Neurodevelopmental Diseases – Laboratory and Clinical Research Series

BEHAVIORAL THEORIES AND INTERVENTIONS FOR AUTISM

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Chapter 12

ACTIVITY SCHEDULES FOR ADULTS WITH AUTISM SPECTRUM DISORDERS

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An activity schedule is a set of pictures or words that is used to cue someone to engage in a sequence of activities (McClannahan and Krantz, 1999). For example, one might make a photographic activity schedule for a severely disabled adult with Autism Spectrum Disorder (ASD) to teach him to prepare his own breakfast. Because the young man likes cereal, the instructor decides that will be the initial target. After completing a task analysis, the instructor takes photographs that represent the component tasks, mounts the pictures on a plain background, and places them in a three-ring binder, one photograph per page. The photographs include a picture of hand washing, and pictures of a box of cereal, a bowl, a spoon, a carton of milk, a napkin, a picture of milk being poured on cereal, and a picture of the learner eating cereal.

Let us assume that the man has never before used an activity schedule. Teaching begins with an initial comment such as, "It's time for breakfast." Subsequently, the instructor stands behind the learner and manually guides him to open the schedule book to the first page, point to the photograph of hand washing, and go to a sink and wash his hands. Then he is manually guided to return to his schedule, turn the page, and point to the next picture—a photograph of a box of cereal. Remaining behind him, the teacher guides him to obtain a box of his preferred cereal from a cabinet and put it at his place at the table. Then he is guided to return to his schedule, turn the page, point to the next photograph (a picture of a bowl), obtain a bowl, and place it on the table. This sequence continues until the learner arrives at the last photograph, a picture of himself eating cereal; the instructor manually guides him to be seated at the table, pick up the spoon, and begin to eat.

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After each task in the schedule is completed, if inappropriate behavior was not observed, the instructor places a token (in this case, a coin) on the man's token board and after all tasks are completed, the learner exchanges them for a preferred activity. Initially, tokens are delivered following prompted responses but as the person gains skills, tokens are delivered for responses that are made with lesser assistance and eventually, with no assistance. The man in our example often exchanges his tokens for opportunities to listen to music or watch TV, although he has many other reward choices. For him and other nonreaders, the available rewards are depicted in photographs; choices change over time as a result of frequent reinforcer assessment.

The teacher does not use verbal prompts or gestures because the goal is to help the man *independently* prepare his own breakfast. The target responses are not evoked by others' instructions, but by the same stimuli that are responsible for our own breakfast preparation—for example, time of day, hunger, and the availability of breakfast foods.

When the learner begins to make the relevant responses with less manual guidance, prompts are faded in a most-to-least hierarchy: manual guidance, graduated guidance, spatial fading, shadowing, and decreased proximity of the instructor to the learner. And when he independently obtains and consumes cereal, new photographs are added to the activity schedule and he is taught to pour juice and later, to make buttered toast. As he becomes a more proficient schedule follower, he is taught to use a second activity schedule to make an alternate breakfast—a frozen waffle that he warms in a toaster oven and covers with syrup, and an orange that he peels. Over time, he learns to use activity schedules to prepare several different breakfasts. His breakfast choices are identified by photographs placed on the covers and spines of his activity schedules and each morning he independently selects one of these schedules and uses it to prepare his own breakfast.

Like the young man in this example, many severely disabled adults have learned to use activity schedules to achieve greater independence and to make choices that contribute to a better quality of life. Of course, if the man in our example were a reader, the instructor would create a written activity schedule that included textual cues such as "wash hands," "get cereal," "get bowl," "get spoon," and so on, but the relevant responses would be taught in the same way, beginning with manual prompts that are gradually faded from most to least.

The Evolution of Activity Schedules

The first activity schedules used at the Princeton Child Development Institute (PCDI) were photographic. Photographs were mounted on plain black backgrounds and placed in three-ring binders, one photo per page, and the last photograph depicted a preferred item or activity. Typically, children's first schedules included only three to six pages and most activities were completion-based; that is, an activity was finished when the youngster used all of the component parts (e.g., all pieces were placed in a puzzle, all Lego© blocks were assembled, or all picture cards were sorted into categories). But many activities are time-based (e.g., looking at books, watching videos, playing computer games, riding bicycles); therefore, young people learned to set timers. These skills were taught using photographic activity schedules that displayed timers with color-coded buttons; users matched colored

buttons depicted in schedules to colored buttons on timers to set their timers for varying lengths of time (McClannahan and Krantz, 1999, pp. 69-72).

As people became accomplished schedule followers, photographic schedules grew increasingly bulky and unwieldy; eventually, learners had daily schedule books that referred them to many different sub-schedule books. For example, a photo of snack foods in a youth's main schedule cued him to obtain one of several sub-schedules that he used to make preferred snacks, and a picture of exercise equipment cued him to get the sub-schedule he used for his workout in the gym.

For readers, written schedules were initially presented as lists, and students struck through or made checkmarks next to completed items. Lists were later supplanted by written entries in daily planners or appointment books and typically, these entries directed users to more detailed textual cues that were located in notebooks, on clipboards, or in file folders. In response to the written entry "cook" in her daily planner, a teenager might obtain a notebook that contained previously mastered recipes and select a written task analysis for making pasta, chicken and rice, or an omelet. Or she might respond to a written cue in her schedule to select a new recipe to prepare with her teacher's assistance.

More recently, many adolescents' and adults' photographic and written activity schedules have been replaced by personal digital assistants (PDAs) such as BlackBerrys™ or Palms™. For nonreaders, digital photographs are imported to folders on PDAs. For example, a man employed as a hotel housekeeper accesses photographs on his PDA to guide him through a lengthy task sequence that includes making beds, dusting, vacuuming, folding and hanging towels, and cleaning bathrooms. A recent comparison of a person's performance when using a picture schedule presented in a three-ring binder versus using a picture schedule presented on a PDA showed that both formats were associated with high engagement and task completion (Decker, Ferrigno, May, Natoli, Olson, Schaefer, Cammilleri, and Brothers, 2003). Further, PDAs are more portable than photographic schedules and they enhance the social competence of adults with ASD by enabling them to appear more like their typical co-workers.

Less severely disabled readers also use schedules displayed on PDAs, and many use textual cues to add their own written schedules to their handheld devices (see Table 12.1). In this case, as with all other photographic and written schedules, instructors use only manual prompts that are faded to graduated guidance, then spatial fading, shadowing, and finally, to decreased proximity of teacher and learner. Verbal prompts and gestures are never used. Of course, before introducing the written schedule shown in Table 12.1, it is important to teach a person to identify and label items such as "USB cable," "stylus," and "case."

