Increasing the Skills of Children with Developmental Disabilities through Staff Training in Behavioral Teaching Techniques

Anna-Lind Pétursdóttir and Zuilma Gabriela Sigurdardóttir
University of Iceland

Abstract: Two staff members working in different preschools received training in the form of instructions, modeling, immediate feedback, and social reinforcement of good performance. Effects of training were assessed with a multiple baseline ABCDCDCD design. Correct use of basic behavioral teaching techniques increased from 16–31% to 92–95% and the rate of learn units increased from 0–0.03 to 2.3–2.4 per minute. A multiple baseline design revealed skill improvements in two 2-year-old boys with developmental disabilities. Skills of instructors and children generalized across teaching settings. Follow-up measures showed maintenance and additional generalization of skills. The results confirm the positive effects of increased rate of learn units on teaching effectiveness and students’ skills, and the importance of high achievement criteria for generalization.

Effectiveness of teaching with discrete trials has been demonstrated in numerous studies (e.g., Eikeseth, Smith, Jahr, & Eldevik, 2002; Lovaaas, 1987; Matson, Benavidez, Comptom, Paclawskyj, & Baglio, 1996). A discrete trial is comprised of a discriminative stimulus, a response by the student, immediate delivery of consequences for the response, and a short intertrial interval (Koegel, Russo, & Rincover, 1977). Several techniques, such as prompting, fading, task analysis, and shaping are used with discrete trial teaching (Anderson, Taras, & Cannon, 1996; Leaf & McEachin, 1999) and it is most often used in a one-to-one format although group teaching arrangements can be successful as well (Taubman et al., 2001).

Discrete trial teaching has several advantages (Leaf & McEachin, 1999; Sundberg & Partington, 1998), one of the most important being the high rate of learn units it makes possible. A learn unit consists of a three-term contingency comprised of antecedents, responses, and consequences that interlock with each other during teacher-student interaction (Catania, 1998; Greer, 1994). Research has shown a positive correlation between the rate of correctly performed learn units by a teacher and student achievement (Greer, McCorkle, & Williams, 1989) as well as direct functional effects of the rate of learn units on students’ performances (Albers & Greer, 1991; Ingham & Greer, 1992) and student objectives met (Selinske, Greer, & Lodhi, 1991).

Learn units can be observed in any educational setting, but typically, the rate of learn units in traditional teaching is very low (Albers & Greer, 1991; Greer, 1994; Ingham & Greer, 1992). Thus, a considerable gap between research on effectiveness of teaching methods and common practices in regular schools seems to exist (Jahr, 1998). Research has shown positive effects of behavioral staff training on the rate of learn units and teaching effectiveness (Albers & Greer; Ingham & Greer), however, such techniques have seldom been used with preschool personnel (Crow & Snyder, 1998). In those studies where...
behavioral staff training has been applied in a preschool setting, positive results have been reported regarding teachers’ use of the trained techniques (Peck, Killen, & Baumgart, 1989) and the rate of learn units (Selinske et al., 1991).

Nevertheless, even comprehensive training that results in significant improvements in staff performance does not guarantee positive effects on the skills of clients. In a study by Smith, Parker, Taubman, and Lovaas (1992), for instance, an intensive, 1-week workshop in behavioral theory and treatment techniques, which resulted in increased treatment skills at the workshop site, did not have any effect on group-home client functioning. Hence, it is essential to incorporate client data in the evaluation of staff training procedures (Harchik, Sherman, Hopkins, Strouse, & Sheldon, 1989; Jahr). Hitherto, few studies have included clients’ skills as a dependent measure of the effects of staff training (Demchak, 1987; Jahr, 1998), although the number of studies has been increasing (e.g., Schepis, Reid, Ownbey, & Parsons, 2001). However, research is lacking on effects of behavioral training for preschool staff on the skills of children with developmental disabilities (Crow & Snyder, 1998) and on generalization of teaching skills across settings and tasks (Jahr).

Discrete trial teaching of children with developmental disabilities usually starts out in a one-to-one setting before group teaching settings are considered (Lovaas, 1996; Handleman, Harris, Kristoff, Fuentes, & Alessandri, 1991). Thus, training of instructors often takes place in a one-to-one setting. Although generalization of teaching skills to new settings is essential to enhance learning of students in a variety of settings, research has rarely assessed generalization of skills acquired during staff training (Jahr, 1998). Only a small number of studies have included measures of generalization of teaching skills across teaching tasks (Koegel et al., 1977; Mörch & Eikeseth, 1992; Kissel, Whitman, & Reid, 1983; Thorisdottir, 1993). Several factors can influence generalization (Stokes & Baer, 1977). One important variable that affects generalization is training with sufficient exemplars until high rates of behavior are displayed. High mastery criteria have also been found to increase the likelihood of generalization of skills across tasks and time (Arco & Millett, 1996; Koegel et al.; Parsons, Reid, & Green, 1993).

