

*TEACHING CHILDREN WITH AUTISM TO
USE PHOTOGRAPHIC ACTIVITY SCHEDULES:
MAINTENANCE AND GENERALIZATION OF
COMPLEX RESPONSE CHAINS*

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We used a graduated guidance procedure to teach 4 boys with autism to follow photographic activity schedules to increase on-task and on-schedule behavior. The multiple baseline across participants design included baseline, teaching, maintenance, resequencing of photographs, and generalization to novel photographs phases. The results indicated that photographic activity schedules (albums depicting after-school activities) produced sustained engagement, and skills generalized to a new sequence of photographs and to new photographs. The acquisition of schedule-following skills enabled these children with severe developmental disabilities to display lengthy response chains, independently change activities, and change activities in different group home settings in the absence of immediate supervision and prompts from others.

DESCRIPTORS: autism, prompting, stimulus control, photographic cues, generalization

A goal of behavioral intervention for people with autism is the development of functional skills that maximize engagement in appropriate self-care, work, and leisure activities. However, many intervention packages rely heavily on verbal instructions, modeling, and gestures. Because these prompts are often associated with reinforcement during teaching, they may acquire stimulus control over target responses, with the result that learners may not display target skills in the absence of teachers and prompting procedures. Although complex behavioral repertoires may be quickly established in a treatment setting, often they do not generalize or endure over time (see Dunlap & Plienis, 1988; Fowler, 1988; Sailor, Goetz, Anderson, Hunt, & Gee, 1988). Children with autism who have been taught to play with toys, dust the furniture, and complete handwriting worksheets or other functional skills often fail to exhibit these responses spontaneously, perhaps because stimulus control did not transfer from prompts embedded in the training setting to naturally occurring stimuli (Billingsley & Romer, 1983; Snell, 1983).

People with autism have also had difficulty acquiring lengthy response chains. Thus, although a boy may have learned to brush his teeth, get dressed, and go to breakfast, he may not complete this sequence without prompts to initiate each activity or each part of an activity. Some investigators have used visual cues (pictures, photographs, or line drawings) as sequenced discriminative stimuli that enable participants to complete the steps in a complex task or to change tasks independently. For example, Wacker and Berg (1983) used photographs of line drawings to teach adolescents with moderate and severe retardation to complete complex assembly tasks consisting of 18 to 30 steps, and Johnson and Cuvo (1981) used pictorial recipes to help adults with developmental disabilities learn cooking skills such as boiling, baking, and broiling. Others have used visual cues to help people with developmental disabilities acquire self-care skills (Thinesen & Bryan, 1981), meal preparation and cooking repertoires (Martin, Rusch, James, Decker, & Trtol, 1982; Robinson-Wilson, 1977), computer use (Frank, Wacker, Berg, & McMahon, 1985), and clerical and laundry tasks (Wacker, Berg, Berrie, & Swatta, 1985). Sowers, Rusch, Connis, and Cummings (1980) taught adults with mental retardation to move independently from

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work to lunch or break and back to work; their research is noteworthy because there have been few examinations of the use of picture cues to teach people to move independently from an activity in one setting to a different activity in another setting.

Although some investigations have shown that the use of visual cues can decrease dependence on teachers and enhance generalization and maintenance of newly acquired skills, most of these studies have used intervention packages that combine pictures, line drawings, or photographs with other procedures. Research using visual cueing procedures has not yet clarified which components of treatment packages are responsible for the reported results, or whether entire treatment packages are essential. Our investigation was designed to assess the effects of a two-component teaching package (photographs and graduated guidance) on participants' on-task and on-schedule behavior. Our goal is to extend the literature with 4 youths whose group-home intervention programs relied on verbal contacts (instructions, questions, and praise statements) by caregivers. Each youth received an average of one or two verbal contacts per minute. Although this rate of staff contacts resulted in very high levels of appropriate engagement and low levels of stereotypic behavior, most responses were prompted, and previously taught skills were seldom spontaneously displayed. Several attempts to fade verbal prompts had been abandoned because decreases in prompts were associated with increases in off-task and disruptive behavior. In this context, we examined the effects of photographic activity schedules, taught with graduated guidance, on the acquisition, maintenance, and generalization of complex response chains that required the participants to remain engaged and to move into different settings in their group home without prompts.