Our data and others' investigations show that schedule-following performance is essentially the same whether readers use textual cues presented on paper or on PDAs (cf. Bellovin, Burck, Tarnoski, Cammilleri, and Brothers, 2003).

Rehfeldt, Kinney, Root, and Stromer (2004) described the construction of computer-based activity schedules created with PowerPoint™, and gave step-by-step instructions on how to prepare closed-ended and open-ended schedules that include photographs, sound, text, and videos. Although lack of portability of computer-based schedules may limit their use in workplaces and other community settings, the same or similar outcomes can be achieved with Microsoft Pocket PCs™ or PalmPilots™.

Table 12.1. A Written Activity Schedule for Adding a Schedule to a Personal Data Assistant (a PalmPilot™)

Tasks	
___	Plug small end of USB Hot Sync cable into Palm Pilot
___	Plug large end of USB Hot Sync cable into computer
___	Double click the *Palm Desktop* icon on the computer
___	Double click *New to Do* icon
___	Type first activity in the title box
___	Click *Add Another*
___	Add each activity and click *Add Another*
___	Click *OK* when finished
___	Turn on Palm Pilot
___	Use stylus to click on the Hot Sync button
___	Click on *Palm Desktop* on top of computer screen
___	Click on *Quit Palm Desktop*
___	Unplug USB cord from computer
___	Unplug USB cord from Palm Pilot
___	Put Palm Pilot in case
___	Put cord in box by computer

Why Use Activity Schedules?

Our research on activity schedules emerged from our concern about the prompt dependence that is so often displayed by people with ASD. By prompt dependence, we mean that a person responds to prompts rather than to the stimuli that are expected to control a response (Touchette and Howard, 1984). At the time of our initial investigation of activity schedules (mid 1980s), discrete-trial teaching was a predominant intervention strategy in our

setting as well as elsewhere, and our data indicated that young people in PCDI's intervention programs received verbal prompts from instructors at very high rates.

Because verbal prompts are frequently paired with reinforcement, they may acquire stimulus control (Bickel, Stella, and Etzel, 1984; Schneider and Salzberg, 1982). We have often discussed how the inter-trial latencies and verbal instructions that are key components of discrete-trial teaching may come to signal reinforcement and thus become discriminative stimuli:

"The teacher gives an instruction or asks a question, and the learner attempts (or does not attempt) to follow the instruction, receives (or does not receive) a reward, and waits for the teacher to initiate the next trial...Behavior other than quiet waiting delays the next trial and the next reinforcement opportunity. Therefore, both passive waiting and instructions become discriminative for reinforcement" (McClannahan and Krantz, 1997, p. 271).

In practice, we repeatedly observed this problem. A person who long ago learned to make popcorn passively waited in the kitchen until someone instructed, "Get the popcorn." Another who was a proficient biker stood near the bicycle until a staff member prompted, "Why don't you ride the bike now?" And a student who practiced handwriting every school day sat looking at a worksheet until a teacher said, "It's time to do handwriting." Other researchers have also noted "deleterious relationships between verbal prompts and the potential emergence of spontaneous behaviors" (Reed, undated, p. 19).

In our initial investigation of activity schedules as a means of ameliorating prompt dependence (Knapp, McClannahan, and Krantz, 1986), we used a multiple-baseline design across three students. The teaching procedures included verbal prompts, modeling, and behavioral rehearsal, and as the young people learned to follow photographic activity schedules, verbal prompts were replaced by gestures and the teacher's proximity was gradually faded until she was no longer present in the room. The learners met criterion in the training setting, but probes in a different setting at a different time of day showed that schedule-following skills did not transfer until the teacher instructed. Although two of the participants responded to a single instruction to generalize ("Do your schedule"), the third remained dependent on verbal prompts.

Packages of prompting procedures such as those used in that first study may miscue learners and prevent them from responding to the critical stimuli (cf. Hoogeveen, Kouwenhoven, and Smeets, 1989). Further, the use of multiple types of prompts makes it difficult to determine which components of the treatment package are responsible for the results, and may also result in selective stimulus control (i.e., one type of stimulus blocks the effect of other types). Thus, in our second study (MacDuff, Krantz, and McClannahan, 1993), we assessed the effects of photographic activity schedules taught only with graduated guidance that was delivered from behind a learner and then faded. The data indicated that the three participants (residents of a group home) displayed sustained engagement with scheduled activities, and their independent schedule-following skills generalized to a different sequence of photographs and to new photographs. Similar results were obtained in a third study that used the same prompting procedures (Krantz, MacDuff, and McClannahan, 1993).

In our subsequent research on photographic and written activity schedules, we have continued to use graduated manual guidance, followed by spatial fading (prompts to the hand, then the wrist, then the elbow, and then the shoulder). When a person acquires a correct response chain, the instructor shadows and finally, decreases physical proximity. This most-to-least prompt hierarchy is "errorless"--that is, in contrast to most other teaching procedures,

it achieves a very low error rate and prevents errors that might otherwise be embedded in response chains. But if a learner pauses for more than a few seconds, begins to make an error, or engages in inappropriate behavior, manual prompts are reinstated and again faded. All prompts are delivered from behind learners and instructors attempt never to insert any part of their bodies between the learners and their activities or their schedules, because to do so may make their presence more salient, promote prompt dependence, and make it more difficult to fade physical proximity.

Our early uses of activity schedules were directed toward children and adolescents, but as learners matured we modified the content of activity schedules to provide age-appropriate activities for adults with ASD. Today, it is difficult to imagine an intervention program for adults in which schedules do not occupy a prominent position. We are not aware of other procedures that are equally successful in diminishing prompt dependence and promoting independence and choice.

THE PARTICIPANTS IN PCDI'S ADULT LIFE-SKILLS PROGRAM

Prior to 1984, when the first young person with ASD had his twenty-first birthday and completed his schooling at PCDI but needed continuing support, we embarked on the development of a program for adults. It was, and continues to be, an uphill battle to persuade funding agencies of the importance of a seamless transition from adolescence to adulthood, but the benefits of program continuity are worth the effort. Intervention for preschool and school-age children enhances their outcomes in adulthood, and data on adults' repertoires often result in key revisions of the curriculum for children (McClannahan, MacDuff, and Krantz, 2002).

At PCDI, all adults with ASD receive the services of staff members identified as Life-Skills Coaches. They provide job coaching and ensure effective work performance; in addition, they teach a plethora of other relevant skills such as shopping and money management, grooming and health-care skills, menu planning and food preparation, housekeeping, family participation, and use of leisure time. The ratio of learners to staff members is 2 to 1.

