Video Enhanced Activity Schedules for Children with Autism: A Promising Package for Teaching Social Skills

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Abstract

Teaching with activity schedules may yield functional skills that are not readily achieved by traditional discrete-trial teaching or by naturalistic intervention strategies. Activity schedules are unique because the procedures focus on teaching a learner to do and say things in the presence of instructional cues accessed independently rather than in response to cues provided by a teacher. Typically, such "self-directed" schedules make use of notebooks or placards that contain pictures or words to cue a learner's sequences of activities. To supplement such procedures, we explored how video models may be used as instructional cues within computer-presented activity schedules. The purpose of this paper is to illustrate how using computers to combine the two instructional technologies—activity schedules and video models—could enhance the use of activity schedules in teaching, particularly in the realm of social skills.

At the request of the United States Department of Education, Office of Special Education Programs, the National Research Council convened a panel to examine the issues and practices of educating children with au-
tism (National Research Council, 2001). In versions of two papers solicited by that panel, Goldstein (2002) and Wolery and Garfinkle (2002) remind us that a lack of social skills, including play, is a defining feature of autism. Goldstein (2002) underscores the importance of qualitative and quantitative amelioration of social deficits, noting that to do so "can set the stage for other developments as well, e.g., generalized use of newly acquired language skills, modeling of new language skills, inclusion in more normalized educational settings, and, hopefully, the development of positive, long-lasting relationships with peers and others" (p. 390). Yet Wolery and Garfinkle (2002) find play skills to be understudied and conclude that "relatively little is known about teaching them" (p. 466). McConnell (2002) agreed, stating that "There are few examples of empirical evaluations of intact, well-described and disseminable interventions or curricula" (p. 367), at least when it comes to social interaction. He maintains this should be a priority for researchers on behalf of teachers and parents of children with autism, and goes on to say that "although empirical support for various intervention components seems strong, the literature still requires practitioners to assume a significant burden in developing a logistically feasible yet sufficiently powerful package for use in their classroom. Researchers ... may want to develop and evaluate one or more intervention packages that represent compilations of techniques identified in existing research" (p. 368; italics, added).

In our home and center-based early intervention programs for children with autism, we employ a number of such research-based interventions, including activity schedules and video modeling, and we have combined these tactics to develop instructional packages for teaching children to practice social skills in the context of on-going routines. Specifically, we have capitalized on the multimedia capabilities of today's reasonably affordable personal computers as a means of presenting activity schedules that are embedded with other methods for teaching social skills, including auditory and video modeling. During their experience with these computer-mediated schedules, learners have become skilled not only at independent schedule following, but also at initiating social responses as they do so. We believe the combination of "low-tech" instructional technology and "high-tech" information technology has potential as a more "powerful package" of the type for which McConnell (2002) calls.

In this article, we will: (a) briefly discuss the component technologies—activity schedules and video modeling—that we have combined in PowerPoint® and delivered via computers; (b) summarize the steps involved in creating a computer-mediated video-enhanced activity schedule; (c) provide a detailed case example of how a video-enhanced schedule was used to improve the social skills of one learner; and (d) suggest questions for future teaching and research.
The Evolution of Activity Schedules

Basic Schedules: Increasing Independence

Children with autism are often quite capable of completing a variety of activities but often depend on prompts to do each one separately (McClannahan & Krantz, 1997). One form of empirically validated and disseminable intervention that can promote greater independence is the activity schedule, as described by McClannahan and Krantz (1999; reviewed by Rehfeldt, 2002).

Activity schedules usually consist of notebooks or placards depicting a series of pictures, symbols, and/or words (Krantz & McClannahan, 1993; Lalli, Casey, Goh, & Merlino, 1994) that are presented sequentially to cue a chain of responses from the person using the schedule (McClannahan & Krantz, 1999). There is much research supporting the use of activity schedules to teach and promote functional independence of children with autism. For example, we have known for some time that learning independent following of one activity schedule may generalize to other schedules (e.g., MacDuff, Krantz, & McClannahan, 1993), and that schedule-following may also coincide with reductions in stereotypic or disruptive behaviors (Krantz, MacDuff, & McClannahan, 1993; Pierce & Schreibman, 1994).

