed with pervasive developmental disorder NOS, borderline intellectual functioning, and generalized anxiety disorder. Her IQ was 77 as measured by the Slosson Intelligence Test–Revised (Slosson Nicholson, & Hibpshman, 1991). She had previously volunteered for a few months providing direct care to adults with ASD at a residential facility. Information about the child participants is shown in Table 1. Children 1, 2, and 3 participated in Experiment 1 only, Child 4 participated in Experiments 1 and 2, and the remainder of the children participated in Experiment 2 only.

All sessions were conducted in therapy rooms at the day programs where the children were enrolled for ABA services. The rooms contained a table, chairs, and materials that were needed to teach the skills.

Table 1
Age, Topographies of Problem Behavior, Experiment, and Behavior Technician for Each Child

<table>
<thead>
<tr>
<th>Child</th>
<th>Age (years)</th>
<th>Problem behavior</th>
<th>Experiment</th>
<th>Behavior technician</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>Aggression (biting), crying</td>
<td>1</td>
<td>Neal, Kurt</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td></td>
<td>1</td>
<td>Hayden</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td></td>
<td>1</td>
<td>Hayden</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Crying, throwing task materials</td>
<td>1 and 2</td>
<td>Lenard, Neal, Kurt</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>Aggression (biting), self-injury (bitting elbows on table), screaming</td>
<td>2</td>
<td>Lenard, Kurt</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>Aggression (bitting), crying</td>
<td>2</td>
<td>Neal, Kurt</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>Aggression (bitting, pinching), property destruction, crying</td>
<td>2</td>
<td>Neal</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>Aggression (bitting), screaming</td>
<td>2</td>
<td>Lenard</td>
</tr>
<tr>
<td>9</td>
<td>3</td>
<td>Crying</td>
<td>2</td>
<td>Donna</td>
</tr>
<tr>
<td>10</td>
<td>7</td>
<td>Aggression (pinching), crying, vocal stereotypy</td>
<td>2</td>
<td>Donna</td>
</tr>
<tr>
<td>11</td>
<td>7</td>
<td>Hand flapping, body rocking</td>
<td>2</td>
<td>Donna</td>
</tr>
</tbody>
</table>
EXPERIMENT 1: INCIDENTAL TEACHING

Method
Neal, Kurt, and Hayden were taught to use IT to implement mand training with two children.

Response Measurement and Reliability

Adult. A trained observer scored each of the following components as correct, incorrect, or not applicable during each opportunity to conduct IT (i.e., on each “trial”): (a) toys or edible items visible to the child; (b) picture exchange cards available, if applicable; (c) left–right position of the cards and items alternated on each trial, if applicable; (d) access to items blocked until correct child response occurred; (e) hand placed between cards with palm up, if applicable; (f) delivered a prompt within 5 s to 10 s after the child indicated an interest in the object (defined as looking, reaching, or pointing to it) but did not exhibit a correct response; (g) delivered prompts using least-to-most intrusive hierarchy (correct prompt forms individualized for each child); (h) waited 3 s to 7 s between prompts; (i) delivered specific praise (e.g., “Super, you want the [specific toy]”; “Awesome, you want the [specific toy]”) contingent on the correct child response; (j) delivered the requested tangible item contingent on the correct child response; (k) delivered specific praise and the requested item within 5 s of the correct child response; (l) made eye contact with the child while delivering praise and the requested item; (m) provided access to the requested item for 20 s to 30 s; (n) collected data; (o) enticed the child (by activating the toy or picking it up and showing it to the child) if at least 1 min elapsed without an initiation (reaching for, looking at, or pointing to a preferred item); and (p) stopped delivering prompts if the child stopped showing an interest in the item. A trial began with a child initiation, defined as looking at, reaching for, or pointing to a preferred item, or trainer enticement, defined as the trainer activating a preferred toy or picking up a preferred item and showing it to the child. A trial ended when the child stopped showing interest in the preferred item, the child consumed an edible item that the trainer had delivered, or the trainer removed a preferred item that had been delivered for a correct response. Sessions lasted 5 min unless the child failed to show interest in a preferred item for 2 min. In the latter case, the experimenter terminated the session. The primary dependent variable was the percentage of correct response components across all trials during a session. We divided the total number of correctly implemented components by the total number of opportunities to implement the components in each session and converted the result to a percentage to generate the percentage of correct responses.

Child. Child responses (mands) were selected and defined individually, based on the results of preference assessments conducted immediately before the start of the session. Each child was taught to request up to two preferred items in each training session using the communication modality that was targeted during his or her regular instructional sessions. Table 2 shows the behavior technician, communication modality, and targets (preferred items) for each child. None of the mands were taught outside the experimental sessions. Child 1 was taught to exchange pictures with Neal and to sign with Kurt. The switch to signing occurred because Child 1 had made limited progress with picture exchange outside the study (i.e., the child was not discriminating among multiple pictures). At the time that Kurt entered the study, Child 1 had two signs in his repertoire. Child 4 was taught to use picture exchange with Neal and to sign with Kurt. The switch to signing occurred because Child 1 had made limited progress with picture exchange outside the study (i.e., the child was not discriminating among multiple pictures). At the time that Kurt entered the study, Child 4 had not yet acquired any signs but would periodically vocally mand for items using a single word. Kurt was instructed to teach signs to Child 4 because prompts did not reliably occasion vocalizations; however, Kurt was told to reinforce correct vocal...
If they occurred during his teaching sessions and to pair prompts for the sign with echoic prompts. Hayden taught vocal mands to Children 2 and 3 because they each had a strong echoic repertoire.