Presently, 20 adults (18 men and 2 women), ages 21 to 44, receive services. All have diagnoses of autism. They have been enrolled in PCDI's programs for 17 to 38 years. All of them receive day services; 10 of 20 reside in the Institute's group homes, 5 participate in supervised apartment or supported community-living programs, and 5 live at home with their own families.

Due to serious health issues or low-rate but severe behavior problems, two men work at PCDI, completing contract work for local organizations. The other adults hold jobs in community workplaces. Their positions include word-processing, data-entry, general office work, and employment in food services, hotel housekeeping, and grounds maintenance. All of the adults use photographic or written activity schedules to complete employment-related tasks. As children, four of the adults were participants in our study of the effects of activity schedules on generalization and maintenance of complex response chains (MacDuff, et. al., 1993) and two others participated in our research on parents' use of activity schedules (Krantz, et. al., 1993). Most of the adults have been schedule followers for at least a decade

and when new schedules are introduced, their acquisition rates are typically related to the severity of their disabilities.

Six people are non-readers who use photographic activity schedules. Four continue to learn sight words when those words are relevant to their scheduled activities. Sight words are taught via discrete-trial procedures (albeit with trials embedded in their daily activities rather than with massed trials); new sight words are not placed in written schedules until they are mastered. The remaining ten adults are readers who use written activity schedules; their reading grade levels range from kindergarten to fourth grade. They learn new sight words in the context of their schedules and activities.

Because PCDI provides continuity of services to people who continue to need them (from early childhood through adulthood), all of the adults have lengthy histories of schedule-following. However, evidence from other settings suggests that adults with developmental disabilities who have never previously been introduced to activity schedules can achieve impressive benefits from this intervention strategy (cf. Watanabe and Sturmey, 2003; Weiberg-Aurdal, undated).

ADULTS' SCHEDULES: SOME EXAMPLES

It is difficult to identify a skill area in which adults at PCDI do not use schedules, but because all of them have long schedule-following histories, many activities that were once guided by multiple photographs or lengthy written task analyses are now cued by single pictures or words. With few exceptions, the adults routinely manage their own photographic or written schedules—that is, they obtain or create their schedules at the beginning of each day, transport them across activities and settings, and turn pages or check-off activities as they are completed. When new skill sets are mastered, new activities are added; schedules are dynamic rather than static.

Personal Hygiene

As children and adolescents, many of the adult participants in PCDI's programs used activity schedules to complete daily hygiene tasks, such as washing face, brushing teeth, taking a shower, and dressing. But standards for appropriate grooming evolve during childhood and adolescence; the tooth-brushing repertoire that was acceptable for a seven-year-old is not appropriate for an adult and as a result, activity schedules are modified to meet new age-related expectations (McClannahan, et.al., 2002). For example, a young child may follow a face-washing schedule that includes washing with soap, rinsing, and drying his face, but a teenager's schedule may include washing with anti-acne soap, rinsing, drying, and applying acne medication.

As children grow up, new schedules are introduced. A teenage boy learns to follow a detailed schedule for shaving (e.g., *get shave cream, get razor, put water in sink, wet face...)* and when it is mastered, tasks are gradually faded until they are replaced with a single word (*shave*). An adolescent girl learns to follow a schedule that pertains to her menstrual cycle.

Young men who recently began work as hotel housekeepers have new items in their dressing schedules—for example, a picture of a name badge or a textual cue (*put on name badge*).

Schedule-following repertoires help people make rapid adaptations to changes in routine. For example, a person who needs seasonal allergy medication quickly learns to take his pill when a cue is added to his morning hygiene schedule. Although some adults continue to need detailed schedules to complete personal care tasks, many now respond to lists of the relevant tasks, or to general textual cues ("Get ready for work"), or they no longer need any cues to complete personal hygiene activities. Some activity schedules have been completely faded without decrements in the target skills that were taught.

Home Living

Like personal hygiene schedules, schedules for completing home-living activities are usually introduced during childhood. Young children learn to be helpful family members by following schedules to set the table or unload the dishwasher, and housekeeping schedules are expanded as they move through adolescence and arrive at adulthood.

Illustrative home-living schedules for adolescents and adults include doing laundry, ironing, washing windows, and cleaning oven and refrigerator. An activity schedule for cleaning a bathroom is typically preceded by several component schedules, such as cleaning sink and shower, cleaning a toilet, washing mirrors and windows, dusting, and mopping. When the component schedules are mastered, the person is prepared to use a schedule to clean the bathroom.

Other home-living schedules include menu planning, making a grocery list, and preparing food. These schedules may be written or pictorial. For example, a non-reader plans menus by selecting pictures from categories such as fruit, vegetables, main dishes, and desserts and placing them on pages that represent days of the week. And when making a grocery list, a non-reader checks cupboard shelves; if there is no salt near the photograph of salt, he removes that picture and places it in a notebook that he will take to the grocery store; the notebook serves as the shopping list.

Food preparation schedules (i.e., recipes) are selected on the basis of learners' preferences, although menu-planning schedules guide them to make selections that result in healthy diets. Successive activity schedules for food preparation become increasingly lengthy and complex and gradually introduce measures such as one-fourth cup and one-half teaspoon; utensils such as grater, sifter, and spatula; and tasks such as whisking, peeling, mincing, and dicing.

Presently, many adolescents and adults prepare entire meals that include entrees such as meatloaf, enchiladas, spaghetti and meatballs, and roast beef, as well as a variety of salads, vegetable dishes, and desserts. Although their cooking repertoires are extensive, only a few have learned to use typical cookbooks or recipes on food containers. For that reason, their "cookbooks" are notebooks that contain photographic or written schedules for preparing previously mastered foods.

Community Participation

Typically, using an activity schedule to learn to make a single purchase (e.g., buying a beverage or a snack) precedes a schedule that teaches grocery or clothing shopping. Similarly, a schedule for placing an order in a fast-food restaurant is often mastered before a schedule for eating in a restaurant is introduced. Calculating tips, using a laundromat, using an automatic teller machine, and using vending machines are also schedules that are frequently used in community settings. A schedule for packing a suitcase has been useful to group home residents who regularly visit their families, as well as for adults who occasionally take vacations with family members, staff members, or friends.

In community settings, written schedules are less likely to call undue attention to people with developmental disabilities, and such schedules are often reduced in size, so that they can be easily carried in a shirt pocket or purse. Photographic schedules displayed on PDAs accomplish the same objective.