Schedules may be used with students of different ages and entry skills, in a variety of settings (e.g., Krantz, MacDuff, & McClannahan, 1993, trained parents to teach their children to follow a schedule at home), and across a variety of both discrete activities such as puzzles or worksheets and open-ended activities such as toy play (Anderson, Sherman, Sheldon, & McAdam, 1997; Bryan & Gast, 2000; Copeland & Hughes, 2000; Massey & Wheeler, 2000; Schmit, Alper, Raschke, & Ryndak, 2000). For example, in a family-style group home, MacDuff, Krantz, and McClannahan (1993) taught four boys with autism, ages 9 to 14 years, to follow schedules in the form of a notebook (three-ring binder) that contained photographs depicting six after-school activities (e.g., homework sheets, Lincoln Logs®, and snack). Through most-to-least manual guidance, the boys initially were taught to complete schedules with invariant sequences of activities. Later, they independently performed the trained tasks in a new sequence when the order of the pictures changed, and they performed additional skills when new photographs depicting them were included in the schedule, even though they had not received direct training with these skills.

These results suggested that the boys were indeed responding to the pictures rather than performing a chain of activities by rote.

Activity schedules thus represent a significant instructional technology that addresses functional skills in a manner different than, and complementary to, other traditional approaches such as discrete trial instruction (Charlop-Christy & LeBlanc, 1999; Delprato, 2001) or naturalistic interventions (Krantz, 2000; McClannahan & Krantz, 1997). The chief reason for including conventional activity schedules in children's educational pro-
grams has been precisely to help them engage in habilitative routines in the absence of other people (i.e., to overcome problems of prompt dependency that children may exhibit when they have participated in significant amounts of unbalanced discrete trial teaching; McClannahan & Krantz, 1997). At the same time, however, researchers have reported that some children have increased their social initiations while following this basic type of schedule (e.g., Krantz et al., 1993, 1998).

Enhanced Schedules: Enabling Additional Skill-Building

Activity schedules have evolved in terms of both the ever more sophisticated media for their delivery and the resulting ever broader range of independent skills they may support. Having noted the potential of activity schedules to facilitate social and communication skills, researchers explicitly targeted them within the context of schedules (e.g., Dauphin et al., 2003; Krantz & McClannahan, 1993, 1998).

Textual cues. Krantz and McClannahan (1998) taught three preschool boys with autism to solicit attention from adults. First, the children learned to follow schedules depicting 11 different activities (e.g., puzzle, toy piano, fireman's hat). Separately, with flashcards, they learned to "read" the phrases "Watch me" or "Look." Subsequently, these phrases were printed on cards affixed either above or below selected pictures in the child's notebook. The script accompanying the photo was to be said aloud, and then said again to an adult either during the activity ("Watch me") or after performing it ("Look"); during teaching, these responses were prompted vocally if they did not occur. When the boys' responses had stabilized, the scripts were faded in three steps by literally cutting away one-third of the card at a time. Afterward, the children initiated both scripted and unscripted comments, even when the activities and conversation partners differed. In effect, they had learned to approach people reliably rather than to rely on people to approach them.

Auditory modeling. For nonreaders, auditory scripts have been used successfully to teach students to initiate social interactions. For example, Stevenson, Krantz, and McClannahan (2000) recorded vocal scripts on audio cards (e.g., "What is your favorite food?") that were then played in a Language Master™play back device. Four boys with autism (ages 10 to 15 years) learned to remove an audio card that cued a social interaction from their notebooks, approach the recipient of the interaction, play the card, and then repeat the message.

Video Modeling

Video modeling can be a remarkably effective teaching tool for children with autism spectrum disorders (e.g., Buggey, 1999; Krantz, MacDuff, Wadstrom, & McClannahan, 1991; Neumann, 1999). Among other competencies, video modeling has been shown to effectively teach communica-
tion and social skills (e.g., Charlop & Milstein, 1989; Hepting & Goldstein, 1996; Taylor, Levin, & Jasper, 1999). Videos can be used to model how to react to what others say and the nuances of using gestures when communicating, as has been done using live models (Buffington, Krantz, McClannahan, & Poulson, 1998; Gena, Krantz, McClannahan, & Poulson, 1996). Supplementing live modeling, videos can be used to teach children to ask questions about things and events they encounter at the moment (e.g., Taylor & Harris, 1995), and to answer questions about temporally remote events (e.g., Krantz, Zalenski, Hall, Fenske, & McClannahan, 1981). Charlop-Christy, Le, and Freeman (2000) found that children with autism were more apt to learn to make comments following video rather than “live” modeling, and Sherer et al. (2001) found that both self-and other-video modeling were effective in teaching conversation skills.