Data were collected on the frequency of correct prompted and independent mands. To be considered correct, the mand had to be in the correct form and represent the item for which the child was currently showing interest. Independent mands were those that occurred in the absence of a prompt, and prompted mands were those that occurred within 10 s of a gesture prompt (e.g., pointing to the picture card), model prompt (e.g., saying the name of the item), or physical prompt (e.g., guiding the child’s hand). For picture exchange, a correct response was defined as picking up the card with the picture of the item and placing it in the hand of the therapist. For signing, a correct response was defined as displaying the correct sign in American Sign Language. For vocal mands, a correct response was vocalizing the name of the item (“piano” and “computer” for Child 2, “apple” and “chewie” for Child 3, “train” and “radio” for Child 4). Data on the frequency of independent mands and prompted mands were divided by the number of minutes in the session to generate responses per minute.

Reliability. An independent observer scored at least 22% of the sessions in each condition for each participant (range, 22% to 50%) from video recordings. For the data on adult behavior, we calculated agreement on a trial-by-trial basis by dividing the number of trials with agreement (for correct and incorrect responses) by the total number of trials and converting the results to a percentage. For child responses, we calculated agreement by dividing the smaller number of responses by the larger number and converting the result to a percentage. The mean percentages of agreement for the adult responses were 97% (range, 92% to 100%) for Neal, 89% (range, 88% to 98%) for Kurt, and 87% (range, 67% to 100%) for Hayden. Mean percentages of agreement for child independent mands were 82% (range, 0% to 100%), 97% (range, 75% to 100%), and 100% for the children working with Neal, Kurt, and Hayden, respectively. Mean percentages of agreement for child prompted mands were 84% (range, 0% to 100%), 92% (range, 67% to 100%), and 100% for the children working with Neal, Kurt, and Hayden, respectively. The low end of the ranges occurred when a single response was scored by one data collector and no responses were scored by the other.

Procedure

The effects of the training on the adult participants’ accurate implementation of IT and on the children’s manding were evaluated via a multiple baseline design across adult–child pairs. We slightly modified the structure of typical IT sessions to ease training and data collection for the participants. Commonly, IT procedures are
implemented under naturalistic conditions, in which preferred items are placed on shelves or otherwise restricted under the context of play situations or regular routines. The child may ambulate freely, and the therapist follows the child’s lead. In this study, all IT sessions were conducted with the adult therapist sitting across from the child at a small table. Two preferred items were placed on the table but out of the child’s reach, along with the corresponding picture exchange cards, if used. An experimenter prompted the child to return to his or her seat if necessary during training.

Adults participated in baseline and training sessions for 1.5 to 2 hr per day, 2 days per week. They were offered frequent breaks and could request a break at any time. The experimenter described each phase change as it occurred (e.g., switch from immediate to delayed feedback) and gave the participant an opportunity to delay the phase change if desired (i.e., the participant wanted access to more support for a little longer in spite of their good performance). This option was provided to reduce the risk of stress or frustration associated with the training procedures for the adult participants with ASD. Two participants (Neal and Hayden) both opted to delay the switch from immediate to delayed feedback once during training. Before the daily sessions, the adult participant was encouraged to participate in a 10-min free-play session with each child to build rapport. He was not given any instructions, other than to play with the child. None of the preferred items used during IT was available during the free-play sessions.

Baseline. Before training, 5-min baseline sessions were conducted in role-play with a research assistant and with two children. The participant was given two food or leisure items, a board with pictures affixed via Velcro that matched the items (if applicable), a data sheet, clipboard, pen, and stopwatch. The experimenter stated to the participant, “We need to know if our training will help you, so first we need to know how you would naturally teach the learner to ask for his toys [snacks],” and described the child’s targeted communication responses. The research assistant followed a prepared script consisting of child responses that were randomized before each session (scripts are available from the first author). The script was not visible to the adult participant. Procedures were identical for the baseline sessions with the child participant, with the absence of the prepared script for child responses.

Training. All training initially was conducted within the context of role-play with a research assistant. During the first training session, the experimenter provided written and verbal instructions, modeled correct IT procedures with the research assistant using the prepared scripts described previously, and answered any of the participants’ questions (written instructions are available from the first author). Next, the participant engaged in role-play with the research assistant, who followed the prepared scripts. Each training session consisted of eight trials. The experimenter provided feedback after each trial by describing all steps performed correctly and all steps performed incorrectly (i.e., immediate feedback). The experimenter correctly modeled any responses that had been performed incorrectly, and the participant repeated the trial until he completed all response components correctly.

The remainder of training differed slightly for our first participant (Neal) than for the other two participants due to experimenter error when working with Neal. After Neal performed the response components with at least 80% accuracy for two consecutive sessions while receiving immediate feedback during role-play, he began to practice IT with the first child during 5-min sessions. He received brief feedback during each trial. This feedback was relatively simple so as to not interrupt the session, such as a thumbs-up to indicate that the trial had been conducted correctly or a gesture to indicate incorrect responses. At the end of the 5-min session, the experimenter correctly modeled any responses
that had been performed incorrectly, and the participant had an opportunity to practice with the experimenter until he performed all response components correctly. After four sessions with the first child, Neal began to practice with the second child, and, at that time, the experimenter removed all immediate feedback. Neal continued to receive feedback after each 5-min session as described previously. Training was similar for Kurt and Hayden except that they received delayed feedback during role-play for at least two sessions before they began practice sessions with the children. The criterion for moving from immediate to delayed feedback during role-play and from delayed feedback to IT sessions with the child was at least 80% accuracy for two consecutive sessions.

The total number of training sessions with the children varied across participants and was highly dependent on the availability of the participant, the children, and the experimenter. As noted previously, the session ended if the child did not indicate an interest in the toys or food items for 2 min. This occurred for at least one session for each participant.

In addition to specific praise during the feedback component of the sessions, the participants received $10 for attending each training appointment, regardless of their performance or the duration of the appointment. Participants also received an additional $1 for each trial performed with 100% accuracy during training with a child, with the maximum amount of bonus money set at $5.