METHOD

Participants

The 4 participants in this study were Mike and Walter, age 9; Steve, age 11; and Roy, age 14. They met the DSM-III-R (APA, 1987) criteria for autism, and an independent diagnosis of autism had been conferred by outside agencies before their

program enrollment. The boys' scores on the Peabody Picture Vocabulary Test ranged from 2.1 to 3.9 years ($M = 3.2$); Steve was unable to obtain a basal score. Age-equivalent scores on the Vineland Adaptive Behavior Scale were 5.5 for Mike and Walter, 5.3 for Roy, and 3.3 for Steve. Informed parental consent was obtained for each participant.

All participants had long histories of disruptive behavior, including aggression, tantrums, and running away, and all displayed high rates of stereotypic behavior in the absence of structured programming. In addition, all had severe language deficits; they exhibited echolalia, vocal noise, non-contextual speech, and lack of spontaneous language. The boys were dependent on ongoing supervision and verbal prompts to complete self-help, housekeeping, and leisure activities. Prior to this investigation, incidental teaching and discrete-trial teaching procedures were used to teach home-living skills such as vacuuming, dusting, and table setting, as well as leisure skills such as using manipulative toys, biking, and rollerskating. All participants had acquired picture-object correspondence skills before the study began, and each had a limited experience with a photographic activity schedule that either (a) displayed the steps in preparing a bag lunch for the next school day or (b) depicted the steps necessary to obtain a preferred beverage. None had ever used photographic cues that prompted leisure skills or that depicted a sequence of different activities.

Setting

The study was conducted in a community-based Teaching-Family Model group home where the participants had resided for 1.1 to 4.2 years ($M = 2.1$ years). The home was staffed by live-in teaching parents (a married couple) and two other full-time therapists. Like other Teaching-Family programs, the home was family-style and consumer-evaluated (McClannahan, Krantz, McGee, & MacDuff, 1984). Sessions were conducted in the living room, family room, and participants' bedrooms.

Photographic Activity Schedules

Each participant's photographic activity schedule was displayed in a three-ring binder. Each binder

contained six photographs (35 mm) depicting leisure and homework activities; each photo (7 cm by 11.5 cm) was mounted in the center of a single page of white paper (21.5 cm by 28 cm) that was inserted in a plastic page protector. Photographs displayed materials against a plain background without distractors; for example, a picture of a snack showed only a plate with two cookies.

Initially, the first three photographs in Mike's schedule were Colorforms[®], handwriting worksheets, and Tinker Toys[®]; Walt's first, second, and third photos were handwriting worksheets, Lincoln Logs[®], and Colorforms[®]; Roy's were Memory[®] game, Lego[®] blocks, and Cootie[®] game; and Steve's were Lego[®] blocks, Colorforms[®], and Perfection[®]. The three remaining activities in the boys' schedules were snack, puzzle, and TV in the fourth, fifth, and sixth positions, respectively. Some of the leisure materials depicted in the photographic activity schedules were displayed on shelves above the youths' desks, some were located on their dressers, and others (e.g., the TV) were located several rooms away from the boys' bedrooms in the family room.

Dependent Variables

On-task. On-task was recorded if participants were (a) visually attending to any appropriate play or work materials, (b) looking at their photographic schedules, (c) manipulating play or work materials appropriately (i.e., as they were designed to be used), or (d) in transition from one scheduled activity to another. Off-task was scored if they (a) used materials in a manner other than that for which they were designed, (b) manipulated but did not visually attend to the materials, (c) engaged in inappropriate behavior (e.g., aggression, tantrums, stereotypies), or (d) did not engage in activities or use materials.