Activity schedules for using cell phones deserve special mention because this skill set contributes to the safety of adults with ASD. Learning to call an instructor, a parent, or the agency's main telephone number may be very important if transportation from work to home is delayed, if a person is ill, or if unexpected events occur at a job site when a staff member is not present.

Leisure Skills

Photographic and written activity schedules have been useful in teaching adults to take and print digital photographs, to load and play computer games and view DVDs, to use exercise equipment, and to construct scrapbooks. Schedules have also been helpful in enabling people to independently put on protective equipment relevant to biking and skating, and to set up recreational equipment such as indoor golf putting greens. Recently, activity schedules have also enabled people to send and receive e-mail and to manage e-mail accounts.

Employment

In the best of circumstances, adolescents use activity schedules to acquire repertoires that contribute to their employment opportunities in adulthood. For example, learning to clean a room is a skill set that is important in a person's living environment, but it may also contribute to successful employment as a hotel housekeeper. Activity schedules that teach people to collect and recycle paper and plastics, to inventory custodial supplies, to restock office or cleaning supplies, or to sweep sidewalks and pick up trash on lawns often contribute to their later success in community workplaces.

Adults who have acquired competitive word processing and data-entry skills benefit from schedules that teach other white-collar repertoires, such as filing; using copiers, scanners, and laminators; and taking coffee breaks in office settings. And although some people may need continuous supervision in the intervention setting, activity schedules help to diversify the employment activities that they can perform in-house. In our day-treatment program, we have

used activity schedules to teach adults to complete a very broad array of contracted employment tasks, including stringing tennis rackets; assembling rivet kits; assembling and packaging materials as diverse as paint-mixing equipment and toys; doing auto detailing; preparing mailings for insurance companies; and packaging books to be sent to public libraries.

Of course, the effectiveness of an activity schedule is dependent upon on the skillfulness of the instructor who creates the task analysis upon which the schedule is based. For example, tasks and task sequences may be different for an Epson™ scanner than a Xerox™ scanner, and the person who constructs the task analysis must know how to operate the scanner that the learner will use. The job coach who prepares an activity schedule that will be used by a hotel housekeeper must not only know all of the job components, but must also know management's expectations about how beds should be made, how towels should be folded, and where amenities such as soap, shampoo, and shower cap should be placed.

Social Skills

Activity schedules offer an invaluable framework for teaching people with ASD to initiate conversation. At PCDI, a severely disabled man has a photographic activity schedule that includes pictures of potential conversation partners. He also has a file box that contains photographs of conversation topics—for example, pictures of him at an amusement park, in a swimming pool, and at a fast-food restaurant. When he turns a page of his activity schedule and encounters a picture of a conversation partner (a peer or staff member), he selects a picture of a topic, mounts it in his schedule, and then seeks out the depicted recipient. Although he has a very small spoken vocabulary, the schedule enables him to open conversation with brief statements such as, "Roller coasters are fun," "I like to swim," or "McDonalds is great!" His schedule enables him to initiate conversation; without the schedule, his frequency of social interaction is much lower.

Pictures of potential conversation partners or the textual cue "talk" can also be used to cue learners to obtain audiotaped or written scripts, approach interaction partners, and say scripts; subsequently, scripts are gradually faded from end to beginning. Eventually, after many sets of scripts have been introduced and faded, many people learn to engage in spontaneous conversation. The use of these procedures is more fully described in Teaching conversation to children with autism: Scripts and script-fading (McClannahan and Krantz, 2005).

Schedules also provide a useful structure for teaching people to report next activities and recently completed activities. For example, the word "talk" or a photograph of a learner talking to someone appears in a person's activity schedule before and after selected activities. When he encounters this cue, he is guided to obtain an audiotaped or written script, approach someone, and say the script. Scripts that a person might say before beginning the next activity are: "I'll do word processing," "Time for lunch," and "I'm going to walk on the treadmill." Scripts he might use after completing these activities are "I did word processing," "I had lunch," and "I walked for twenty minutes." When such scripts are completely faded and a person continues to talk about word processing, lunch, and walking on the treadmill, new scripts are introduced before and after different activities (e.g., playing a computer game, making a purchase, riding a bicycle).

After several sets of scripts have been introduced and faded, the word "talk" or a photographic cue is inserted in the schedule before and after activities that have never been associated with scripts. If the learner does not discuss these activities, we continue to provide multiple exemplars. If he initiates conversation in the absence of scripts, the "talk" cue temporarily remains in his schedule, but we occasionally remove it and observe whether he interacts in its absence. When he discusses his activities in the absence of the cue, it is permanently removed.

Learning to report next and recently completed activities is a critical skill for adults with ASD, because it makes it possible to fade supervision. If a worker in an office setting says, "I'm going to the copy room" and the data show that he accurately reports next activities, the job coach need not draw co-workers' attention by following him. Or if a group home resident reports, "I'm going to do the laundry," a staff member need not interrupt a teaching activity with others to follow her to the laundry room.

Activity schedules also help adults who live in group homes or supervised apartments learn to entertain guests. A written schedule may contain items such as: *Say "Welcome! Please come in"; take coats; invite guests to sit in living room; ask "Would you like coffee or tea?"; say "Excuse me for a moment"; serve beverages; serve cookies.* We know some adults with ASD who use written schedules to prepare meals for guests and to plan special events with family members and peers.

Daily, Weekly, and Monthly Schedules

Upon their arrival at adulthood, most service receivers at PCDI are familiar with daily activity schedules, and those who use textual cues may have daily schedules that include activities such as *check e-mail, take a photograph and print it, feed the fish, iron work clothing, set the table.* They have also learned to sequence their own activities, and many of them begin each day by removing note cards from a box; each card displays the name of a daily activity. The schedule user arranges the cards in a preferred sequence, and then writes the sequence of activities in a daily planner or types them on a computer and then prints the page (of course, these activities were taught using an activity schedule).

A next step is to teach people to schedule their own weekly and monthly activities. For example, a woman who uses a daily schedule arrives at the textual cue "Plan a weekly activity." She obtains a list of weekly activities, such as *check calendar for birthdays and holidays, make shopping list, do laundry, iron clothes, water plants, call Mom and Dad.*

She selects an activity from the list, writes it in her daily schedule, and draws a line through the activity on the list that she has just transferred to her daily schedule. Her monthly list includes *make haircut appointment, make manicure appointment, call grandmother, clean oven, clean closets, invite someone to dinner.* Although she accomplishes these tasks with paper and pencil, other learners use calendar programs such as Apple Computer's iCal™ program. These skills are taught in the same manner as other schedule-following skills.