**RESULTS AND DISCUSSION**

Each participant required a total of about 3 hr of training with the experimenter before meeting the mastery criteria to work directly with children. They worked with the children across an additional 2 (Hayden) or 8 (Neal and Kurt) days after training. Percentages of correct responses for the adult participants during baseline and training with the two children are shown in Figure 1, but data on performance during role-play are not shown. During baseline, Neal engaged in similarly low percentages of correct responses \( (M = 27\%) \) during role-play and when he worked with the children. His performance immediately improved to high levels during role-play after he received verbal and written instructions and demonstrations of the correct responses \( (M = 94\%; \text{ data not shown}) \). He continued to perform at high but variable levels when he worked with Child 1.
under immediate feedback ($M = 90\%$) and with Child 4 under delayed feedback ($M = 86.4\%$). Neal’s performance was maintained at high levels with Child 1 ($M = 93.5\%$) and during occasional sessions with Child 4 ($M = 100\%$) as the experimenter continued to give Neal feedback after each 5-min session.

Kurt also engaged in low levels of correct responses during role-play and with the children in baseline ($M = 29.8\%$). Following instruction and modeling, he performed with high procedural integrity during role-play under both immediate (posttrial) and delayed (postsession) feedback ($M = 90\%;$ data not shown). His performance was maintained at high levels when he worked with Child 1 and received immediate feedback ($M = 92.5\%$) but became more variable when he worked with both Child 1 ($M = 84\%$) and Child 4 ($M = 89\%$) under delayed feedback. Kurt typically scored lower on the following components: (a) waiting at least 5 s to 10 s between prompts, (b) delivering the correct form of the prompt, and (c) delivering prompts only when the child was still showing interest in the preferred item. However, his mean level of correct responses was at least 80\% in most sessions.

Hayden’s performance during baseline with the child was more variable and somewhat higher than that of the other participants ($M = 44\%$). Closer inspection of the session data indicates that the three higher baseline points (Sessions 1, 5, and 6) were an artifact of our data-collection system. Specifically, in those sessions, he correctly blocked access to the preferred items if the child did not engage in the targeted response but had few opportunities to engage in the other components of incidental teaching. This necessarily inflated the percentage of correct responses per opportunity. Following instruction and modeling, he averaged 97\% correct responses under immediate and delayed feedback during role-play (data not shown), levels that were maintained when he worked directly with the children ($M = 96\%$). Hayden’s evaluation was shorter than that of the other participants due to his limited availability.

Responses per minute of correct independent and prompted communication responses for the children during baseline and training are shown in Figure 2. Neither of the children paired with Neal handed him the picture card during baseline. Following Neal’s initial training, both prompted and independent picture exchange responses increased during the IT sessions. Independent responses sharply increased during the latter half of the training for Child 1, exceeding his prompted responses. Child 4 received fewer training sessions than Child 1, but his independent responses exceeded prompted responses in the majority of sessions. Child 1 and Child 4 did not exhibit any correct communication responses in the form of signs during baseline with Kurt. Even after Kurt received training, Child 1 failed to engage in any independent signs during the IT sessions, although he engaged in prompted responses throughout training. It should be noted that we had difficulty capturing the relevant motivating operations (MOs) for Child 1, who frequently did not show interest in the items identified via preference assessments. Child 1’s regular therapists had identified a variety of other and perhaps more preferred items, but they were teaching him signs for those items outside the research sessions. Thus, weak MOs or reinforcement effects may account for the lack of progress for Child 1, rather than Kurt’s procedural integrity per se. Child 4 exhibited a single correct vocal mand (“train”) during baseline, and Kurt gave him access to the train. On the first trial of his first IT session, Child 4 vocally requested one of the toys (“train”) although Kurt correctly delivered a prompt for the sign (combined with an echoic prompt). Child 4 exhibited no independent signs but moderate to high levels of prompted and independent vocal requests throughout the teaching sessions; thus, only vocal mands are shown in Figure 2.
Neither of the children paired with Hayden exhibited correct vocal mands in baseline. During IT sessions, Child 2’s prompted responses immediately increased when Hayden received immediate feedback, and his independent responses increased when Hayden received feedback at the end of the session. Child 3 began to exhibit both prompted and independent vocal mands in his first IT session. In the second session, however, Child 3 showed much less interest in the food items. Thus, the decrease in responding appeared to be due to the absence of the relevant MO rather than problems with Hayden’s procedural integrity.

Overall, results suggested that the three adults with ASD acquired the skills needed to conduct mand training via a modified IT approach. Levels of procedural integrity were similar to those

Figure 2. Responses per minute of correct independent and prompted communication responses for the children who worked with Neal, Kurt, and Hayden in Experiment 1. FB = feedback.
reported in previous research on caregiver training and IT or mand training (e.g., Hsieh, Wilder, & Abellon, 2011; Nigro-Bruzzi & Sturmey, 2010). In addition, their teaching was effective in promoting the acquisition of mands for the majority of children. The contribution of the small performance-based monetary reward for up to five correct trials to the outcomes for the adult participants should be evaluated in future research.

EXPERIMENT 2: DISCRETE-TRIAL TEACHING

METHOD

Experiment 2 was intended to extend the results of Experiment 1 and those of Lerman et al. (2013) by (a) targeting a more complex form of DTT, (b) teaching the participants to work with multiple children, all of whom engaged in problem behavior, and (c) assessing the possible emergence of generalization across targets and children during training.

Response Measurement and Reliability

Adult. Trained observers scored each response component of DTT as correct, incorrect, or no opportunity on each trial. The responses, which were similar to those in Lerman et al. (2013), are displayed in Table 3. Responses measured during additional qualitative training, conducted at the end of the study, are described further below. The data were expressed as a percentage of components implemented correctly across each six-trial session by totaling the number of correctly implemented components (excluding the additional qualitative responses), dividing by the total possible components, and converting the outcome to a percentage. During qualitative training, the percentage of additional response components that the participants implemented correctly was calculated by totaling the number of correctly implemented components (excluding the originally trained responses shown in Table 3), dividing by the total possible components, and converting the outcome to a percentage.