On-schedule. On-schedule was scored if, at the moment of observation, a participant was engaged in the activity depicted on the page to which his activity schedule was open. For example, if a boy was building with Lego[®] blocks and his notebook was open to a page displaying a photograph of Lego[®] blocks, on-schedule was scored. However, if he was using the blocks and the photographic

activity schedule showed handwriting worksheets, the observers scored on-task but off-schedule. Further, off-schedule was recorded if on-task criteria were not met.

Independent Variables

Verbal contacts. These were defined as verbal instructions, questions, or praise statements (e.g., "Steve, look at your puzzle," "What color will you use, Roy?" or "Good, Mike, you're looking at your blocks!").

Gestures and gestural prompts. These prompts included all pointing, motioning, or nodding toward children or materials, as well as pointing to specific toys, materials, or photographs that represented the next tasks in a sequence. Thus, both nonspecific gestures (e.g., pointing toward a child) and gestural prompts (e.g., pointing to the last piece to be placed in a puzzle) were scored. This broad definition was used to identify any trainer behavior that could potentially influence participants' performance.

Manual prompts. Manual prompts were defined as orienting a youth's head toward materials, hand-over-hand prompts, and light touches such as those that occur when manual guidance is faded.

Measurement Procedures

During all sessions, independent observers used a 60-s momentary time-sampling procedure to score on-task and on-schedule. Additional observers recorded verbal contacts, gestures and gestural prompts, and manual prompts with a 60-s partial-interval procedure.

Experimental Design

A multiple baseline design across participants was used to assess the effects of photographic activity schedules on on-task and on-schedule behavior during baseline, teaching, maintenance, resequencing of pictorial schedules, and generalization to novel photographs.

Experimental Conditions

Sessions were 60 min in duration. Prior to all sessions, participants were seated on a bench in the living room; their photographic activity schedules

were located on a table approximately 1 m from the bench and directly in front of them. Activity schedules and the depicted materials were present during all conditions. Sessions began when the primary data collector gave the instruction, "Everyone look at me; please find something to do." This standard instruction was used throughout all phases of the research, and no rewards were delivered by the teacher.

Baseline. After the standard instruction was given, no additional manual, gestural, or verbal prompts were delivered, and inappropriate behavior was ignored. The teacher (the first author) was never present during baseline.

Teaching use of pictorial schedules. Participants successively entered the teaching condition. At first, the teacher stood next to the bench where the boys were seated, and after the primary observer gave the initial instruction, the teacher waited 10 s for a target child to stand up. If the participant did not get up during this interval, the teacher placed his hand on the boy's shoulder and manually guided him to his photographic activity schedule. If the child got up but did not move toward the photographic schedule, the same prompt was delivered. Graduated guidance, delivered from behind the youth, was used to help him complete the sequence of activities pictured in his activity schedule, in the order in which photographs were presented. During initial sessions, the boy was manually prompted to pick up his notebook, carry it to his bedroom, open it, point to the first picture, gather the necessary materials, complete the activity, put materials away, and turn the page to the next activity. A child was manually prompted to put materials away and move on to the next activity when he (a) used all the available materials (e.g., if 30 Lego® blocks were provided, he used all pieces) or (b) completed all items on his worksheets. If a participant progressed to the last scheduled activity (TV) before 60 min had elapsed, he continued this activity until the session ended. The teaching procedure specifically prohibited verbal contacts, gestures, and gestural prompts, and called for the preventive use of manual prompts to decrease errors.

Manual prompts were always delivered from behind the youth. Graduated guidance was initially available for all tasks specified by the photographic schedule, but prompts were faded in frequency and intensity as rapidly as possible. Fading began by moving from graduated guidance to spatial fading (i.e., the teacher changed the location of manual prompts). Subsequently, the teacher moved to shadowing—he followed the youth's movements with his hands near the boy, but without making physical contact (Cooper, 1987; Foxx & Azrin, 1973). However, if a boy engaged in inappropriate behavior, or if he paused for an extended period of time, prompts were reinstated.