A recent special issue of the *Journal of Positive Behavior Intervention* (2003, 5[1]) published studies addressing the use of video technology to teach children with autism complex play (D’Ateno, Mangiapanello, & Taylor, 2003), perspective taking (Charlop-Christy & Daneshvar, 2003), and spontaneous requesting (Wert & Neisworth, 2003). A fourth study (Kinney, Vedora, & Stromer, 2003) used a laptop computer to teach spelling commensurate with school placement. They developed a program in PowerPoint® to deliver video models and to provide contingent reinforcement in the form of preferred video clips. Kinney et al. (2003) also observed that the child in their study became quite motivated to use computer-mediated programs, even though academic tasks were embedded in them. Indeed, Romanczyk, Weiner, Lockshin, and Ekdahl (1999) reported that children with autism preferred computer-based instruction to that presented by a teacher. Fortunately, we have observed that once skills have been taught with video models embedded in computer-mediated schedules—skills that can not be smoothly instructed while a child is in the process of following a notebook schedule—they subsequently will be exhibited when completing the same activities cued by a notebook schedule (Kalaigian, Kinney, Taylor, Stromer, and Spinnato, 2002).

**Developing Computer-Mediated Activity Schedules**

*Laying the Groundwork for Video-enhanced Activity Schedules*

We suggest that anyone wishing to develop video-enhanced activity schedules should first become fluent with the contents of McClannahan and Krantz’s (1999) how-to book on activity schedules. Additional resources available to practitioners and parents include the research literature (e.g., MacDuff et al., 1993; Krantz et al., 1993, 1998; Pierce & Schreibman, 1994), videos on activity schedules (Krantz, McClannahan, Fenske, & MacDuff, 1998) and other visual supports (Savner, 2001), and how-to materials on related visual supports (Alberto & Fredrick, 2000; Bondy & Frost, 1998; Downing & Peckham-Hardin, 2000; Kimball, Kinney, Taylor, & Stromer,
2003; Savner & Myles, 2000). Also, in our experience, newcomers to behavior analysis usually benefit from focused training on how to use the most-to-least prompting strategy of establishing independent activity schedule following (McClannahan & Krantz, 1999; Cooper, 1987). We also recommend partnering with parents and teachers throughout the project, in an effort to ensure the effectiveness, efficiency, and social acceptance of the programs.

Basic Steps in Creating Video Enhanced Activity Schedules

It would be too ambitious a project to provide, in this space, a detailed set of directions for how to use PowerPoint® to create an instructional package that includes video models embedded in computer-mediated activity schedules. We will therefore provide a brief overview of the procedures here.

There are two main phases in developing a computer-mediated activity schedule. Phase 1 consists of gathering digital photographs, video clips, and sound files of the people, places, and things with which the learner will interact while following their schedules (Kimball et al., 2003). We typically use a Sony Mavica® digital camera with video capability to capture the instructional content: that is, peer models engaging in the targeted desired behavior, as well as the settings and activities in which we plan to train the skill. Additional sounds not associated with video (e.g., a sound to indicate when the required time for completing the activity has expired) can be recorded directly onto the computer using a microphone purchased at an office supply store for about $10. It is also possible to scan visual images into the computer for use in the activity schedule. Rehfeldt et al. (in press) also describe the use of inexpensive webcams (e.g., Logitech® QuickCam Pro 3000, ClickSmart 510) to gather content (sounds, still photos, videos).