Table 3

Responses and Definitions for Behavior Technicians in Experiment 2

<table>
<thead>
<tr>
<th>Gets child’s attention</th>
<th>Calls child’s name and says “look at me” if child’s head is turned away from the therapist by at least 90 degrees or if the child is engaging in competing stereotypy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instruction form</td>
<td>Matches specific instruction designated for program</td>
</tr>
<tr>
<td>Instruction delivery</td>
<td>Delivered with clear articulation; voice at conversation level or above; neutral tone; not repeated within 5 s (unless child has emitted an incorrect response)</td>
</tr>
<tr>
<td>Prompt form and sequence</td>
<td>If no response or incorrect response, delivers a verbal or physical prompt; each prompt is more intrusive than previous one; no repeated prompts</td>
</tr>
<tr>
<td>Prompt timing</td>
<td>Not delivered with initial instruction; if child does not respond, wait at least 3 s and no more than 10 s after initial S^D or prompt; if child responds incorrectly, prompt delivered immediately</td>
</tr>
<tr>
<td>Prompt delivery</td>
<td>Paired with correct verbal S^D</td>
</tr>
<tr>
<td>Reinforcement form</td>
<td>Consequence is delivered as specified on data sheet; praise specifies desired response (“good touching car”); enthusiastic tone (different than instruction delivery).</td>
</tr>
<tr>
<td>Reinforcer immediacy</td>
<td>Praise delivered within 5 s of correct response; “thanks” or “that’s correct” is not considered reinforcement unless paired with a tangible item; when applicable, item delivered within 5 s of praise</td>
</tr>
<tr>
<td>Praise variety</td>
<td>Wording differs from the last three praise statements by at least one word</td>
</tr>
<tr>
<td>Differential consequences</td>
<td>Reinforcement withheld for incorrect responses, no responses, or physically guided responses</td>
</tr>
<tr>
<td>Removal of materials</td>
<td>Instructional materials removed within 5 s of reinforcer delivery</td>
</tr>
<tr>
<td>Management of problem behavior</td>
<td>Says nothing about the behavior and continues the prompting sequence</td>
</tr>
<tr>
<td>Intertrial-interval length</td>
<td>No more than 10 s unless child still consuming food; if toy delivered, new trial begins no more than 10 s after the reinforcement interval</td>
</tr>
<tr>
<td>Data collection</td>
<td>Outcome of trial (correct, prompted, or no response) recorded correctly for each trial</td>
</tr>
<tr>
<td>Trial interspersal</td>
<td>Trials are conducted with each target presented every other trial</td>
</tr>
</tbody>
</table>
Observers scored occurrences of correct responses by the child on a trial-by-trial basis and the total frequency of inappropriate behavior that occurred during instructional trials. A correct response was defined individually for each target and had to occur within 5 s of the vocal discriminative stimulus (SD) in the absence of any prompts to be scored as correct. Prompts were defined as any gesture, model, or physical assistance, or a spoken instruction that was repeated at least 5 s after a previous spoken instruction. The targeted responses for each child are shown in Table 4. These responses included at least two training targets and two generalization targets for each child, with the exception of the generalization child (see below for further explanation). The total number of correct responses in each six-trial session was divided by the total number of trials and converted to a percentage of trials with correct responses.

In addition to individualized targets, the children were assigned individualized types and schedules of reinforcement based on the results of preference assessments and schedules used during their regular instructional sessions. Correct responses by Children 4, 7, and 8 produced reinforcement (i.e., choice of an activity or food item) on a fixed-ratio (FR) 1 schedule. Correct responses by Child 5 produced reinforcement (i.e., choice of food items) on an FR 2 schedule, correct responses by Child 6 produced reinforcement (i.e., choice of food items or a break with tangible items) on an FR 3 schedule, correct responses by Child 9 produced token reinforcement on an FR 1 schedule with access to a toy after five tokens, and correct responses by Children 10 and 11 produced token reinforcement.

Table 4

<table>
<thead>
<tr>
<th>Child</th>
<th>Behavior technician</th>
<th>Training targets</th>
<th>Generalization targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Lenard</td>
<td>Set 1 Animal ID (sloth) Intraverbal: “You sleep in a (bed)”</td>
<td>Set 2 Animal ID (chipmunk) Intraverbal: “You ride in a (car)”</td>
<td>Animal ID (anteater) Intraverbal: “A frog says (ribbit)”</td>
</tr>
<tr>
<td>4 Neal</td>
<td>Two-step instructions (touch nose, clap hands) Intraverbal: “When is your birthday?” (date)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Kurt</td>
<td>Three-step instructions (pat nose, touch ears, touch eyes) Intraverbal: “When is your birthday?” (date)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Lenard</td>
<td>Set 1 Body parts ID (elbow) Money ID (nickel)</td>
<td>Set 2 Body Parts ID (chin) Money ID (dime)</td>
<td>Body parts ID (knee) Money ID (penny)</td>
</tr>
<tr>
<td>5 Kurt</td>
<td>Money ID (quarter) Intraverbal: “When is your birthday?” (date)</td>
<td>Money ID (penny) Intraverbal: “What is your brother’s name?” (name)</td>
<td></td>
</tr>
<tr>
<td>6 Neal</td>
<td>Three-step instructions (touch head, touch tummy, touch shoulder) Sounds ID (sh)</td>
<td>Three-step instructions (touch eyes, touch mouth, touch nose) Sounds ID (qu)</td>
<td></td>
</tr>
<tr>
<td>6 Kurt</td>
<td>Three-step instructions (stand up, clap hands, jump) Sounds ID (ch)</td>
<td>Three-step instructions (shrug shoulders, wave hands, nod head) Sounds ID (Pl)</td>
<td></td>
</tr>
<tr>
<td>7 Lenard</td>
<td>Money summation 35¢ (quarter, nickel, dime) Intraverbal: “When is your birthday?” (date)</td>
<td>Money summation 55¢ (quarters, nickel) Intraverbal: “What are some silverware?” (knife, spoon, fork)</td>
<td></td>
</tr>
<tr>
<td>8 Lenard</td>
<td>Three-step instructions (wave hands, touch chin, raise leg) Money ID (quarter)</td>
<td>Sounds ID (ch) Animals ID (hyena)</td>
<td></td>
</tr>
<tr>
<td>9 Donna</td>
<td>Three-step instructions (pat legs, raise arm, nod head) Money ID (penny)</td>
<td>Three-step instructions (pat legs, raise arm, nod head) Money ID (penny)</td>
<td></td>
</tr>
<tr>
<td>10 Donna</td>
<td>Body parts ID (Elbow) Intraverbal: “What do you drink from?” (cup)</td>
<td>Body parts ID (head) Intraverbal: “What do you sleep in?” (bed)</td>
<td></td>
</tr>
<tr>
<td>11 Donna</td>
<td>One-step instruction (turn around) Intraverbal “What color is the grass?” (green)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* ID = identification.
reinforcement on an FR 1 schedule with access to a toy after three tokens. Inappropriate behavior was defined individually for each child (see Table 1) and included disruption, aggression, self-injury, and stereotypy. Frequency data on inappropriate behavior were expressed as both responses per minute and percentage of trials with inappropriate behavior.