When a youth was scored as on-task and on-schedule during at least 80% of time samples with shadowing, the teacher began to fade his physical proximity. The teaching condition ended for a youth when he remained on-task and on-schedule during at least 80% of time samples for five consecutive sessions after the teacher's physical proximity had been faded. (Because Mike and Walter shared one bedroom and Roy and Steve shared another, the teacher was present in each bedroom until his proximity was faded for the second boy in each dyad. The teacher was present in the living room and family room until his proximity was faded for Steve.)

Maintenance. During maintenance, the teacher was present to prompt the youth entering the teaching condition, but boys in maintenance received no prompts. For example, although the teacher stood next to the bench at the beginning of the session or was present in the room of a child who had recently completed training, he did not provide any prompts to participants who had completed training.

Resequencing photographic activity schedules. At the beginning of this condition, four of the six original activities in Mike's, Walter's, and Roy's schedules were resequenced (i.e., all activities except snack and TV were randomly assigned to new positions in their schedules). All other aspects of the schedules remained constant, no prompts were delivered, and the teacher was absent. This manipulation was performed to assess whether the boys were using their schedules or following now-fa-

miliar routines. Because of time constraints, Steve did not participate in the resequencing condition.

Generalization. The teacher was absent throughout this condition. During the generalization phase, two of the six original activities were replaced with two similar but novel leisure activities for each boy. In Mike's schedule, Colorforms® and Tinker Toys® were replaced by a marble game and coloring; in Walt's, Lincoln Logs® and Colorforms® were replaced by Pipeworks® and Lego® blocks; in Roy's, Memory® and Cootie® games were replaced by Perfection® and a peg game; and in Steve's schedule, Legions of Power® and Ramagon® replaced Lego® blocks and Perfection®. Although these new activities called on previously acquired skills, none had ever been the topic of instruction, nor had any of them been components of photographic activity schedules.

Interobserver Agreement

Interobserver agreement data were obtained for the dependent and the independent variables in at least 30% of sessions across all conditions. Interval-by-interval percentage interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Mean interobserver agreement on the occurrence of on-task was 96% (range, 0% to 100%), and mean agreement on nonoccurrence of on-task was 95% (range, 0% to 100%). For on-schedule, mean agreement was 99% for both occurrence and nonoccurrence, and ranges for both were 98% to 100%. No verbal or gestural prompts were ever scored; interobserver agreement on nonoccurrence was 100%. Mean agreement on the occurrence of manual prompts was 99% (range, 50% to 100%), and mean agreement on nonoccurrence of manual prompts was 99% (range, 99% to 100%).

RESULTS

On-Task

Figure 1 shows levels of on-task for the 4 participants across all conditions. During baseline, the boys, with the exception of Steve, displayed con-

siderable variability across sessions; on-task was almost never scored for Steve.

With each application of teaching pictorial schedules, on-task immediately increased for all youths. Mean on-task performance was 99% for Mike, Walt, and Roy, and 97% for Steve. During maintenance, resequencing of photographs, and generalization to novel photographs, all youths displayed high and stable on-task performances. Means for Mike and Walt across these three conditions were 99%; Roy's on-task means were 97% in maintenance, 96% in resequencing, and 97% in generalization. Finally, Steve's on-task averaged 91% in maintenance and 96% during generalization; he did not participate in the picture-resequencing phase.

On-Schedule

Figure 2 reports the participants' on-schedule data during all experimental conditions. During baseline, on-schedule was never scored for any of the youths. Teaching pictorial schedules produced on-schedule means of 99% for Mike, Walter, and Roy, and 96% for Steve. In maintenance, on-schedule means were 98%, 99%, 97%, and 91% for Mike, Walter, Roy, and Steve, respectively. Further, the boys continued to use their schedules after the photographs were resequenced, obtaining mean on-schedule scores of 97% (Mike), 99% (Walter), and 95% (Roy). The presentation of novel photographs and materials during the generalization phase produced on-schedule means of 99% for Mike and Walter, 97% for Roy, and 96% for Steve.