Problem Solving Schedules

People in supervised apartments and supported-living programs and people who are employed in community workplaces, like the rest of us, sometimes encounter unanticipated issues—the computer quits, cable television doesn't work, there is an electrical power outage, or there is no water. Some of these problems are potentially serious: a person sustains a deep cut while dicing vegetables, a smoke detector sounds, there is a fire in the kitchen, or a person becomes ill at work when a job coach is not present.

A man who participates in PCDI's supervised apartment program has a notebook that includes these problem-solving schedules. Each written schedule is identified by a tab that identifies a topic (e.g., "Electricity," "Water," "TV"). If his computer freezes or does not work, he has learned to go to the notebook section labeled "Computer" and follow the schedule, which includes textual cues such as: *If computer is on, turn it off, Unplug computer, Plug computer in, Turn computer on. Does computer work? If not, call your Life-Skills Coach.* Another section of the notebook, "Smoke Detector," contains the following schedule: *Get your cell phone, take this notebook, go outside quickly, close the door, stand on the sidewalk near the bike rack, call your Life-Skills Coach.* His Life-Skills Coach knows where to find him, and because she lives in the adjacent apartment building, she can arrive quickly and assess the problem. She also makes practices as realistic as possible; the learner does not know in advance that a pretend "emergency" will occur.

Activity schedules help people with ASD acquire repertoires that will be relevant in the event of real emergencies. Staff members create opportunities for a person to practice following schedules that address life's problems, teach until criteria are met, and regularly assess skill maintenance. Of course, an important aspect of maintenance is that a person always knows where these schedules are kept and can quickly access them.

End Note

Although the foregoing discussion devotes minimal attention to reinforcement procedures they are, of course, essential to the acquisition of schedule-following skills. All of the adults at PCDI have learned to use token reinforcement. People who have not yet acquired these skills are rewarded with: (a) edibles that are dropped in a cup and consumed as soon as schedules are completed; (b) rewards that are programmed as the final activity in a schedule; and/or (c) tangible or activity rewards that are delivered immediately after schedules are completed. However, in our experience, most toddlers, children, and adults with ASD quickly learn to use tokens.

It is also important to note that activity schedules are not intervention strategies to be used in one session per day, or in one setting but not others. They are most effective when they are used to organize a learner's entire day; they provide a framework for instruction. Applied behavior analysis offers many well-documented intervention procedures (e.g. discrete-trial teaching, incidental teaching, video modeling); placing cues for these activities in schedules helps to ensure that people will receive many different instructional strategies that help them learn in many different ways.

Activity Schedules Promote Generalization

There is a body of evidence showing that when activity schedules are taught with graduated guidance, pictures or textual cues become discriminative stimuli that evoke generalized responding. MacDuff, et. al. (1993) demonstrated that after three participants learned to follow picture schedules to complete home-living and leisure activities, their schedule-following skills transferred to a different sequence of photographs and to pictures of two novel leisure activities that were never encountered during teaching. Weiberg-Aurdal (undated) showed that when a developmentally disabled adult was taught to follow lengthy photographic activity schedules to do laundry, make waffles, and make pasta, each successive task was more quickly acquired, with fewer prompts delivered by the trainer.

Table 12.2. Percentage of Tasks Correctly Completed on Pretests with and without Activity Schedules

Participant	Program	Pretest 1—Without Activity Schedule	Pretest 2—With Activity Schedule
Participant 1	Make English muffin pizza	62%	92%
	Make potato-tuna salad	27	52
	Clean a bathroom	8	4
Participant 2	Make potato-tuna salad	0	42
	Dust furniture	0	0
Participant 3	Check personal appearance	0	18
	Clip toenails	0	22
	Make bagel with cream cheese	0	57
Participant 4	Make English muffin pizza	20	36
Participant 5	Set table and make salad	0	40
	Make macaroni and cheese	0	31
	Make soup	0	6
	Make grilled cheese sandwiches	4	40
	Clean mirror and sink	0	7
Participant 6	Set table and make salad	0	19
	Make macaroni and cheese	0	23
	Make soup	7	33
	Make grilled cheese sandwiches	0	33
	Clean mirror and sink	0	14
Participant 7	Make bed	42	71
	Make pasta and sauce	0	38
	Make ziti with cheese	0	52
	Wash face	37	48
	Brush teeth	38	62
Participant 8	Make microwave pizza	0	44
	Make macaroni and cheese	0	70
	Make stuffed shells (pasta)	20	95
	Make microwave lasagna	90	95
	Make salad	85	92
	Make turkey sandwich	70	86
	Make bagel and cream cheese	24	83
	Make ham and cheese sandwich	85	88

During a six-month period at PCDI, we pretested eight participants on every new instructional program that specified a written activity schedule as the intervention procedure (Crognale, Kitson, MacDuff, Zeutenhorst, and McClannahan, 2003). All of the students (7 males and 1 female, ages 12 to 17) had lengthy prior experience with activity schedules. For each new intervention program, two pretests—the first without and the second with an activity schedule—were administered before teaching began. During both pretests, the instructor gave one initial direction to engage in the target repertoire (e.g., "Please clean the bathroom" or "Please make a salad"), after which no prompts were delivered. Pretests ended when a specified amount of time elapsed, when a student ceased to respond for 30 seconds, or when a person requested help. Pretests 1 and 2 were administered for 32 new programs launched for the eight learners.

Percentage interobserver agreement on number of correct responses was calculated by dividing number of agreements by number of agreements plus disagreements and multiplying by 100. Interobserver agreement was obtained on 23 of the 32 programs (72%), and ranged from 85% to 100% for Pretest 1 (mean = 98%) and from 74% to 100% for Pretest 2 (mean = 96%).

On 30 of 32 new programs (94%), the participants' pretest scores were higher when activity schedules were present than when they were absent, and the magnitude of difference ranged from 3% to 75% more tasks correctly completed. These data showed that schedule-following skills generalized to new, never-taught schedules that addressed a variety of activities, and this was true for young people with severe, as well as moderate disabilities. Schedules promote faster acquisition, making it possible to introduce more new curricula.

In practice, we now frequently pretest or conduct baseline probes with, as well as without activity schedules, and we sometimes discover that some programs for adults need not be implemented. For example, a young man who moved from his parents' home to his own apartment achieved criterion scores on pretests when given written activity schedules for cleaning the refrigerator and the oven, and these programs were never introduced. The schedules were added to a notebook in his home, and he continues to successfully use them when these cleaning tasks appear on his weekly or monthly calendar.

