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EVALUATION OF THE EFFECTIVENESS AND EFFICIENCY OF TWO STIMULUS PROMPT STRATEGIES WITH SEVERELY HANDICAPPED STUDENTS

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In this study we compared the effectiveness and efficiency of two treatment packages that used stimulus prompt sequences and task analyses for teaching community living skills to severely handicapped students. Four severely and multiply handicapped students were trained to perform four tasks: (a) making toast, (b) making popcorn, (c) operating a clothes dryer, and (d) operating a washing machine. Following baseline, each student was exposed to two types of training procedures, each involving a task analysis of the target behavior. Training Procedure 1 (Traditional) utilized a least-to-most restrictive prompt sequence. Training Procedure 2 (Prescriptive) utilized ongoing behavioral assessment data to identify discriminative stimuli. The assessment data were used to prescribe instructional prompts across successive training trials. Performance on the tasks was evaluated within a combination multiple baseline (across subjects) and probe (across tasks) design. Training conditions were counterbalanced across subjects and tasks. Results indicated that both training procedures were equally effective in increasing independent task acquisition for subjects on all tasks; however, the prescriptive procedure was the more efficient procedure.

DESCRIPTORS: stimulus prompts, behavioral assessment, severely handicapped

A common feature of many community living training procedures is the use of a least-to-most intrusive instructional prompt sequence (e.g., Cuvo & Davis, 1983). This involves first allowing subjects to respond to naturally occurring discriminative stimuli, followed by the trainer sequentially initiating more restrictive levels of prompting (e.g., verbal, model, gestures, physical assistance) until the subject exhibits the desired response. Transfer of stimulus control from trainer-delivered prompts to naturally occurring stimuli may be facilitated by reinforcing progressive performance on the target tasks with gradually reduced trainer assistance. However, Snell and Browder (1986) suggested that acquisition of performance under such a prompt hierarchy can be slow because not all errors can be prevented and because prompts sufficient to occasion responding are presented only after less restrictive prompts have failed.

Our investigation was conducted to compare two variations of the least-to-most restrictive prompt sequence on complex community living tasks with severely handicapped students. The first variation, termed the traditional method, was a six-step least-to-most restrictive prompt sequence in which the students always received instructional prompts in the same hierarchical order. This procedure was selected for two reasons: (a) it is a frequently used procedure in training community living skills (Cuvo & Davis, 1983), and (b) teachers at the investigation site used the procedure routinely. The second variation (prescriptive method) involved presenting a level of prompting for a task, which, according to ongoing assessment of the students' performance, had been previously sufficient to occasion responding. This prescriptive method was similar to a procedure for teaching self-feeding skills (O'Brien & Azrin, 1972). The comparison of the two prompting sequences was based on measures of both effectiveness (task acquisition and maintenance) and efficiency (trials to criterion, wasted prompts, and cumulative duration of training).

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METHOD

Subjects

Four students ranging in chronological age from 11 to 19 years served as participants. Each student was enrolled in a public school for students with severe handicaps and was classified as severely to profoundly mentally retarded (IQ less than 35) based on evaluations with the Stanford-Binet Intelligence Test and AAMD Adaptive Behavior Scale. The students were selected on the basis of the following criteria: (a) independent in ambulation, (b) able to respond to simple verbal instructions, and (c) motor skills sufficient to perform the target task. These were the only students who met these criteria (most other students were either too young or were physically unable to perform the target tasks). All students had limited expressive language skills, and 3 displayed noncompliant, stereotypic, or aggressive/destructive behaviors.

Setting, Materials, and Target Behavior

Baseline, training, and posttraining phases of the investigation were conducted in a kitchenette/laundry area of the school. This area was equipped with a standard clothes dryer, a front-loading washing machine, a sink, a counter, a dining table, and two chairs. A standard two-slice toaster and an air popper (popcorn popper) were located on the countertop. Maintenance probes were conducted in the student's school and home environments. All students were trained on four tasks: (a) making toast, (b) making popcorn, (c) operating a clothes dryer, and (d) operating a washing machine. (Copies of task analyses are available from the first author.)