Independent Variables

During baseline, no verbal contacts, gestures or gestural prompts, or manual prompts were recorded. In the first five sessions of the teaching phase, the percentage of intervals scored for the occurrence of manual prompts ranged from 3% to 8% for Mike ($M = 4\%$), 0% to 22% for Walt ($M = 8\%$), 20% to 40% for Roy ($M = 23\%$), and 8% to 37% ($M = 19\%$) for Steve. The last five training sessions for each participant contained no manual prompts, and no verbal contacts, gestures, or gestural prompts were scored throughout this condition. No prompts of any type were scored during

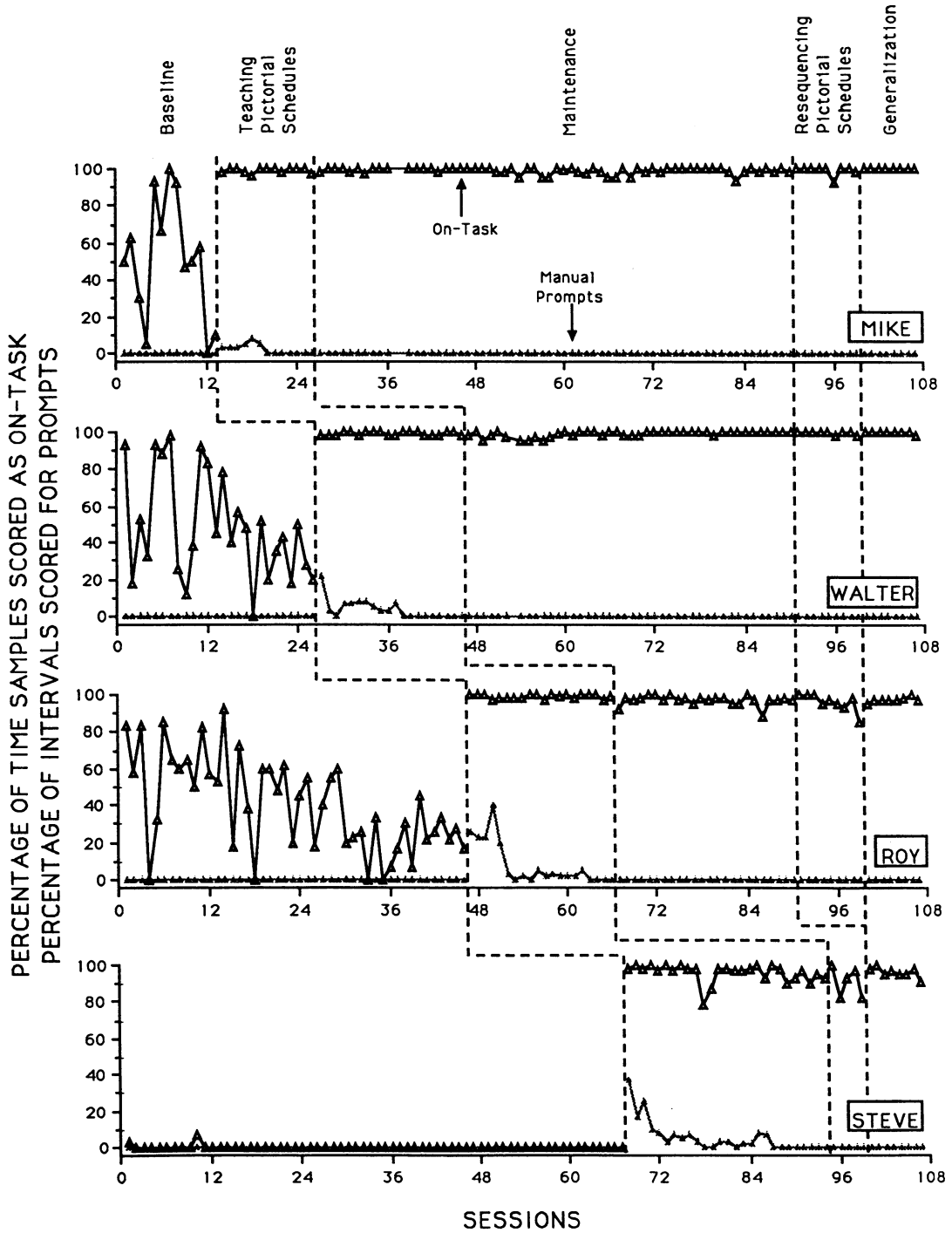


Figure 1. Percentage of 60-s momentary time samples scored as on-task, and percentage of 60-s intervals scored for manual prompts during 1-hr sessions.