Reliability. A second observer independently collected data for at least 32% of the sessions during baseline and posttraining and for at least 28% of the sessions during qualitative training for each participant. The data on each adult response component and child correct responses were compared on a trial-by-trial basis. Trials in which both observers agreed on the occurrence or nonoccurrence of the responses (excluding responses with no opportunity) were divided by the total number of agreements and disagreements and converted to a percentage. For baseline and posttraining, mean percentages of agreement for adult participants (excluding the qualitative responses) were 98% (range, 84% to 100%), 92% (range, 65% to 100%), 91% (range, 77% to 100%), and 98% (84% to 100%) for Lenard, Neal, Donna, and Kurt, respectively. Mean percentages of agreement for adult qualitative responses were 94% (range, 86% to 98%), 93% (range, 77% to 100%), and 94% (84% to 100%) for Lenard, Donna, and Kurt, respectively. Mean percentages of agreement for child correct responses were 99% (range, 83% to 100%), 97% (range, 83% to 100%), 99% (range, 83% to 100%), and 99% (83% to 100%) for the children who worked with Lenard, Neal, Donna, and Kurt, respectively.

Interobserver agreement on the frequency of child inappropriate behavior was calculated by dividing the smaller number by the larger number and converting to a percentage for each session. Mean percentages of agreement for child problem behavior were 87% (range, 0% to 100%), 91% (range, 25% to 100%), 88% (range, 0% to 100%), and 93% (range, 0% to 100%) for the children who worked with Lenard, Neal, Donna, and Kurt, respectively. The low end of the ranges occurred when one or two occurrences were scored by one data collector and no occurrences were scored by the other.

Procedure

A multiple baseline design across participants was used to evaluate the outcomes of the training program. The adults participated in 2-hr training meetings once or twice per week, depending on their availability. After baseline, an experimenter taught each adult with ASD individually using verbal and written instructions, modeling, role-play, and practice with feedback. Experimenters taught the participants to teach two targets (training targets) to two children and assessed generalization of the participants' teaching skills by having them teach two additional targets (generalization targets) to each of those two children and to teach two different targets to a third child who had never participated in training sessions (see Table 4 for children and targets). Lenard taught his children an additional set of training targets during the qualitative portion of his training (see further explanation below).

Baseline. An experimenter asked the participant to teach a child two specific targets and to do his or her best. The participant was given a data sheet, along with the instructional materials and reinforcers for the child and targets. The data sheet contained the targeted child responses, the materials and reinforcers needed for each target, and a section for recording the outcome of each trial (the data sheet allowed participants to circle a plus symbol for an independent response or a number associated with the prompt level needed). Each baseline session lasted six trials. A trial ended contingent on a correct response exhibited by the child or after two prompts exhibited by the adult trainer. The first instruction delivered by the adult trainer following either a correct child response or two prompts was considered the start of the next trial.
Baseline sessions were conducted with all three children and 10 targets.

Training. One child and two of his or her targets were randomly selected for initial training. The experimenter provided verbal and written instructions to the participant and then modeled the procedures during a six-trial role-play with a research assistant who pretended to be the child and followed a prepared script (script available from the first author). Cards affixed to a standing easel that was turned away from the participant prompted the research assistant to engage in these predetermined responses. After modeling, the experimenter asked the participant to practice via role-play and provided feedback to the participant after each trial. The research assistant again followed a prepared script with predetermined responses randomly presented to the participant across six trials. The experimenter initially provided feedback about performance after each trial by describing the components that the participant completed correctly and incorrectly. For any incorrect response, the experimenter modeled the correct response and asked the participant to repeat the trial until he or she completed the trial with 100% accuracy. Participants completed two six-trial practice sessions with feedback after each trial.

Next, the experimenter provided feedback at the end of each six-trial practice session by describing what the participant completed correctly and incorrectly. If the participant performed a specific component incorrectly more than once during the six-trial session (e.g., failed to give immediate reinforcement), the experimenter modeled the correct response and required the participant to practice the relevant trial until performed correctly. Sessions with delayed feedback continued until the participant performed the skill components with at least 90% accuracy across three consecutive six-trial sessions. The identical training procedures described above (i.e., instructions, modeling, role-play, practice with child) commenced for a second child and his or her two training targets after the participant met the mastery criterion with the first child. The participant also conducted a six-trial practice session with a third child and his or her two targets to assess potential skill generalization after every three consecutive sessions with the training child. The experimenter provided no instructions or feedback for sessions with the generalization child and targets. In addition, the participant conducted a practice session with the first child (both training and generalization targets) at least once during each training meeting, if possible, and continued to receive feedback following sessions with the training targets. In this manner, we examined potential generalization across children and targets during the context of ongoing training.