Using Activity Schedules to Teach Self Monitoring

Over the course of several years, we noted that some young people who were long-time users of written activity schedules occasionally stopped making check marks or drawing lines through text to indicate that activities were completed; instead, they began to mark plus (+) or minus (-) beside tasks on their schedules. In our setting, when staff members collect observational data, they mark plus and minus to indicate correct and incorrect responses respectively. In some cases, the students' uses of plus and minus appeared unrelated to correctness but in other situations, it appeared that they were attempting to assess their own performance. These observations led us to wonder whether we could teach them to take interobserver agreement as a means of helping them learn to monitor their own correct responses and errors, and we designed a study to investigate that question (Kitson, Connor, Crognale, MacDuff, Young, and McClannahan, 2007).

Method

Participants and setting. Gary, Brad, and Peter, ages 15, 18, and 14, participated in the study. All had received independent diagnoses of autism, and all were experienced users of written activity schedules. The research was conducted in PCDI's school; teaching was conducted in a kitchen, pre- and posttests were conducted in the youths' usual classroom, and follow up was conducted in a copy room.

Dependent variable. The dependent variable was interobserver agreement between student-instructor pairs. After student and instructor independently marked their own copies of the written activity schedules, each task was scored as an agreement or disagreement. Agreements were scored only if both members of a pair scored plus or minus; marks other than plus or minus, and the absence of marks, were scored as disagreements.

Activities and schedules. The activities used in the study were selected because they were never previously taught, and because the youths' past performance on other written schedules suggested that there would be many opportunities for them to score both plus and minus. The activity schedule selected for teaching was making apple muffins. The activity schedules used on pre- and posttests were (a) assembling metal frames for hanging Pendaflex™ file folders and (b) taking and printing digital photographs. The written schedule for follow-up was sending a fax.

Experimental design and measurement. A nonconcurrent multiple-baseline across participants was used to assess interobserver agreement between instructor-student dyads. Data collectors used a per-opportunity measure to score each task on a written schedule as correct or incorrect. Subsequently, each task was scored as an agreement or disagreement.

Experimental conditions. During baseline, the instructor gave a student a written activity schedule; each task on the schedule was preceded by a blank. The instructor said, "Let's take data on (name of activity). Mark plus if you do something without help and if you do it correctly." Then the instructor modeled marking plus on an activity schedule that was never used for data collection. Next, the instructor said, "Mark minus if you do something incorrectly or if I help you" and modeled marking minus on the schedule. Subsequently, the instructor gave the student the schedule for a never previously taught activity (making apple muffins) and said, "Let's take data." During the data collection period, the instructor did not interact with the student about data collection, but used graduated guidance when necessary to help him complete scheduled tasks. At the end of the activity, the instructor delivered tokens and praise for correctly completing tasks, but did not mention data collection.

During the teaching condition, the instructor gave the same initial instructions used during baseline, and then student and instructor independently marked their data sheets (i.e., activity schedules). Initially, after each task, the instructor placed her schedule adjacent to the student's schedule. If both student and instructor marked plus on a task the instructor said, "You did (task) correctly and I didn't help you. Good, we both scored plus—we agreed," and gave the student a token. If both members of the pair marked minus, the instructor said, "You didn't do (task) by yourself; I helped you. Good, we both scored minus—we agreed," and delivered a token.

If the student scored plus and the instructor scored minus, the instructor said, "You didn't do (task) correctly" or "I helped you do (task); I scored minus but you scored plus—we disagreed" and removed a token. If the student scored minus and the instructor scored plus, the instructor said, "You did (task) without my help and you did it correctly; you scored

minus and I scored plus—we disagreed," and removed a token. During teaching, the instructor continued to use graduated guidance to help the young people complete tasks that they did not independently complete. But tokens and feedback were never delivered for correct performance; they were only delivered for agreements between student and instructor.

After two consecutive sessions during which student and instructor achieved 100% interobserver agreement, the instructor no longer delivered feedback after each task was scored. Instead, at the end of the activity, she collected the student's data sheet and calculated interobserver agreement. The student did not see the data sheet after interobserver agreement was calculated. If agreement was 80% or better, the instructor said, "Good, we agreed," and delivered tokens that were immediately exchanged for a reward. If agreement was less than 80%, the instructor said, "We disagreed; it's time for (next activity)" and did not deliver any tokens. After at least six sessions during which (a) the instructor did not deliver immediate feedback and (b) overall interobserver agreement was consistently above 90%, maintenance began. The maintenance condition was identical to baseline.

Peter's maintenance condition began immediately after he returned from a one-week school recess during which he was ill. Although he met criterion for entering the maintenance condition, the first three data points in this condition showed that overall agreement between Peter and the instructor declined and their nonoccurrence agreement fell to an all-time low. For that reason, he returned to the teaching condition and again met criterion before moving to maintenance.

Follow-up data were collected 10 weeks after Gary's last maintenance session, 10 weeks after Brad's last session, and 7 weeks after Peter's last session. On follow-up, the youths were given a written activity schedule for a new, never-taught task—sending a fax. Follow-up procedures were identical to those used during baseline.

Pre- and post-teaching tests. Once during baseline and once during maintenance, the instructor provided written activity schedules never used prior to the study or in any experimental conditions. These schedules pertained to two new data-collection activities on two never-taught tasks—assembling metal Pendaflex™ frames for hanging file folders and taking and printing a digital photograph. The instructor followed the same procedures used during baseline. The instructor and a second observer recorded the student's performance, after which student-instructor interobserver agreement and instructor-observer interobserver agreement were calculated. These pre- and post-teaching tests assessed whether the student learned to reliably collect data (i.e., whether he learned to self-monitor his correct and incorrect schedule-following responses).

Assessment of the independent variables. On at least two sessions during the teaching condition for each participant, independent observers scored whether the instructor (a) modeled marking plus or minus signs on a sample data sheet, (b) aligned her data sheet and the student's data sheet after each scoring opportunity, (c) provided the specified feedback, and (d) contingently gave or removed tokens. The data indicated that the instructor exhibited these responses on 100% of opportunities for Gary and Brad, and on 99% of opportunities for Peter. Interobserver agreement between independent observers on the integrity of the teaching procedures was 100%.

Interobserver agreement. Percentage overall agreement and percentage nonoccurrence agreement were calculated by dividing number of agreements by number of agreements plus disagreements and multiplying the result by 100. Mean overall agreement between instructor and observer was 100% in baseline and 99% in teaching (range = 98% to 100%). One data

point between instructor and observer during Peter's maintenance condition yielded 100% interobserver agreement.