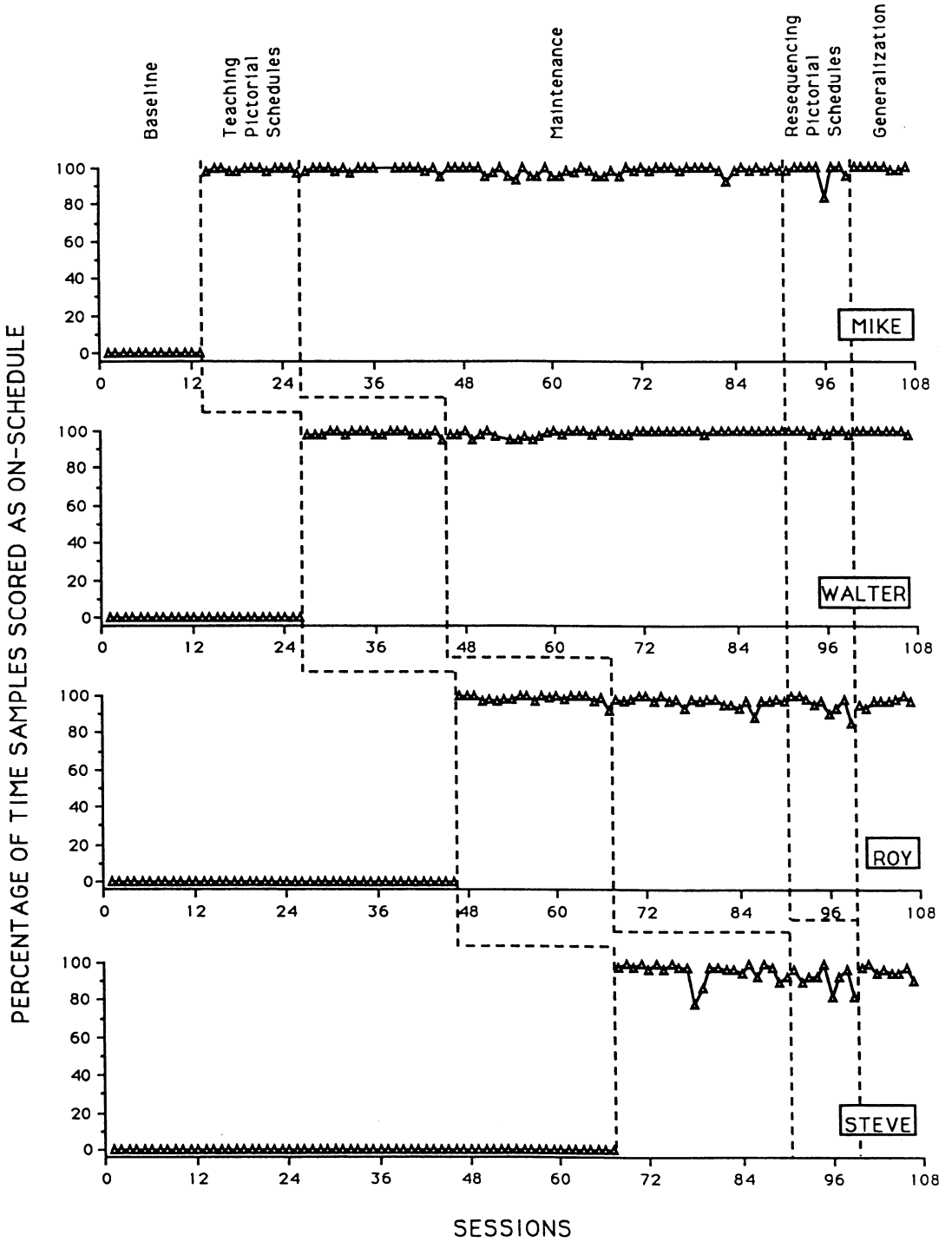


Figure 2. Percentage of 60-s time samples scored as on-schedule during 1-hr sessions.

maintenance, resequencing, or generalization phases. The boys completed these sessions without assistance or guidance, and from Session 90 on, the teacher was no longer present.