The aim of this study was to: a) assess effects of staff training in behavioral techniques on instructors’ skills in the use of discrete trials and rate of learn units during their teaching, b) measure effects of changes in the staff’s teaching on the skills of children with developmental disabilities, c) evaluate generalization of instructors’ and children’s skills from a one-to-one teaching setting to a group setting and, d) assess generalization of the staff’s acquired skills to new teaching tasks.

Method

Participants

Instructors. Two instructors, each from a different preschool, who were specifically allocated to attend to each child participant during most of the children’s attendance time, volunteered. Dora was a 35 year-old paraprofessional with an elementary school education and 5 years of work experience at the preschool. She had been attending to David for 5 months before the beginning of this study, providing general assistance in various activities in the classroom. Dora had some basic knowledge of behavior management but no training or experience in applying behavioral teaching techniques such as discrete trials. Hanna was a 52 year-old special education preschool teacher and assistant director of the preschool. She had 33 years work experience with young children, but no training in applying behavior principles to teaching. The children in the study were the first children with developmental delays that the instructors worked with.

Children. Two children with developmental disabilities participated in the study. David was a 25 month old boy with Down’s syndrome and a developmental index of 55 according to Bayley Scales of Infant Development—Revised (BSID-II, Bayley, 1993). David was non-verbal, but used gestures and a few simple signs to communicate. He had some imitation skills and limited verbal comprehension. Adam was a 27 month old boy with developmental delays of unknown origin and a developmental index of 50 (BSID-II, Bayley). Adam was non-verbal and did not show any clear signs of
comprehending spoken language or symbols. He possessed no imitation skills and was not able to participate in classroom activities without manual guidance. Neither of the children had been exposed to discrete trial teaching before the study.

Setting

The study took place in two public preschools in Reykjavik, Iceland, which had facilities for one-to-one teaching. Preschool 1 served 56 children in three units. In David’s unit there were 17 children ages 1 to 3 years, including three with developmental delays. One-to-one teaching took place in separate rooms adjacent to the main activity room of the unit. During teaching sessions, the participants sat on child-sized chairs or pillows on the floor, facing each other. To their side was a table for materials. Group instruction took place in one of the main activity rooms of the unit, with the child seated alongside two to three other children facing the instructor.

Preschool 2 served 54 children in three units. In Adam’s unit, there were 14 typically developing children, aged 1 to 3 years. One-to-one teaching usually took place in a special education room, which was separate from the unit. Participants either sat on pillows on the floor or at a regular sized table with the child seated in a high chair sideways to the instructor. Group instruction took place in the main room of the unit or in the assembly hall (gym) with the participants sitting at a table or on pillows on the floor. In the group instruction sessions, two to three other children were present but engaged in other tasks.

Dependent Variables

Instructors. The target behaviors of instructors were: presentation of instructions, use of prompts, delivery of consequences, and the rate of complete learn units (frequency per minute). Definitions of target behaviors were drawn from previous teacher training research (Arco & Millett, 1996; Greer & McDonough, 1999; Koegel et al., 1977). Correct presentation of instructions was defined as a request directed to the child to perform a physical action, stated in a clear, specific, and consistent manner. Correct prompting was defined as any additional assistance (physical guidance or other) provided within 2 seconds from the presentation of an instruction, enabling the child to perform the physical action entailed in the instruction. Consequences were defined as the instructor’s reaction to the child’s response to an instruction. Consequences were considered correct if they were delivered immediately and contingent on the child’s response (i.e., distinctively positive following a correct response or a neutral “no” following an incorrect response). A learn unit was scored as correct if the use of instructions and consequences met the definitions for correct application. A more detailed description of the target behaviors can be obtained from the first author upon request.

Children. Four skills from the children’s Individual Education Plans (IEPs) were selected for intervention: imitation of object use, imitation of gross motor movements, following instructions, and receptive labeling of objects. Correct imitation was defined as performing the same action as the instructor. Following verbal instructions correctly was defined as performing the action the instruction entailed. Correct receptive labeling was defined as touching the object mentioned in the instruction. In all cases, responding had to occur within 5 seconds to be scored as correct and be free of errors (i.e., self-corrections were not scored as correct). Both children had previously been exposed to tasks involving these target behaviors but had difficulty acquiring them.

Dependent Measures

Teaching skills. Teaching sessions were videotaped by placing recording equipment on a tripod, 2-5 meters away and side-on to the participants. Instructors’ target behaviors were assessed by analyzing a total of 35 5-minute segments of Dora’s teaching sessions and a total of 43 5-minute segments from Hanna.