Phase 2 consists of authoring the activity schedule in PowerPoint® by inserting the pictures, videos, sounds, and timers into "slides." In a basic activity schedule, our convention is to take two pictures per activity. The first—the "activity picture"—shows the activity in isolation and appears on one PowerPoint® slide; the second—the "cue-to-play"—appears on the next slide. This second slide shows the child involved in the activity and is intended to serve as the cue for him to leave the computer to do that activity. In addition to each of these activity pairs, we also develop a text slide for the beginning of the schedule and a final slide with a photograph of the preferred reinforcers a learner may earn upon completing the schedule. Figure I shows a sample of the slides a learner would see for the basic computer schedules we have developed. When the slideshow begins (it has been our practice for a teacher to open a given PowerPoint® file and begin the slideshow) the first slide is accompanied by a recording saying "Time for centers." Upon hearing this, the learner comes to the computer, clicks the "action button" in the lower right corner of the slide to advance
to the activity picture, then clicks on the activity picture to view the "cue-to-play" and goes off to complete the pictured activity (the action buttons on the cue to play slides are set to appear after a delay, in order to prevent the child from clicking to the next activity without performing the one currently depicted; "action button," incidentally, is a PowerPoint® term—we also call them "page turners"). When the learner completes the activity (if it is closed-ended) or hears a timer built in to the slideshow (if the activity is open-ended) he puts away any materials he was using, returns to the computer, clicks the action button (the one that appeared after a delay on the cue-to-play), and resumes the cycle with the next activity picture. After the learner performs the last scheduled activity, he clicks the action button on the cue-to-play slide and advances to the final slide, which shows the reinforcement earned for completing the schedule. This last step-ending the schedule with free access to a preferred activity or object—is an important part of standard procedure with activity schedules: as the final link in a chain, the pictured item must be carefully chosen to motivate the considerable amount of independent responding that must occur before it becomes available. In Figure 1, the final slide contains a picture of a choice board (the better to prevent satiation and capitalize on momentary changes in motivation); when it appeared it was accompanied by a recording saying, "Good job! Make a choice."

Our video-enhanced schedules—both in development and in viewing—differ from the basic schedule just described in only one way: each activity requires one extra slide, placed between the activity picture and the cue-to-play, that contains a clip of video (see Figure 2). In the language of PowerPoint®, each schedule/slideshow is set up as “Browsed at kiosk.” For step-by-step instructions for how to insert and animate action buttons, photos, sound files, video clips, and timers, we refer the reader to Rehfeldt et al. (in press), whose article is written for PowerPoint® 2000 SR-1 and (PowerPoint® 2002, included with Office XP). A simple practice CD, based on Stromer and Kinney, 2002, is also available from the last author.

Extended Case Example

In this section, we describe a case example to convey a greater sense of what is involved in planning and implementing the type of instructional package we have been describing. While activity schedules are a component of the package, it may be advisable to teach a learner first to complete them in isolation before introducing additional components such as video modeling (assuming a given learner also possesses the generalized imitation skills necessary to benefit from modeling). The following example of Ray, based on Kimball, Fitzgerald, Foley-Ingersoll, & Stromer (2002) and Kimball, Casey, Foley-Ingersoll, Stromer, and Kinney, (2003) illustrates this point. It is important to note that Ray proceeded from a basic computer schedule (see Kimball, Kinney, Taylor, & Stromer, 2003) to a video-enhanced schedule in a manner dictated by his progress and his unique combination
Figure 1. A portion of one version of Kay's basic computer schedule. The first ("Time for centers") and final slides (choice board) are shown; a third activity (game) is not shown. The other two versions had the same activities in different orders. The choice board signaled the opportunity to ask a teacher for access (3 to 5 minutes) to a large therapy ball, interaction with a preferred staff person, free play with toys, free time in the "library," or computer games.

Figure 2. Schematic of one version of Ray's video-enhanced schedule, for which the modeled response was "Let's play!" (first and last slides not shown). Ray watched video models of play bids for game (top) and tunnel (bottom). For parachute (middle) the video did not play. The "Y in the lower left corner of the cue-to-play slides for parachute and tunnel is a 3-min countdown timer for these open-ended activities.
of talents and needs. His outcomes for the initial schedule, as we enumerate below, certainly constitute uniform minimal mastery criteria for a basic schedule, but components and outcomes of the subsequent package are more idiosyncratic.