DISCUSSION

Clinical data indicated that the 4 participants had learned to do a variety of recreational and home-living tasks, but baseline data showed that the presence of leisure and homework materials did not prompt sustained engagement. During the teaching condition, however, participants met criterion in only 13 to 27 sessions; subsequently, they continued to be on-task and on-schedule without prompts from the teacher, and their schedule-following skills generalized to new sequences of activities and to novel photographs and materials with no additional training. The photographic schedules enabled the boys to display lengthy and complex chains of previously mastered, functional behavior. Anecdotally, it also appeared that when following their schedules, they engaged in fewer aberrant behaviors; this may be a topic for future research.

The present study extends previous investigations of pictorial and photographic cues in several ways. First, prompts were specified and measured. Most earlier studies used training packages that included multiple prompting procedures, making an analysis of the effects of specific classes of training stimuli difficult or impossible. Only one other study of visual cues measured all of the prompts used in training (Johnson & Cuvo, 1981); our research isolated the effects of graduated guidance. Our investigation also measured another variable, on-schedule, that has been frequently discussed but seldom assessed. Several other researchers have reported that participants eventually discontinued or modified their use of photographs or pictures. For example, Thinesen and Bryan (1981) reported that after 1 week of training, all 15 participants stopped paging through their albums, using only the first or a randomly selected photograph to complete an entire grooming sequence. Connis (1979) noted that subjects eventually stopped checking each picture before changing work tasks. In our study, the

resequencing and generalization conditions established that the photographs were relevant discriminative stimuli, and that participants were not merely engaging in familiar routines.

The participants' consistent use of schedules may be related to the training procedures. The trainer ensured that the boys turned single pages, pointed to photographs before beginning tasks, obtained the depicted materials, and completed scheduled activities in sequence. Graduated guidance was used to prevent errors, lengthy delays that might have interrupted response chains, and stereotypies that might otherwise have become embedded in response chains. The boys continued to demonstrate look-then-do sequences throughout the study.

The nature of the target tasks may also influence the posttraining use of visual cues. People who engage in one repetitive task (e.g., assembly or packaging tasks) may cease to use visual prompts because tasks are familiar and unchanging. But activities that are frequently resequenced (e.g., grocery shopping or work assignments in an industrial kitchen) may require continued reference to pictorial cues.

It is interesting that in the current investigation, boys not yet in training were never observed to imitate the schedule-following behavior of those in the teaching phase. Further, no resistance to manual guidance was noted. After training, off-task was occasionally scored, but children were not observed to engage in functional activities other than those cued by their photographic schedules. The relatively small number of manual prompts required to teach the participants to follow schedules may have been related to (a) their prior mastery of picture-object correspondence skills, (b) their previous acquisition of the types of skills needed to complete depicted tasks, and (c) the fading of graduated guidance. The manual prompting procedure was selected because it was hoped that nonverbal prompts delivered from behind a youth would prevent performance from becoming dependent on the teacher's presence. Although least-to-most prompt sequences are frequently used with participants such as these, the most-to-least sequence described above was effective in preventing errors that might otherwise

have become embedded in schedule-following response chains.

Before this investigation began, the 4 participants were dependent upon verbal prompts to remain constructively engaged in appropriate activities. In the absence of verbal prompts from supervising adults, it appeared that stimulus control transferred to photographs and materials that were available in the group home. When the study ended, all 4 boys were able to display complex home-living and recreational repertoires for an hour, during which time they frequently changed tasks and moved to different areas of their group home without adults' prompts. Photographic activity schedules, taught with graduated guidance, became functional discriminative stimuli that promoted sustained engagement after training ceased and fostered generalized responding to new activity sequences and novel leisure materials.

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