The three term contingency, or learn unit, was the unit of observation during these segments. The beginning of a unit was marked by delivery of a discriminative stimulus (S<sup>o</sup>) and ended with delivery of consequences. Each instructor’s target behavior was scored as either correct or incorrect, and prompting was
also recorded by type. Measures of instructors’ target behaviors were calculated by dividing correct use of each component of a discrete trial with the sum of the correct and incorrect use of that component and multiplying the result with 100 to get a percentage correct. Rate of learn units was calculated by dividing the number of correctly executed units in each 5-minute segment by 5.

Children’s skills. Each instructor scored the child’s response in between the teaching trials or during teaching breaks. Measures of child behavior were calculated by dividing number of correct responses by the total number of responses (i.e., the sum of correct, prompted, and incorrect responses) and multiplying the result with 100. The number of trials needed to teach each item within skill domains was also summarized.

Performance Criteria

Instructor’s performance criterion was an average of at least 80% correct teaching across target behaviors in three consecutive sessions. Child’s performance criterion was at least 80% correct responding in three consecutive teaching sessions. When the child had learned at least six items in a skill domain and both instructor and child had reached their performance criteria, the training was moved from a one-to-one teaching setting to a group setting. Simultaneously, a new task was introduced for teaching in the one-to-one setting. Thus, experimental phases overlap with this regard.

Experimental Conditions

Pretests. Prior to baseline a preliminary assessment of the children’s current functioning was conducted. The first author assessed each child’s ability in several skill domains, such as imitation skills, instruction following, and receptive and expressive labeling. This assessment was done to facilitate the selection of skill domains to target in the study.

Baseline (A). Baseline observations of instructor’s teaching performance took place during daily one-to-one instruction sessions. Five-minute videotaped segments of teaching were collected and analyzed for each instructor until a stable baseline was reached. Assessment of the children’s skills took place in a one-to-one setting and was recorded for evaluation of inter-observer agreement.

Workshop (B). The first author held a 5-hour workshop for each instructor, each child’s parent and one other preschool staff person. The workshop consisted of 3 hours of lectures on basic principles of applied behavior analysis accompanied by written handout (eight pages) and instructions on discrete trial teaching (three pages) as well as video clips of discrete trial teaching (total of 10 minutes) and discussion. The remaining 2 hours consisted of modeling discrete trial teaching with the target child, rehearsal of discrete trials with prompts, and performance feedback administered by the first author. On the two days following the workshop, instructors videotaped two 15-minute discrete trial teaching sessions under one-to-one conditions. Three 5-minute segments of their recordings were analyzed.

Training in one-to-one setting (C). Instructors were trained in the one-to-one instruction resource rooms, one to four times per week, for 6 weeks over a 10-week period. Each training session lasted 15-60 minutes and entailed the same procedures applied in the latter part of the workshop (except the video clips), delivery of prompts, occasional modeling, and performance feedback, referencing the material covered in the workshop. Number and length of training sessions decreased as the instructors’ skills increased.

Generalization to group setting (D). Participant instructors were asked to continue teaching a skill in the same way as before with two
to three other children present. No further directions, prompts or feedback were provided. Taped segments of three to four teaching sessions were then analyzed.

Children’s responding was assessed in the same way as before. The instructor scored whether the response was correct, incorrect or prompted and the proportion of correct responding within each skill domain was calculated.

Follow-up measures. Follow-up measures were taken 1 and 4 months after training ended. The instructors’ teaching accuracy and children’s skills were measured in the same way as before. Instructors were simply asked to teach the children as usual, no instructions or prompts were provided. Sessions were taped as before.

Generalization of teaching skills to teaching new tasks. Instructors’ ability to teach a new task with written directions only was assessed 1 and 4 months after training ended. The first 5 minutes of each teaching session were recorded for evaluation.

Procedure

The study lasted approximately 3 months. After 3 to 5 days of baseline measures, the instructors participated in separate 5-hour workshops, spread over 2 days, followed by a 2-day evaluation period of the effects of the workshop. Dora’s training comprised 23 sessions that spread over 10 weeks. The training period was interrupted due to sick leaves and a 2-week vacation period. During the remaining 6 weeks, instruction of David took place on 34 days, 90-120 minutes per day. Hanna’s training comprised 20 sessions that spread over an 8-week period, which was interrupted by sick leaves and a 3 days vacation. On the remaining 6 weeks, Adam was instructed on 31 days, 60-140 minutes per day.

Instruction sessions usually took place twice a day, 30-110 minutes at a time. Each session was divided into 2–15 minute long teaching intervals, which included 5 to 50 discrete trials each. In between teaching intervals, contingent on a correct response, the child was allowed a 2–8 minute free-play break. Teaching focused on one item within a task, until a mastery criterion was achieved. A variety of reinforcers were used for correct responding, including listening to songs/singing, opportunity to play with a favorite toy, and having bubbles blown. On rare occasions edible reinforcers, such as raisins or cookie bites were provided.

Observer training. An undergraduate psychology student was trained to assist the first author in observing and scoring both instructor and child behavior. Training consisted of studying scoring instructions and practicing scoring participants’ behaviors from videotapes. After about 5 hours of training a criterion of 85% or higher occurrence agreement across observers was attained.