Qualitative training. When the participant had met the mastery criterion with both training children and targets, the experimenters reviewed the final taped sessions with all three children to identify qualitative aspects of the participant's
performance (e.g., tone of voice, enthusiasm of praise) that we had not directly targeted in training that needed improvement. We identified additional targets for Lenard, Donna, and Kurt. First, we noticed that Donna’s tone sounded artificial and monotone and that Kurt’s tone was somewhat gruff when he delivered instructions. Thus, we targeted a more natural or conversational tone for delivery of instructions. Conversational tone was scored as correct if the instruction was not delivered in monotone (for Donna) or if the instruction was not delivered in a commanding and rising tone, similar to a drill sergeant (for Kurt). Second, all participants’ tone and volume of praise, although appropriate, were identical following children’s prompted and independent responses. We targeted differential levels of enthusiasm following independent and prompted correct responses. For some participants (Lenard), this meant lowering the quality of the praise delivered for prompted responses. For others (Donna and Kurt), it meant increasing the quality of the praise for independent responses. Delivering praise with differential levels of enthusiasm (Lenard, Donna, and Kurt) was defined as delivering praise with higher pitch tone, energy, and voice volume for independent unprompted responses than for responses that occurred after any partial or full model prompts.

Third, we noticed that Lenard and Kurt occasionally inserted a brief delay between the reissue of the $S^D$ (e.g., “What is your address?”) and the prompt (e.g., partial model) when the child required a prompt during a trial, but they inserted the delay only for vocal responses. This was problematic because the child sometimes responded incorrectly before the participant delivered the prompt. Thus, we targeted providing the prompt quickly enough after the $S^D$ to prevent an opportunity for a child response. A correct response was defined as delivering vocal (model) prompts no more than 1 s after the reissue of an $S^D$. Finally, Kurt occasionally made negative comments when a child engaged in problem behavior (e.g., “This isn’t going well”), so we wanted to eliminate these comments. He was scored as emitting a correct response if he refrained from making negative comments about the session and the child’s behavior.

Training consisted of verbal and written instructions for each target (training targets only) and videotaped demonstrations of the research assistants using differential praise, delivering instructions in a conversational tone and volume, and providing verbal model prompts without a delay between the $S^D$ and the prompt. Participants watched the video at least once but had multiple opportunities to do so if they requested it. After video modeling, an experimenter modeled correct and incorrect responses with a research assistant who role-played as a child and exhibited the same scripted responses as those during initial training. The experimenter modeled correct responses for two six-trial sessions. Next, the participant role-played with the research assistant who was using prepared scripts while an experimenter provided immediate feedback after each trial as described previously. After three consecutive six-trial sessions with immediate feedback, the experimenter provided feedback at the end of each six-trial session until the participant demonstrated 90% performance accuracy for six consecutive sessions. If the participant performed a particular skill incorrectly for two consecutive sessions in either the immediate or delayed feedback conditions, the experimenter modeled the correct response and the participant repeated the trial until he or she responded with 100% accuracy.

Sessions with the children began again after training, and the participants received feedback following each session as described previously. Feedback continued to be withheld after training sessions with the generalization targets and the generalization child. Lenard was instructed to teach two new targets to each of his children (Set 2 in Table 4) during this phase because they had nearly mastered the original training targets. We
continued to collect data on the originally trained components and to provide feedback on those components as well.

Social validity assessment. At the conclusion of training, the adults with ASD used a 6-point rating scale to indicate how much they agreed or disagreed with nine statements related to training (see Lerman et al., 2013, for a list of the statements). A space also was available for additional written comments. In addition, we recruited five master’s level board-certified behavior analysts (BCBAs) who were unaware of the purpose of the study. They reported having a range of 5 to 13 years of experience in the field of ABA, with 1.5 to 6 years of experience training and supervising behavior technicians to provide DTT to children with autism. We told the BCBAs that they would view brief sessions of several newly trained therapists implementing DTT with children. The BCBAs observed video clips of the participants’ practice sessions with a child at the end of training (session randomly selected) and of two previously trained graduate students in behavior analysis (one male, one female) working with one of the same children and targets. They implemented the same DTT procedures taught to the participants. We also included a video clip of an undergraduate student (female) with no prior experience who received the same training as the participants. After viewing each video clip (randomly ordered), the BCBA used a 6-point scale to rate (a) the quality of the participant’s interactions with the child, (b) the likely effectiveness of the participant’s approach, and (c) the likelihood that the BCBA would hire this person to provide DTT to a child with autism. Clips were rated from 1 (lowest; i.e., low quality, low likelihood of effectiveness, low likelihood of hiring the person) to 6 (highest; i.e., high quality, high likelihood of effectiveness, high likelihood of hiring the person). We also asked the BCBAs to provide written comments about their ratings in a space provided.

After obtaining the ratings from the BCBAs, we recruited an additional five BCBAs who were told the diagnoses of the participants and the status of the nonparticipants (i.e., graduate student in behavior analysis, undergraduate student). Specifically, we told them which technicians had been diagnosed with an ASD and which technicians were either graduate or undergraduate students. All other instructions remained the same. We matched these BCBAs to the naive BCBAs based on number of years of experience and the order in which they viewed the videos.