Results

During baseline, all participants had 0% interobserver agreement with the instructor. They either made check marks in the blanks beside tasks on their activity schedules, marked through completed activities, or did not mark their schedules. Mean percentage overall interobserver agreement for student-instructor dyads in the teaching condition was 95% for Gary, 83% for Brad, and 98% and 99% for Peter in his first and second teaching conditions respectively. In maintenance, mean percentage overall agreement was 100% for Gary, 99% for Brad, and 93% and 100% for Peter (see Figure 12.1).

On pretests of taking and printing digital photographs and assembling Pendaflex frames, all three youths had 0% overall interobserver agreement with the instructor. On posttests conducted during maintenance, Gary's overall interobserver agreement scores on Pendaflex frames and digital photos were 100% and 96%, Brad's were 80% and 90%, and Peter's were 100% and 93%.

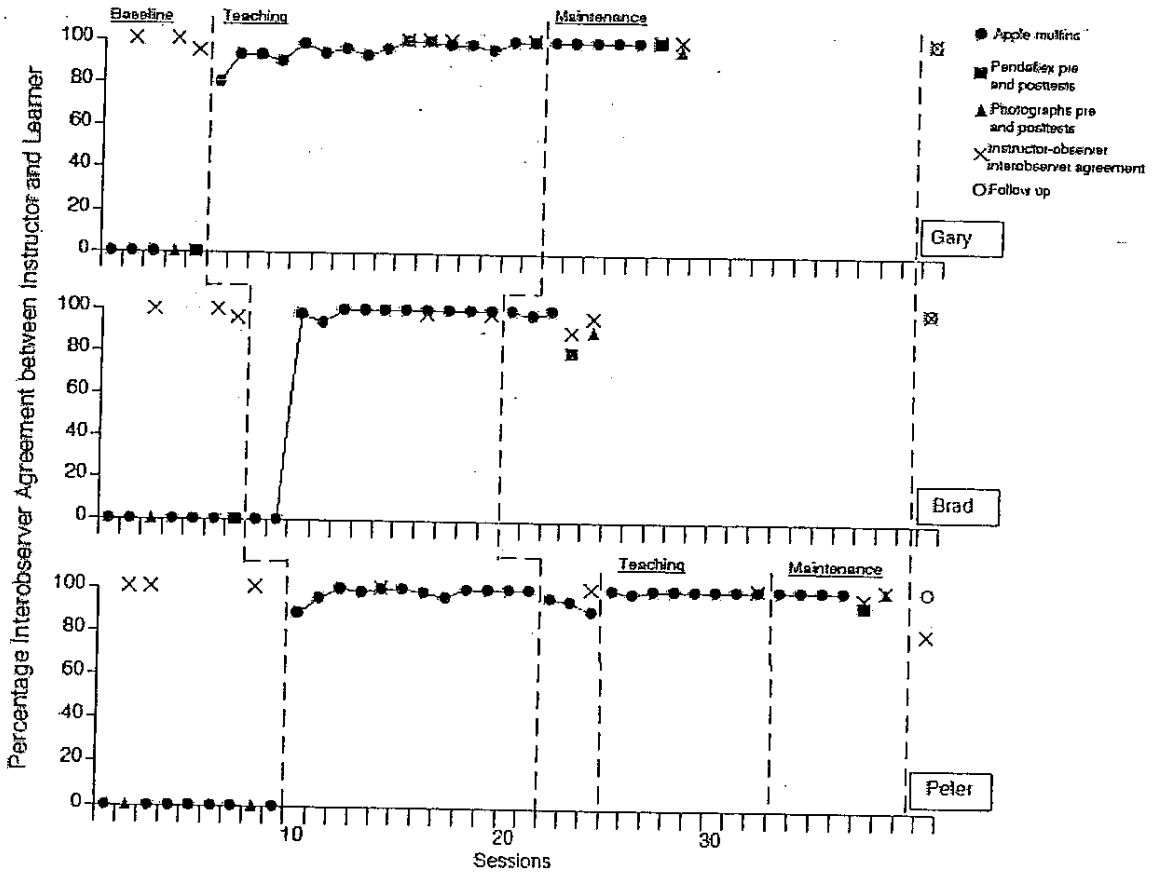

Figure 1. Percentage overall interobserver agreement between instructor and students and between instructor and an observer during baseline, teaching, maintenance, and follow-up. Percentage overall agreement is also shown for pretests during baseline and posttests during maintenance.

Follow-up assessment occurred seven to ten weeks after maintenance ended. Using the never-taught activity schedule for sending a fax, all three participants achieved 100% overall interobserver agreement with the instructor.

Mean overall percentage nonoccurrence interobserver agreement during teaching was 76% for Gary (range = 36% to 100%), and 78% for Brad (range = 0% to 100%). Means in Peter's two teaching conditions were 91% (range = 67% to 100%) and 99% (range = 98% to 100%). In his two maintenance conditions, mean nonoccurrence agreement was 54% (range = 44% to 62%) and 100%. At follow-up, percentage nonoccurrence agreement was 100% for all three participants.