Inter-observer agreement. Seventeen to 50% of observations of instructor target behaviors in each experimental phase were checked for agreement, amounting to 39% of total observations. Observers used videotape recordings from teaching sessions to measure inter-observer agreement on observations of instructors’ performances. One three term contingency unit was watched at a time and the video paused while the performance was scored. Occasionally one of the observers asked for the trial to be shown again but did not enclose the reason for it. After independent scoring of the segments, occurrence agreements were calculated for each target behavior. Percent agreements were calculated by dividing the sum of agreed occurrences by the sum of agreed and disagreed occurrences and multiplying by 100. A summary of inter-observer agreement on observations of instructor performance is presented in Table 1. On average, agreements for all behaviors were above 95%.

Inter-observer agreement on children’s performance was measured in 24 to 72% of responses in each skill domain, a total of 39% of

### Table 1

<table>
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<tr>
<th>Instructor Target Behavior</th>
<th>Range</th>
<th>Agreement Means</th>
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<tbody>
<tr>
<td>Presentation of S’ss</td>
<td>85–100%</td>
<td>97%</td>
</tr>
<tr>
<td>Use of prompts</td>
<td>80–100%</td>
<td>95%</td>
</tr>
<tr>
<td>Delivery of consequences</td>
<td>87–100%</td>
<td>97%</td>
</tr>
<tr>
<td>Total average</td>
<td></td>
<td>96%</td>
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all measurements. The observers watched the teaching sessions and scored the child’s behavior simultaneously, but independently. At the end of the teaching session the instructor’s and the observer’s scoring of the child’s behavior were compared and agreement assessed. Percent agreement was calculated as described earlier. A summary of inter-observer agreement measures of child behaviors is presented in Table 2. On average, agreements for all behaviors recorded were above 90%.

Social Validity

After the experiment ended, instructors were asked to answer a 20-item questionnaire on the perceived usefulness of several components of the training and the effects they felt each component had on their skills and the children’s skills. A 5-point Likert scale was used with each question, with 1 standing for Not useful at all and 5 for Very useful.

Results

The staff training procedures had a clear effect on teaching skills of the instructors. Accuracy of their teaching improved and the rate of learn units increased. Moreover, independent correct responding of the children increased in all skill domains with one exception. There also was an indication of accelerated learning rate for Adam. Social validity measures revealed general satisfaction with the training procedures on behalf of the instructors and a perceived usefulness of them with regard to increasing their teaching skills and the skills of the children.

Changes in teaching. The workshop had a clear effect on the teaching techniques of both instructors. Overall, the application of three-term contingencies, or discrete trials, increased from 16–31% correct on average during baseline to 92–95% correct on average during intervention phases and learn units increased from 0.03 to 2.3–2.4 per minute on average for both instructors.

Figure 1 demonstrates to what extent teaching of the instructors was in accordance with the discrete trial teaching criteria. During baseline, Dora presented 6% of $S^D$’s correctly on average, 55% of prompts, and 16% of consequences. After the workshop, there was a clear increase in level of teaching accuracy. While teaching gross motor imitation, Dora presented on average 64% of $S^D$’s correctly, 91% of prompting, and 83% of consequences. Consultation in the one-to-one setting led to a further increase in teaching accuracy; resulting in an average 87% of $S^D$’s used correctly, 98% of prompting, and 95% of consequences.

Moreover, Dora’s skills in using discrete trials to teach gross motor imitation generalized to group settings without further training. While teaching gross motor imitation in a group setting, the use of $S^D$ was 98% correct on average, prompting was 100% correct on average and delivery of consequences 89% correct on average (see Figure 1).

In the second consultation phase, while teaching following instructions, Dora presented 91% of $S^D$’s correctly on average, 98% of prompts, and 94% of consequences. In the group setting, 96% of $S^D$’s were correctly presented on average, 100% of prompts, and 85% of consequences.

In the third task targeted during staff training, receptive labeling of objects, Dora presented on average 82% of $S^D$’s correctly, 98% of prompts, and 94% of consequences. Follow-up measures at 1 and 4 months after training ended showed that Dora maintained high teaching accuracy while teaching tasks targeted during staff training. The use of $S^D$ was 100% correct, prompts were 94–100% correct, and consequences 92–94% correct.