RESULTS AND DISCUSSION

The percentages of correct adult responses across baseline and training sessions with the three children are shown in Figure 3. Data for sessions with the training targets are shown separately from those with the generalization targets. Participants averaged 30% to 42% correct responses in baseline. Performance for all participants showed an immediate improvement to high levels after initial training with their first child, typically exceeding 90% correct. The participants’ performance with the generalization targets for the first child looked similar to that with the training targets from the outset of the training sessions. Donna’s performance with the generalization targets was somewhat lower than that with training targets for the first two generalization sessions. All participants engaged in high levels of correct responses with both the training and generalization targets for the second child following training (\(M = 95\%\) for Lenard; \(M = 93\%\) for Neal; \(M = 93\%\) for Donna; \(M = 94\%\) for Kurt), and their performance also immediately generalized to the third child (\(M = 94\%\) for Lenard; \(M = 92\%\) for Neal; \(M = 95\%\) for Donna; \(M = 94\%\) for Kurt) after training with the two children. Their performance was maintained for all children and throughout the qualitative training phase, which is denoted with an arrow on the graph. As noted previously, Lenard introduced two new targets
Figure 3. Percentage of correct teaching responses for Lenard, Neal, Donna, and Kurt when they worked with two different children on training and generalization targets, along with a third generalization child, during baseline and training in Experiment 2. Arrows indicate the first session after the introduction of qualitative training. Train = training targets; Gen = generalization targets or child.
for Children 4 and 5 during the qualitative training phase because the children rarely required prompts at that point in training, and prompting was necessary to evaluate Lenard’s correct use of differential reinforcement.

The percentages of correct adult-trainer qualitative responses immediately before and after qualitative training are shown in Figure 4. Missing data points indicate that there were no opportunities to exhibit the targeted qualitative responses during the session. To obtain pretraining qualitative data, the observers rescored all videotaped sessions of the adult participants working with the children at the point that they had started working with all three children. As shown in the figure, the percentage of correct individualized qualitative responses increased after training for all participants (from $M = 43\%$ to $M = 92\%$ for Lenard; $M = 39\%$ to $M = 92\%$ for Donna; and $M = 80\%$ to $M = 93\%$ for Kurt). The smallest change occurred for Kurt, who generally had higher levels of pretraining qualitative responses than did the other participants. Furthermore, improvements in Kurt’s

Figure 4. Percentage of correct qualitative responses for Lenard, Donna, and Kurt when they worked with two different children on training and generalization targets, along with a third generalization child, before and after training in Experiment 2. Train = training targets; Gen = generalization targets or child.
qualitative responses appeared to be limited to
the training children and targets.

The participants required a combined total of
4 to 8.5 hr of initial and qualitative training with
the experimenter before he or she met the
mastery criteria to work directly with children.
They worked with the children for 8 to 15 days
after training. The percentages of correct child
responses are shown in Figure 5. These data
indicate that the majority of children began to
acquire their targets after the participants had
completed initial training. A notable exception
was the generalization child for Kurt. Rather
than attributing the child’s lack of performance
to some aspect of Kurt’s performance, we believe
that he did not have the necessary prerequisite
skills. However, we did not evaluate this
possibility directly. It also should be noted that
child performance with the generalization targets
likely was lower than that with the training
targets because the children had only one session
with those targets for every three sessions with
the training targets. Furthermore, the children
received sessions with the training targets just
once per week when the adults participated in
the study sessions, which might have delayed
their acquisition of these skills.

We examined the amount of child problem
behavior during the instructional trials and the
adult participants’ correct responses to problem
behavior (i.e., say nothing about the behavior
and continue the prompting sequence). Lenard
encountered a total of nine instances of problem
behavior during instructional trials, and he
responded correctly to 89% of those occurrences.
Neal encountered a total of 70 instances of problem
behavior during instructional trials, and he
responded correctly to 96% of those occurrences.
Donna encountered a total of 28 instances of problem behavior during instructional trials, and she responded correctly to 100% of those occurrences. Kurt encountered a total of 14 instances of problem behavior during instructional trials, and he responded correctly to 77% of those occurrences. Incorrect responses
typically involved making a comment in
response to the problem behavior (e.g., calling
the child’s name). These findings indicate that,
to varying degrees, all of the adult participants
were required to manage problem behavior
during instructional trials. Furthermore, they
typically responded to avoid inadvertent re-
inforcement of problem behavior.

On the satisfaction survey, participants’
ratings for all of the statements indicated that
they liked the training procedures and felt that
the procedures would be effective for others with
ASD. Neal and Donna assigned a 6 to all nine
statements, and Donna wrote, “I really enjoyed
training with kids with autism, and I really didn’t
want to leave the study. … I hope to work with
kids with autism someday soon.” Lenard and
Kurt assigned a 5 or 6 to all of the statements
($M = 5.77$ for Lenard; $M = 5.67$ for Kurt).
Lenard, who was working with children in a
martial arts school at the time of the study wrote,
“This program drastically improved my teaching
skills and confidence as a leader. I work along
challenging students often and this help is a
godsend. Tell everyone the good news.” Neal
wrote, “It was great working with the kids. I
really enjoyed it. I would do it again.”