Observation and Reliability

The first author and a graduate student in school psychology acted as trainers. Each trainer used both training procedures on an approximately equal basis. Three additional observers (two teachers and a graduate student) independently recorded data on 25% of the trials across all conditions. Observers were trained in the procedures used but were not aware of the specific purposes of the investigation. During reliability trials, a trainer and an observer simultaneously but independently recorded the accuracy of performance on the tasks. During each trial, trainers recorded on a data sheet the level of prompt used to occasion correct performance on each step of the task analysis. A step-by-step comparison of the level of prompt needed for correct responding during a trial was used to determine the percentage of agreement between the trainer and the observer. Agreements and disagreements on each step were compared; percentage agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. Interobserver agreement ranged from 88% to 100%, with a mean of 98% agreement. No deviations were noted for the provision of the training sequences (integrity of the procedures). Duration of each trial was recorded with a stopwatch by the trainer.

Procedures

Baseline. All baseline trials were begun by presenting relevant materials to the student, saying, "[Name], I want you to [specify task]. Do your job." Trials were terminated when the student ceased to engage in task-relevant behavior. The trainer provided no assistance.

Three baseline trials were conducted within 3 days for making toast and operating the clothes dryer. Following every third training trial on these tasks, baseline probes were conducted for making popcorn and operating the washing machine.

Training. Each training trial was initiated with the same verbal instruction. Students were assigned to one of the two training sequences for one set of tasks and to the other training sequence for the other set of tasks. Training trials on each task were conducted one to three times daily during the school week. Both training sequences involved the following instructional prompting sequence: (a) naturally occurring prompt, (b) nonspecific verbal prompt, (c) specific verbal prompt, (d) gesture and verbal prompt, (e) partial physical and verbal prompt, and (f) total physical and verbal prompt. Training was completed on a task with both training sequences when the student independently performed 100% of the steps of the task analysis for two consecutive trials.

During traditional training, the trainer provided

verbal praise for correct performance on each task step. If the participant failed to initiate a response within approximately 5 s, the trainer provided successively more restrictive instructional prompts until the student exhibited the desired response.

For prescriptive training, the first training trial was identical to traditional training. Thereafter, data from each trial were used to prescribe the level of prompt to be delivered by the trainer during the next trial. For each task step, the student first responded only to the naturally occurring prompt. If the student did not exhibit the correct response, the trainer provided a prompt at a level just above (less restrictive) the prompt that had occasioned responding during the previous trial. If the student was still unsuccessful, the next more restrictive prompt (previously successful) was provided.

Posttraining probes. Three posttraining probes, conducted as in baseline, were conducted in the training setting immediately following the completion of training. Additional posttraining probes were conducted following every third training trial on subsequent tasks. Posttraining was completed when students had reached the training criteria on all tasks.

Maintenance probes. Following posttraining, 6-week maintenance probes (as in baseline) in both the school and home environments were provided to John and Matt, and a 2-week probe was provided to Christy. These students were also provided a 6-month probe. Parents completed two questionnaires (after each maintenance probe) to determine if the behaviors were socially valid within the home environment. Mark was unavailable for maintenance probes.

Experimental Design

A combination multiple baseline (across subjects) and probe (across tasks) design (Hersen & Barlow, 1976; Horner & Baer, 1978) was used to evaluate the training procedures. The multiple baseline across subjects was conducted across each pair of subjects on the two initial target tasks. Training conditions were counterbalanced across both subjects and tasks. Initially, John and Matt were trained to perform the four target tasks, beginning with the toast and clothes dryer tasks. Concomitantly, training was begun on the remaining two tasks. A systematic replication involving Mark and Christy was initiated following the completion of posttraining with John and Matt.

RESULTS AND DISCUSSION

The performances of John, Matt, Mark, and Christy on the training tasks are shown in Figures 1 and 2. Each data point (trial) represents one attempt to complete the task. During baseline, the students made few correct responses, as shown by the stable but generally low performance of all students. Both training sequences were equally effective across students and tasks. All students reached the training criteria and continued to perform at or near 100% of task acquisition during posttraining. During maintenance probes, the students performed the tasks on the average with over 85% accuracy regardless of the method used during training.

The efficiency data for each training method are presented in Table 1. The prescriptive method was the more efficient training sequence for all students. Only once (Christy, trials to criteria) were the two training methods equivalent. The traditional method, when compared to the prescriptive method, resulted in a 44% increase in the number of training trials (213 vs. 148, respectively), a 53% increase in cumulative duration of training, and an 85% increase in the number of "wasted" (ineffective) prompts. A total of 3,363 wasted prompts (2,181 for traditional and 1,182 for prescriptive) was provided during training across all tasks. The cumulative duration of training across students on all tasks was 1,681 min (1,015 for the traditional method and 666 for the prescriptive method).