Measures of generalization of teaching skills to new tasks showed that Dora was able to teach new tasks by following only written di-

<table>
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<tr>
<th>Child Target Behaviors</th>
<th>Range</th>
<th>Agreement Means</th>
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<tbody>
<tr>
<td>Gross motor imitation</td>
<td>83–100%</td>
<td>92%</td>
</tr>
<tr>
<td>Imitation of object use</td>
<td>82–100%</td>
<td>93%</td>
</tr>
<tr>
<td>Verbal instructions</td>
<td>78–100%</td>
<td>90%</td>
</tr>
<tr>
<td>Receptive labeling of objects</td>
<td>83–100%</td>
<td>90%</td>
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<tr>
<td>Total average</td>
<td></td>
<td>91%</td>
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rections. While teaching matching of objects 1 month after conclusion of staff training, Dora presented 95% of SDs correctly, 90% of prompts, and 81% of consequences. While teaching receptive labeling of body parts 4 months post training, Dora used 96% of SDs correctly, 67% of prompts, and 79% of consequences correctly as shown in Figure 1.

Hanna showed a similar increase in discrete trial teaching skills. Figure 1 shows that during baseline, on average 4% of SDs were correctly presented, 29% of prompts, and 15% of consequences. The workshop led to an increase in level of teaching accuracy as well as an upward trend. While teaching imitation of object use, Hanna presented on average 36% of SDs correctly, 77% of prompts, and 46% of consequences. Consultation in the one-to-one setting led to a further increase in level of teaching accuracy; on average 96% of SDs were used correctly, 93% of prompts, and 89% of consequences. In addition, variability decreased considerably.

Hanna’s skills in using discrete trials to teach imitation of object use generalized to group settings, with every aspect of the teaching (SDs, prompting, and consequences) 100% correctly performed (see Figure 1).

While teaching to follow verbal instructions, Hanna presented 99% of SDs correctly, 99% of prompts, and 98% of consequences. The teaching skills generalized without further training to a group setting where every SD was correctly presented, 93% of prompts on average, and 93% of consequences as shown in Figure 1.

In the third task targeted during training, gross motor imitation, Hanna presented on average 99% of SDs correctly, 96% of prompts, and 100% of consequences (see Figure 1). The teaching skills generalized to the group setting where 98% of SDs were correctly presented on average, 100% of prompting, and 97% of consequences.

As can be seen on Figure 1, effects of training to teach the first task transferred to teaching the remaining tasks. Hanna immediately showed high teaching accuracy when teaching to follow verbal instructions and imitation of object use. The performance criteria for teaching in group settings were also attained in gradually less time across tasks. This reflects both Hanna’s improved teaching skills and Adam’s accelerated learning rate.

Follow-up measures at 1 and 4 months after training ended showed that Hanna main-
tained high teaching accuracy while teaching tasks targeted during staff training. The use of SPs was 92–100% correct, prompts were 100% correct, and consequences 92% correct.

Measures of generalization of teaching skills to new tasks showed that Hanna was able to teach new tasks by only following written directions. One month after staff training ended, every SP and prompt was used correctly and 88% of consequences, while teaching matching of objects. During teaching receptive labeling of objects 4 months post training, Hanna used 94% of SPs correctly, 100% of prompts, and 89% of consequences (see Figure 1).

Changes in prompting. The intervention led to a decrease in the use of prompts by both instructors (see Table 3). Thus, the proportion of independent responding on behalf of the children increased greatly during the intervention phases.

Increases in learn units. The average rate of learn units increased from 0–0.03 per minute during baseline probes to 2.3–2.4 per minute during the experimental phases.

As can be seen in Figure 2, there were no learn units in Dora’s teaching sessions during baseline, due to incorrect presentation of SPs and/or incorrect delivery of consequences. After the workshop, there was a clear upward trend in the rate of learn units as well as an increase in level reflected in an average of 1–2 learn units per minute while Dora taught gross motor imitation. Further increase in rate of learn units occurred after consultation took place, resulting in 3.2 units per minute on average. When teaching gross motor imitation was moved to the group setting the rate level dropped to 1.4 units per minute on average. Thus teaching in group settings included only half of the learn units compared to teaching in a one-to-one setting. This considerable drop is probably due to less time allocated to teach David while simultaneously attending to the other children.

While teaching the second task, following verbal instructions, Dora used 2.6 learn units per minute on average. Figure 2 shows an upward trend in the rate and no drop in level when the teaching was moved to a group setting, with Hanna maintaining an average rate of 2.3 learn units per minute. During teaching of receptive labeling, 2.1 learn units occurred on average per minute. Due to time limitations, teaching of the third task was not transferred to a group setting.

During baseline, only one learn unit occurred in Hanna’s observed teaching sessions (see Figure 2), which amounts to an average rate of 0.03 learn units per minute. After the workshop, there was an upward trend in rate of learn units, as well as increase in level, reflected in an average of 1 learn unit per minute when teaching imitation of object use. During consultation the average rate of learn units became 1.7 learn units per minute. This rate of learn units was maintained when teaching was transferred to a group setting, and even increased considerably during the last observation, leading to an increase in average to 2.6 learn units per minute.

While teaching the second task, following verbal instructions, Hanna used 2.3 learn units per minute on average and 2.6 learn units per minute on average in the group setting. The rate of learn units again showed an upward trend in the last staff training task, gross motor imitation. There, Hanna used 3.2 learn units per minute on average and the rate remained the same during teaching in the group setting, albeit with greater variability.