The means and ranges of the BCBAs’ ratings
for the four participants and the three non-
participants (two graduate students and one
undergraduate student) were compared as
another measure of social validity (Figure 6).
Ratings were obtained from five BCBAs who
were unaware of the diagnostic status or back-
ground of the participants and four BCBAs who
were given this information (one of the BCBAs
did not return the ratings). For all of the BCBAs,
at least two of the participants were given similar
ratings as one or more nonparticipants. Of the
participants, Lenard received the highest ratings
by seven of the nine BCBAs ($M = 5$; range, 4 to
6), and his ratings equaled or exceeded the
ratings given to the nonparticipants ($M = 4.6$;
range, 2.7 to 6). Neal received the lowest ratings
by five BCBAs ($M = 2.9$; range, 2 to 4), but two
Figure 5. Percentage of trials with correct responses for the children who worked with Lenard, Neal, Donna, and Kurt in Experiment 2.
of those BCBAs assigned similar ratings to at least one nonparticipant. Kurt ($M = 3.9$; range, 2.5 to 5.3) and Donna ($M = 3.5$; range, 2 to 5.3) received moderate to high ratings that were similar to at least one nonparticipant for three of the five BCBAs who were naive about diagnosis. Kurt received similar ratings from the BCBAs who were informed of the diagnosis, although Donna’s ratings were slightly lower. The BCBAs’ written comments on the rating forms primarily focused on various technical aspects of the participants’ and nonparticipants’ performance. Many of the aspects were a function of the specific procedures that we taught to the participants (e.g., use of intermittent reinforcement schedules, a prompting hierarchy that did not include gesture prompts) and varied widely across the participants and nonparticipants. Some of the BCBAs addressed qualitative aspects of the participants’ performance, and overall, they were more likely to provide negative comments about the quality of the technician’s interactions with the child if the technician was a participant rather than a nonparticipant. However, the comments did not always reflect the rating given to the participant. For example, one BCBA wrote the following comment about Donna, but rated the quality of her interactions with the child as a 5: “Used specific praise, but could have been more enthusiastic/natural when the student provided an independent correct response.”

**GENERAL DISCUSSION**

Results replicated and extended those of Lerman et al. (2013), suggesting that BST is highly effective for teaching adults with ASD and no ID some of the skills needed to serve as behavior technicians for young children with autism. Despite increasing the complexity of the DTT arrangement (e.g., multiple targets, multiple reinforcement schedules), requiring participants to manage problem behavior, including a less structured teaching arrangement (i.e., IT), and targeting somewhat subtle child responses (i.e., indicators of interest), the adult participants implemented the interventions with fairly high levels of procedural integrity. Results of Experiment 2 also indicated that the adults’ teaching skills generalized to child targets and children who were not included in training. The children’s performance in both experiments suggested that the adult therapists were effective in teaching a variety of skills. Immediately after training, three of the participants (Lenard, Kurt, and Donna) began volunteering at clinics that served children with autism. Within a few months, Lenard was offered a paid position. In response to an e-mail sent by the first author to Lenard asking about his experience on the job, Lenard wrote,

I am currently enjoying success at [location]. All 19 coworkers (two bosses and one supervisor included) are fantastic people who seem to be very tolerant in their demeanor, knowledgeable in their work, and direct in their feedback. It helps me when they use ABA therapy on me. I also find myself making friends closer to my own age, improving my teaching skills and ability to interact with parents, growing more patient, and strengthening my work ethic since I have more of my day busy. Other
places of employment would not have the knowledge and tolerance of autism that an ABA clinic has.

The skills evaluated in our training program to date represent a small portion of the necessary skill set for behavior technicians; thus, further research is needed. However, the effective use of differential reinforcement, prompting hierarchies, behavior management, and data collection is integral to behavior-analytic interventions. A more critical concern relates to the qualitative aspects of behavioral intervention delivery, such as tone of voice and other characteristics that may be difficult to operationally define (e.g., “naturalness”). We attempted to improve some qualitative aspects of the participants’ performance that were not targeted initially, such as the use of differential enthusiasm when delivering praise and more conversational tone of voice when delivering instructions. Our data suggested improvements in these areas as a result of brief training. Ratings provided by BCBAs who supervise and train behavior technicians also suggested that at least some of the participants were considered indistinguishable from typically developing adults who were either extensively or minimally trained. Overall, however, the BCBAs were more likely to comment on problems with tone and enthusiasm of the participants compared to those of the nonparticipants. In future evaluations, it might be useful to have BCBAs rate the same participants before and after qualitative training.

Another aspect to consider in future research is whether children will respond similarly to behavior technicians with and without ASD, regardless of differences in the qualitative aspects of their interactions with the children. It is not clear, for example, whether instructions or praise delivered in a monotone voice would be less effective than those delivered in a more natural tone of voice. Although results for the children in the current study generally indicated acquisition of skills, a technician without ASD may have produced greater or more rapid improvements in child behavior. This issue could be addressed in future research by comparing child performance across technicians with and without ASD. Children’s preference for technicians with and without ASD also could be measured in future studies. Another key aspect of social validity is the acceptability of the therapy to relevant stakeholders, including those who hire behavior technicians and parents or caregivers of those who receive the services. Thus, the opinions of these stakeholders should be evaluated more thoroughly when training individuals with ASD to work as behavior technicians. If further research suggests that qualitative aspects of the technicians’ interactions limit the effectiveness or acceptability of their services, strategies to improve this aspect of their performance should be evaluated, because little research has been devoted to this issue in general.

Several other features of our study limit the potential generality of the findings to those who work in real-world settings. We provided feedback to the participants after every brief teaching session (with the exception of the generalization sessions in Experiment 2), and all generalization sessions in Experiment 2 were conducted on the same day as the training sessions. Future research should evaluate whether performance will maintain and generalize with the frequency and level of supervision that is typically provided to behavior technicians. Individuals who are interested in working as behavior technicians also should acquire a broader range of skills within the areas targeted in the current study (e.g., using errorless prompting strategies and discontinuous data-collection systems; implementing individualized treatments for problem behavior) and additional skills that are critical to providing effective intervention (e.g., conducting preference assessments, using shaping and chaining, entering data and updating graphs, avoiding dual relationships). Thus, future research should focus on teaching these technical skills, along with so-called “soft” skills that may be particularly difficult for individuals with
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ASD, such as communicating effectively with parents, supervisors, and coworkers. Our research thus far shows that the training strategies typically used with behavior technicians also will be successful for teaching adults with ASD who are interested in this occupation. In light of the employment difficulties faced by individuals with ASD, research that focuses on vocations that are uniquely suited for this population may be highly beneficial.

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