Following the initial home probe, parents reported that the tasks were important and that their children completed the tasks on a routine basis (once weekly). Following the 6-month home probe, John's and Matt's parents reported that during the last 6 months their children had completed the tasks at least once per week, while Christy's mother reported that Christy had made toast on approximately six occasions.

The overall findings indicate that although the

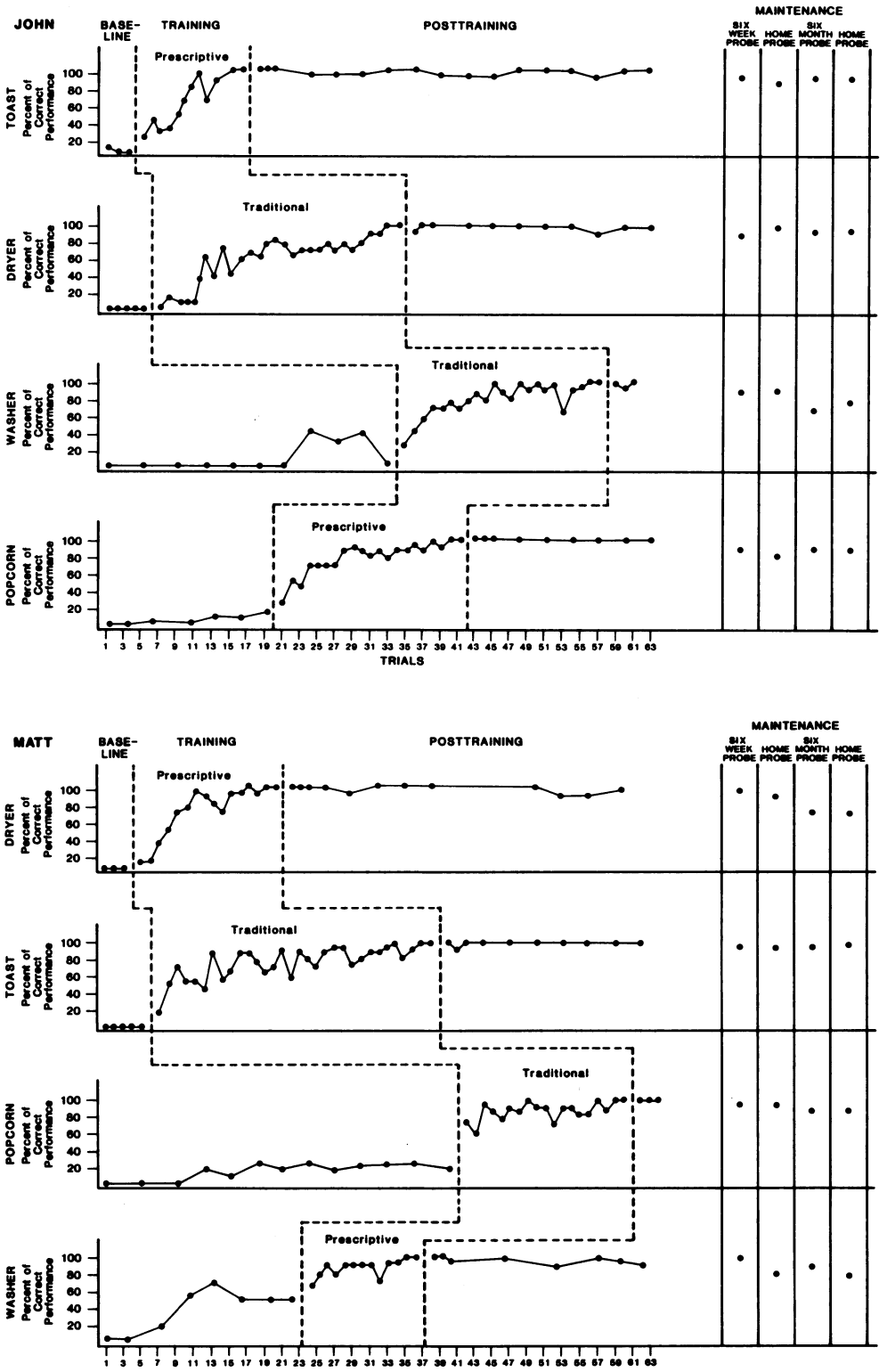
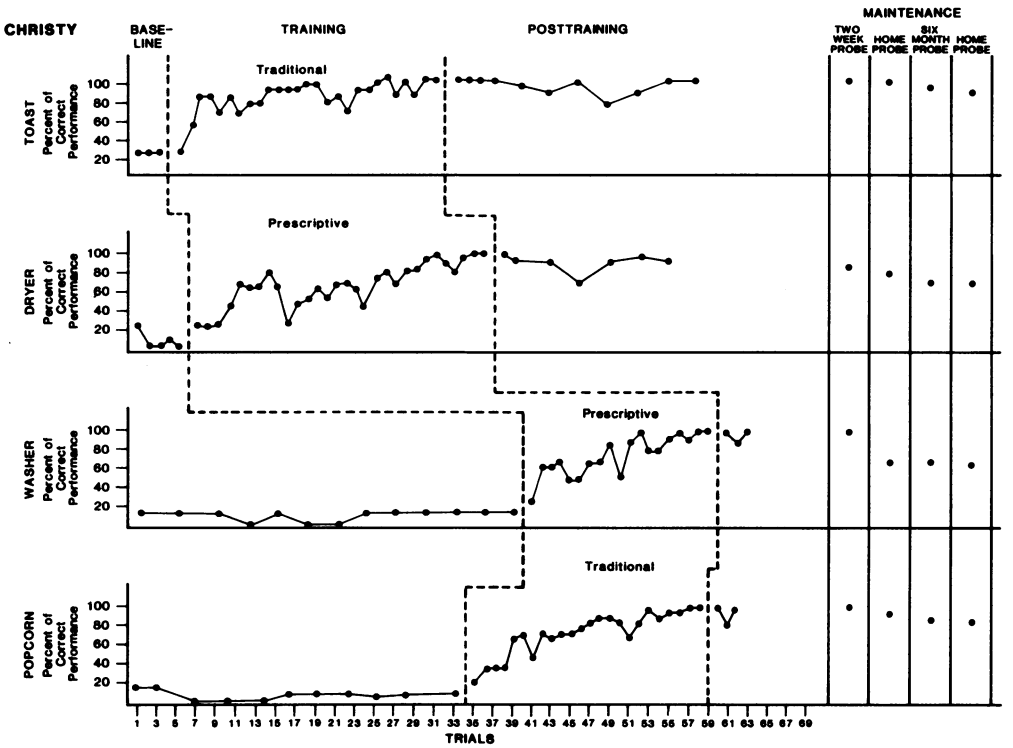