Improvements in children’s skills. Improvements in the children’s skills were considerable in three out of four tasks targeted in staff training. Figure 3 shows correct responding of David in skill domains targeted in staff training. David imitated 25% of gross motor movements on average during baseline. After Dora had attended the workshop, the level of correct imitation of David increased, reflected in an average of 69% correct responding, and during training in the one-to-one setting the

| TABLE 3 |

| Proportional Use of Prompts by Instructors During Baseline and Intervention |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Type of Prompt                  | Baseline        | Intervention    |
|                                 | Dora | Hanna | Dora | Hanna |
| Physical prompts                | 33%  | 29%   | 7%   | 4%   |
| Other prompts                   | 43%  | 30%   | 8%   | 7%   |
| No prompts                      | 38%  | 54%   | 86%  | 91%  |

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Figure 2. Rate of learn units during baseline (A), following workshop (B), during one-to-one instruction (C), in group settings (D), at follow-up (FU), and when teaching new skills (Gen). Note: Phases separated by a dotted line show data that overlap in time. 1) Teaching in receptive labeling was not conducted in a group setting due to time limitations.

Figure 3. David’s performance during baseline and after his instructor had attended workshop (B), during one-to-one instruction (C), in group settings (D), and at follow-up (FU). 1) Teaching in receptive labeling was not completed due to time limitations.
overall level remained similar, with an average of 71% correct responding. Imitation skills of David generalized to the group setting, resulting in 87% correct responding. Correct responding to verbal instructions during baseline was 13% on average but after staff training began, there was a clear increase in level, to an average of 65% correct. Also, skills generalized to the group setting, resulting in 91% correct responding on average. During baseline, the performance of David in receptive labeling was 8% correct and correct responding increased to 48% correct during staff training. However, since the task only involved two choices, the performance was only at chance level. Several prompting approaches proved unsuccessful in teaching David receptive labeling of objects and due to time limitations teaching had to be terminated without clear positive results.

Figure 4 shows Adam’s correct responding in skill domains targeted during staff training. Adam did not imitate any object use during baseline, but after Hanna had attended the workshop, Adam’s correct responding showed a clear increase in level, to 36% on average. During staff training there was an upward trend in correct imitation of object use, with the average performance improving to 64% and generalizing to the group setting, resulting in 74% correct responding on average. Correct responding to verbal instructions during baseline was 3% on average but after staff training began, it increased to 73% correct on average and generalized to the group setting, resulting in 79% correct responding on average. Adam’s increased skills in imitation of object use did not result in increased skills in gross motor imitation. Correct responding in the latter skill domain remained low throughout baseline, 6% on average. However, when gross motor imitation was targeted in training, correct responding showed an upward trend as well as an increase in level, reflected in an average of 49% correct. The gross motor skills were maintained in the group setting, with an average of 98% correct responding.

Figure 5 shows changes in amount of trials needed to teach David several items within skill domains targeted in training. The
amount of trials needed did not decrease as more items were taught; no clear pattern of acceleration did emerge in the learning of David.

Figure 5. Trials needed to teach David items within two skill domains.

Figure 6 shows the amount of trials needed to teach Adam several items within skill domains targeted in training. In general, trials needed to teach each item within the skill
domains decreased as Adam learned more items. Approximately 150 trials were needed to teach imitation of the use of each of the first three objects, but only 60 trials to teach the sixth object. The same pattern can be observed with regard to other skills. Teaching to follow verbal instructions took progressively fewer trials as number of learned items increased (i.e., 277 to 30 trials, except for the first item). Teaching of gross motor imitation took 1 to 100 trials, with the first item being the easiest to teach. Teaching of the second item took 100 trials and then gradually fewer, with only 25 trials needed to teach the last item (see Figure 6). Hence, Adam’s progress showed a pattern of accelerated learning.

Social Validity

Both instructors rated every part of the staff training to be useful or very useful (average score 4.7). In addition, they rated the training as having increased their teaching effectiveness and the skills of the children to a great extent (average score 5). Both instructors also agreed that the discrete trial teaching approach had increased the children’s attention span considerably (average score 5). In addition, both instructors rated the teaching technique as more effective than other, previously tried techniques (average score 5) and that it would be useful to them in teaching other children as well (average score 5).

Discussion

The goal of this study was to measure the effects of staff training in behavioral teaching techniques on skills of children with developmental disabilities and to assess the generalization of both staff and children’s skills to new settings and tasks. Results indicate that a short workshop and a few weeks staff training can increase the effectiveness of teaching to a considerable extent and thereby greatly improve the skills of children with developmental disabilities. Moreover, skills of instructors and children generalized to a group setting and the instructors were able to teach new tasks using written instructions without further training. These results are generally in accordance with previous findings and are an addition to the few studies on behavioral staff training of preschool personnel working with children with developmental disabilities.