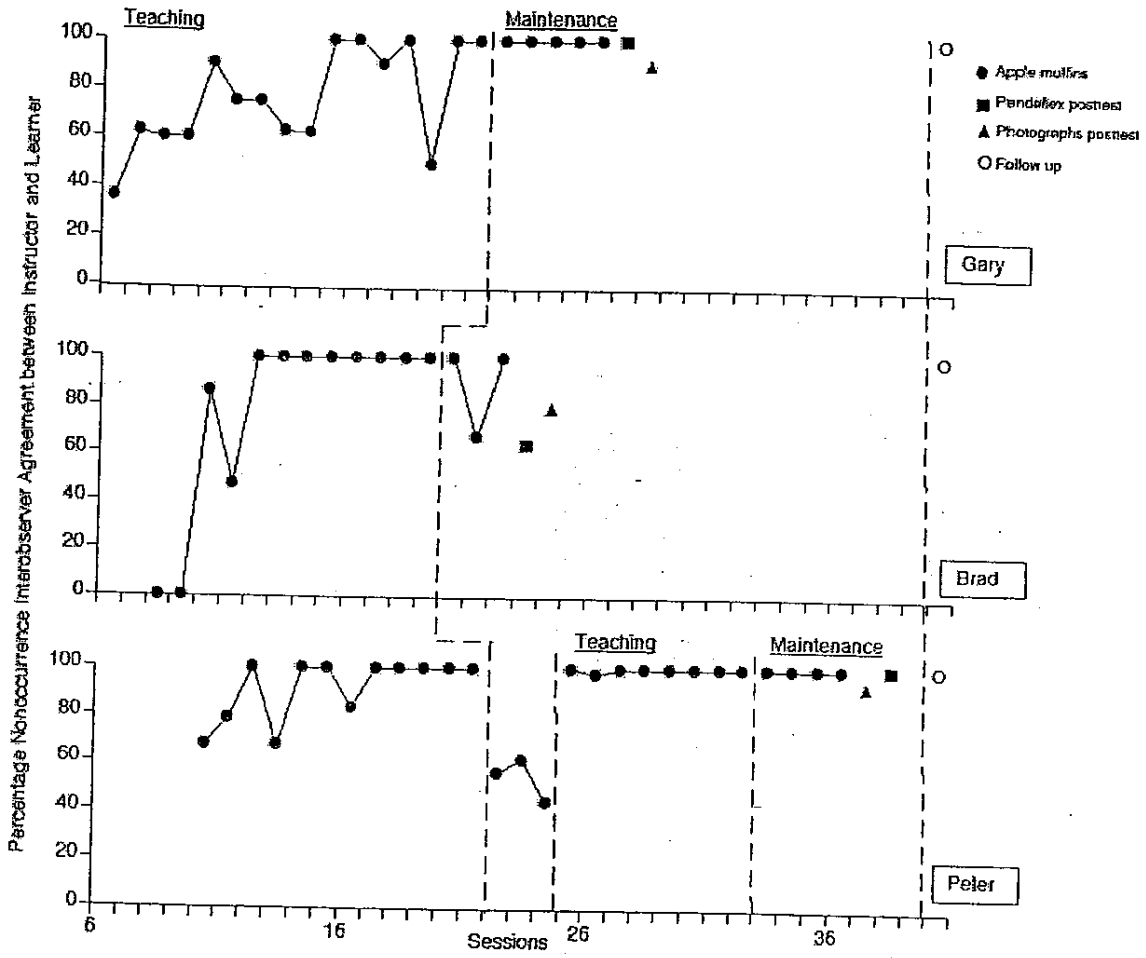

Figure 2. Percentage nonoccurrence interobserver agreement for each student-instructor dyad during teaching, maintenance, and follow-up. Because Peter's nonoccurrence interobserver agreement scores declined during his first maintenance condition, he returned to teaching.

Discussion

We embarked on this investigation to determine whether people with lengthy histories of using written activity schedules could be taught to take interobserver agreement with an instructor. The participants' levels of interobserver agreement during maintenance, posttests,

and follow up show that they correctly scored their own responses as correct or incorrect—that is, they engaged in self-monitoring.

Nonoccurrence interobserver agreement was calculated for every scheduled task on which either or both members of a dyad scored a response as incorrect. During teaching, all three participants' percentage nonoccurrence agreement showed an ascending trend as they learned to correctly score errors as well as correct responses. Data on nonoccurrence agreement are important because it may be easier for people to tact correct versus incorrect performance. A correct response may occur because a task was previously mastered or because the person had some prior experience about how to complete it. For example, the participants in this study had prior experience with tasks such as "Get the ___," "Put ___ away," or "Tell the teacher you are finished with __." Such tasks would be more easily recognizable as correct.

During maintenance, posttests, and follow-up, the youths did not receive item-by-item feedback on their interobserver agreement with the instructor, as they did during the initial phase of the teaching condition. Thus, they received less information about their data collection activities than nonhandicapped observers typically receive after they collect data. It would be interesting to know how the participants' nonoccurrence agreement scores compare with staff members' scores on similar data-collection tasks. It was noteworthy that at follow-up, all participants achieved 100% interobserver agreement with the instructor, but instructor and observer obtained 80% interobserver agreement on Peter's follow-up assessment (two items that Peter and the instructor scored minus were scored plus by the observer).

During the weeks between maintenance and follow-up, none of the students was asked to obtain interobserver agreement with the instructor. But when presented with a new written activity schedule for ironing clothing, Brad spontaneously took data on his own performance and he and the instructor had 100% interobserver agreement. These anecdotal data, as well as posttest and follow-up data, indicate that self-monitoring correct and incorrect responses generalized to new tasks.

All of the participants in this study had lengthy experience with activity schedules; we think it unlikely that novice schedule users would be equally successful in self-monitoring their schedule-following skills. It should also be noted that activity schedules provide only one avenue for helping people to engage in self monitoring. Other strategies have also produced encouraging results (cf. Kirby, Fowler, and Baer, 1991; Likins, Salzberg, Stowitschek, Lignugaris/Kraft, and Curl, 1989; Maag, Reid, and DiGangi, 1993). Nevertheless, activity schedules appear to be useful tools that help people with ASD learn to self-monitor their correct and incorrect responses during scheduled activities. Future research might examine whether such self-monitoring extends to inappropriate behavior such as stereotypy.

SUMMARY

Activity schedules taught with graduated guidance and a most-to-least prompt fading procedure help people with ASD learn to complete lengthy response chains and foster generalized responding to new activities (MacDuff, et. al., 1993). Schedules have been shown to provide a platform for making choices (McClannahan and Krantz, 1999; Watanabe and

Sturmey, 2003), to increase engagement with appropriate activities (Anderson, Sherman, Sheldon, and McAdam, 1997; Bryan and Gast, 2000), and to decrease disruptive behavior (Krantz, et.al., 1993). In addition, photographic and written activity schedules offer a framework for teaching social interaction skills (Krantz and McClannahan, 1998; McClannahan and Krantz, 2005; Stevenson, Krantz, and McClannahan, 2000).

Teaching adults with ASD to display complex repertoires of long duration is an essential component of preparing them for the world of work. Workers who display sustained on-task and who successfully complete diverse assignments are more likely to retain employment.

Using activity schedules as vehicles to teach choice making is often important to job placement decisions. For example, because one young man in our setting was a competent typist and computer user, we initially assumed that we should help him find employment in an office setting. But before launching a job search, we provided some choices in his activity schedule; he had opportunities to choose word processing tasks or manual labor tasks. It was interesting to note that he consistently chose manual labor, and we identified a job placement that was commensurate with his preferences. He went to work in a hotel laundry, where he performed very well.

Activity schedules also provide a structure for teaching social skills relevant to employment. Adults who learn to report task completion, appropriately take coffee breaks, engage in social interaction with co-workers, ask supervisors for additional work assignments, and monitor their own productivity are more likely to become valued employees. All of these skills can be taught via schedules.

Unfortunately, most of the research literature on activity schedules pertains to children. Our data suggest that photographic and written activity schedules are invaluable tools for adults. We hope that, in the near future, applied researchers will focus on the multiple functions of activity schedules for adults with ASD.

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