Figure 1. Performance across tasks for John and Matt.



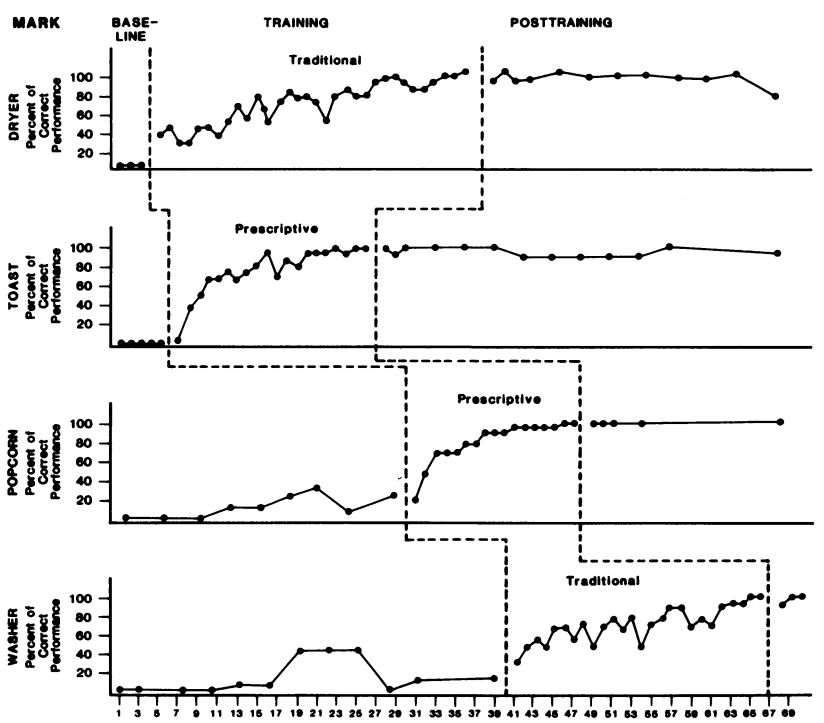


Figure 2. Performance across tasks for Christy and Mark.