Effects of staff training on teaching. Baseline measures revealed that instructors’ teaching had little in common with discrete trials teaching. Only a small percentage of $S^P$s was presented in a way that makes correct responding more likely (Anderson et al., 1996; Koegel et al., 1977; Blanc & Ruggles, 1982). Often the instructions lacked clarity or consistency with previously presented instructions, and many times the child was not attending to the task or teacher. In addition, consequences were rarely used in a deliberate manner to increase correct responding; often they were omitted or they were not in accordance with the child’s response. Hence, many learning opportunities were lost during baseline.

Prompts were more often correctly applied during baseline than $S^P$s and consequences. Prompting usually occurred simultaneously with the $S^P$ and was generally sufficient to help the child respond correctly. Before intervention, prompts were frequently used, making independent correct responding rare. In part, this could be due to too advanced tasks being targeted for instruction during baseline, making independent correct responding nearly impossible. Tasks selected for instruction during staff training fitted the children’s skill level better. Training emphasized building rapid and frequent responding in order to make generalization more likely and facilitate learning of more complex skills (Johnson & Layng, 1994).

There were almost no correctly performed learn units in the instructors’ teaching during baseline. Only one learn unit occurred across nine teaching probes, which approximates a rate of 0.02 units per minute on average during baseline. Interestingly, there was virtually no differences in the rate of learn units in each instructors’ teaching, despite the difference in their education and experience. This low rate of learn units during traditional teaching is in accordance with previous research. For example, teachers in Albers and Greer’s (1991) study used 0.41 learn units per minute during baseline.

Staff training had a considerable effect on the instructors’ use of behavioral teaching techniques. Correct discrete trials teaching increased from 16-31% during baseline to 92-
95% during intervention phases. These results are consistent with previous research on training teachers in discrete trials teaching (e.g., Arco & Millett, 1996; Koegel et al., 1977). Instructors reached the performance criteria for accurate discrete trial teaching after three to seven training sessions. Taking into account the 5-hour workshop and approximately one hour per training session, the instructors needed 8 to 12 hours of training to be able to apply the teaching technique adequately. This number of training sessions is roughly equivalent to the amount in Arco and Millett’s study, where instructors received seven to fourteen 20-minute training sessions in addition to 9 hours of instruction and practice. These 11 to 14 hours of training enabled the teachers to teach new tasks with help of written directions and minimal feedback only (Arco & Millett).

The instructors’ teaching accuracy remained high throughout the study, even at the beginning of teaching new tasks. There were clear signs of transfer of training effects in Hanna’s teaching; continually fewer training sessions were needed to reach mastery when teaching a new task. One of the admission criteria for instructor participants in this study was interest in learning a new teaching technique, and both instructors turned out to be enthusiastic about improving their teaching effectiveness. It is not clear whether the same positive results would have been achieved without this criterion of admission.

Concurrent with improved teaching accuracy the average rate of learn units increased from 0–0.03 per minute during baseline probes to 2.3–2.4 per minute during the experimental phases. This abrupt change in rate of learn units as a result of behavioral staff training is in accordance with previous research (e.g., Albers & Greer, 1991; Ingham & Greer, 1992; Selinske et al., 1991). In Albers and Greer’s study, for example, the rate of learn units tripled when teachers were encouraged to ask more questions of students and present consequences for their students’ responding.

As soon as the instructors started using the behavioral teaching techniques, correct responding on behalf of the children increased. This positive effect of staff training on client’s skills has also been found in previous research (Albers & Greer, 1991; Ingham & Greer, 1992; Kissel et al., 1983; Koegel et al., 1977; Selinske et al., 1991; Thorisdottir, 1993).

Effects of staff training on client skills in this study were greater than in Smith et al.’s (1992) study where a 1-week workshop in behavioral theory and treatment techniques did not have any measurable effect on group home client functioning. Unlike Smith et al.’s study, staff training in this study took place in the workplace, enabling the instructors to practice teaching skills with their actual students. In addition, measures of children’s skills in the current study only included those targeted during staff training, not other areas of functioning.

Although the staff training had a general positive effect on the children’s skills there were a few complications. David showed considerable defiance, which slowed down the teaching process. Differential reinforcement of on-task behavior was not successful since eliminating reinforcers (for noncompliance and throwing objects) in and outside the teaching environment proved impossible (e.g., because of lack of parental involvement). Due to these behavior difficulties, items involving manipulation of objects were removed from David’s imitation tasks.

Another problem that arose in teaching David, concerned unexpected difficulties labeling objects receptively. Although David quickly learned to point to an object on request, he had great difficulty discriminating between objects. Despite diverse prompting strategies (position, sign language, voice inflection, and physical prompting), attempts to teach David receptive labeling of items proved unsuccessful. Many factors could have contributed to this poor outcome, such as too rapid fading of prompts and/or too swift changes in prompting approaches due to time limitations, inaccuracies in SD presentation, lack of proficiency in more advanced teaching skills or David’s lack of necessary prerequisite skills.

Generalization of skills from a one-to-one teaching setting to a group setting. The new learned skills of both instructors and children generalized to a group setting. Both instructors continued to use discrete trials accurately while teaching the child participants in a group setting, but Dora taught the whole group with choral responding while Hanna allocated dif-
different tasks to the other children. Both approaches worked well, although making sure that all the children responded correctly proved to be time-consuming, resulting in a lower rate of learn units for David than in the one-to-one setting.

This generally small decrease in the rate of learn units when teaching was moved to a group setting is much less than in Kamps, Walker, Maher, and Rotholz (1992) where the rate of trials decreased from 3.5 trials per minute to 1.5 per minute when students were transitioned from a one-to-one setting to small groups. The groups in that study, however, differed from the groups in the present study in that group members were older (5 to 21 years old) and all had been diagnosed with autism and/or other developmental disabilities.

The children’s skills generalized very well to the group settings. Their percentage of correct responding was as high and even higher than in the one-to-one setting. This good performance in a group setting is in accordance with Kamps’ et al. (1992) study where elementary students maintained attending and learning skills following transition from a one-to-one to a small group setting. In another study (Taubman et al., 2001), preschoolers with autism and other developmental disabilities were also successfully taught several skills with a group discrete trial teaching approach.

Taubman et al. (2001) results challenge the widely held tenet that individual discrete trial teaching is a necessary prerequisite for teaching in a group setting (Handleman et al., 1991; Kamps et al., 1992; Lovaas, 1996). However, the group discrete trial teaching approach “while demonstrated to be effective, represents a complicated instructional methodology” (Taubman et al., p. 217) and seems to require experienced teachers and thorough training to be achievable. Thus, further research is required to determine exactly what training is required to enable instructors to use discrete trials to teach new skills in group settings. Given the little knowledge and experience of the instructors in the present study it was considered advisable to start out in a one-to-one setting.

Results of this study show that after children with developmental disabilities have reached adequate performance levels in a given skill through discrete trial teaching, correct responding can be maintained in a group setting. Research (e.g., Kamps et al., 1992) shows that when taught in a group, skills take longer to teach. However, considering other advantages of teaching in a group setting, such as the potential of increased social interactions, one-to-one teaching should be restricted to the beginning of teaching new tasks.

Generalization of instructors’ skills to teaching new tasks. During the consultation phase of the study, the instructors’ teaching performance did not drop when starting to teach a new task. This indicates some generalization of skills across teaching tasks, although it is hard to rule out the effects of guidance. Formal measures of generalization of teaching skills to new tasks, 1 and 4 months after training ended, showed that instructors were able to teach new skills by following only written directions.

These positive results on generalization of skills to teaching of new tasks are coherent with findings in Koegel et al.’s (1977) study, where training led to generalized use of behavior modification procedures, and Arco and Millett’s (1996) findings, where training enabled instructors to teach new tasks with minimal feedback. One factor these two studies have in common with the present one is that instructors were trained until they showed at least 80% correct overall performance across several consecutive sessions. These findings are important for the development of effective staff training procedures.

Other studies have shown limited generalization to new tasks (Smith et al., 1992; Thorisdottir, 1993). In Smith et al. staff trainees’ application of one-to-one teaching procedures reached only 39% correct on average in programs taught in the workshop and 30% correct in generalization programs, although their performance was statistically better than a control group receiving no training. After 1 week of training, there was no evidence of any beneficial effects on clients in the group homes. Other factors, such as differences in setting and clients, probably also contributed to this lack of generalization.

This study has several limitations. A multiple baseline design across only two instructors allowed just one replication of the effects of workshop and training on teaching skills. In
addition, the instructors in this study were highly motivated to acquire a new approach to teaching. Thus, it is not known whether the findings apply to preschool personnel in general. Moreover, baseline data were not collected in the group setting, thus making the effects of training in the one-to-one setting on teaching in the group setting unclear.

Taken together the results of this study are generally in accordance with previous findings and add to the scarce research literature on staff training of preschool personnel working with children with developmental disabilities. This study did not explore ways to teach new skills in a group setting and although recent findings (Taubman et al., 2001) suggest that discrete trials can be used to teach new skills in a group setting, necessary prerequisite skills on behalf of instructors remain to be determined. Future research should focus on establishing viable approaches to train preschool personnel to effectively teach new skills in an integrated setting. In addition, it is important to determine the effects of different training variables used in this study as well as the optimal rate, sequence or duration of certain staff behaviors necessary or sufficient to teach children effectively (Vollmer, Roane, Ringdahl, & Marcus, 1999). More research is needed in this area to establish appropriate criteria for training in order to make staff training more precise and efficient.

References


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