Table 1
Efficiency of Training Methods Across Students and Tasks

Student/ training procedure	Number of trials to criterion					Number of "wasted" prompts					Cumulative duration of training time (minutes)				
	Toast	Pop-corn	Dryer	Wash-er	Total	Toast	Pop-corn	Dryer	Wash-er	Total	Toast	Pop-corn	Dryer	Wash-er	Total
John															
Prescriptive	12	21	—	—	33	112	176	—	—	288	54.3	108.2	—	—	162.5
Traditional	—	—	29	23	52	—	—	313	162	475	—	—	119.4	111.1	230.5
Matt															
Prescriptive	—	—	16	13	29	—	—	131	52	183	—	—	59.8	37.7	97.5
Traditional	32	19	—	—	51	236	64	—	—	300	159.2	113.6	—	—	272.8
Mark															
Prescriptive	20	17	—	—	37	161	128	—	—	289	93.6	111.4	—	—	205.0
Traditional	—	—	33	26	59	—	—	533	362	895	—	—	139.0	111.6	250.6
Christy															
Prescriptive	—	—	30	19	49	—	—	289	133	422	—	—	139.7	61.3	210.0
Traditional	27	24	—	—	51	181	330	—	—	511	105.6	155.7	—	—	261.3
Total															
Prescriptive	32	38	46	32	148	233	304	420	185	1,182	147.9	219.6	199.5	99	666
Traditional	59	43	62	49	213	417	394	846	524	2,181	264.8	269.3	258.4	222.7	1,015.2
Grand total	91	81	108	81	361	690	698	1,266	709	3,363	412.7	488.9	457.9	321.7	1,681.2

two training procedures were equally effective, substantial differences occurred with respect to their efficiency. If efficiency, as well as effectiveness, is considered to be a necessary component of treatment packages for severely handicapped students, then the prescriptive method of treatment is preferred for these students.

It is likely that the major reason for the observed differences in efficiency is due to the direct link between the ongoing assessment and the selection of prompt. That is, the prescriptive method provided for a more precise selection of prompts, thus dispensing with unnecessary errors or failures to respond.

These results extend previous findings on prompting strategies by focusing on the acquisition of complex behaviors by severely handicapped learners. Although various authors have compared the effectiveness of prompting strategies with discrete behaviors (e.g., Mosk & Bucher, 1984), our study compared two instructional prompt strategies with complex behavior that were both functional and age appropriate.

These results should be interpreted with some caution, however, given the small number of subjects evaluated and the fact that only one prompt sequence (six steps, least-to-most restrictive) was evaluated. In addition, the use of this relatively complex prescriptive procedure may not be applicable to trainers in some programs. In at least some cases, it may be easier to teach training staff to follow one stable rule (e.g., least-to-most restrictive prompting) rather than to teach them to follow several relatively complex rules (e.g., prescriptive method). Given that both types of procedures are equally effective, this issue is probably best resolved by balancing the practical applicability of the prescriptive procedures with training staff and the need for more efficient training of students.

REFERENCES

Cuvo, A., & Davis, P. (1983). Behavior therapy and community living skills. In M. Hersen, R. Eisler, & M. Miller (Eds.), *Progress in behavior modification* (Vol. 14, pp. 125–172). New York: Academic Press.

Hersen, M., & Barlow, D. (1976). *Single-case experimental designs: Strategies for studying behavior change.* New York: Pergamon Press.

Horner, R., & Baer, D. (1978). Multiple probe technique. A variation of the multiple baseline. *Journal of Applied Behavior Analysis,* **11,** 189–196.

Mosk, M., & Bucher, B. (1984). Prompting and stimulus shaping procedures for teaching visual-motor skills to retarded children. *Journal of Applied Behavior Analysis,* **17,** 23–24.

O'Brien, F., & Azrin, N. H. (1972). Developing proper mealtime behaviors of the institutionalized retarded. *Journal of Applied Behavior Analysis,* **5,** 389–399.

Snell, M. E., & Browder, D. M. (1986). Community-referenced instruction: Research and issues. *Journal of the Association for the Severely Handicapped,* **11**(1), 1–11.

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