The learner. Ray attended a full-day preschool for children with autism where he learned to follow his first computer mediated activity schedule at the age of three. Ray initially had been identified as a child who might benefit from using a computer schedule for the following reasons: (a) he appeared to enjoy and be reasonably skilled with many classroom play and leisure activities, but often would not participate in them unless prompted to do so by an adult; and (b) he liked playing games on the computer in his classroom. Before experiencing schedules that included video models, Ray had achieved independence at following a computer-mediated schedule whereby he spent 5 minutes interacting appropriately with the materials if not the peers in each of four classroom centers (e.g., library, block area). His mastery of the basic schedule was demonstrated by his ability to complete it even when (a) the pictures were presented in different orders; (b) he had taken a two-week holiday break during which all of the centers were relocated; and (c) photographs identical to those he saw on the computer were presented in notebook form (see Kimball, Kinney, Taylor, & Stromer, 2003).

Ray's first schedule, developed in PowerPoint®, contained not only digital photographs but also recordings of his teacher's voice labeling each picture as it appeared to him on the screen. Ray not only reliably completed this schedule, however: he also unexpectedly (if not surprisingly) imitated the vocal cues, once per opportunity, as he went off to the pictured center (a response that generalized to, and maintained with, the notebook, which had no paired auditory cue). Ray's contextual imitation suggested that he could learn more from a computer-mediated schedule than simply the independent performance of familiar activities. We were excited by this possibility because while Ray communicated primarily with speech, much of his spontaneous vocalization consisted of delayed echolalia (i.e., he would repeat, out of context, lines from a preferred video or storybook). We determined that if we were to embed carefully selected audiovisual content into computer-mediated activity schedules, the content could model behavior of which he was capable but which he did not usually exhibit, and the schedule could cue the appropriate context in which to exhibit it. One ideal target skill was play bids because, as mentioned, Ray remained on-schedule in classroom centers, but while there he engaged in solitary or parallel play, almost never making social initiations to classmates. Those approaches he did make often took a hostile or peculiar form, and his educational plan targeted social skills for improvement.

At the time we introduced video modeling, Ray was four years old and attended his original preschool in the afternoon only; he spent each morning at a preschool primarily for typically developing children. He reliably attended to videos and was able to use a computer mouse. All instruction
and practice occurred within a 26' x 26' classroom where there were three to four teachers and nine other children of similar ages and abilities.

The equipment. Ray's schedules were constructed and presented on a Dell Dimension 4100 desktop computer with a 16" monitor. This computer had a 75-gigabyte hard drive, a Pentium 3 processor, and 512 megabytes of RAM; the operating system was Windows 98, 2nd edition.

The schedule. In order to teach Ray the targeted initiation, we chose three activities that provided opportunities to make the initiation, "Let's play": a child's turn-taking game, a small nylon parachute, and a tunnel. Baseline data showed that, "off schedule," Ray reliably remained independently engaged with the respective activities for at least 3 minutes, and a natural language sample, also gathered before the schedule was introduced, indicated he did not make play bids while engaged with the materials.

Because Ray had previously shown that he could complete a schedule irrespective of the sequence of activities, we made three versions of this schedule (i.e., three separate PowerPoint® slideshows), each having the three activities in a different order. On any given day, Ray only practiced the schedule one time; which of the three versions he practiced that day was determined arbitrarily (across days of implementation, each of the three versions both preceded and followed the others). An additional baseline probe in which Ray actually followed one version of this schedule prior to exposure to any video also showed that even while "on schedule" he did not ask peers to play (there was only one probe in this case because of extensive historical observations from Ray's first schedule).

We previously had made three 5-second digital videos—one for each activity—showing one familiar age-mate saying "Let's play" to a partner and then engaging with the partner in the activity. We introduced these videos as an active slideshow component one activity at a time. The video would automatically play when Ray clicked on the activity picture, before the cue-to-play appeared (refer to Basic Steps..., above). To elaborate, first we introduced the video for the tunnel into all three versions of the schedule, so that regardless of the version selected for that session (i.e., regardless of the order in which the three activities were scheduled) Ray would see "Let's play" modeled for the tunnel, but only for the tunnel. We did this because, assuming he would correctly imitate the modeled initiation, we wanted to find out whether he would also make play bids while performing the other two activities for which he did not see a model (i.e., we wanted to assess generalization to game and parachute).

Thus, at first Ray viewed only an activity picture and a cue-to-play picture for the game and the parachute (as in a typical activity schedule), whereas for the tunnel he viewed an activity picture, a 5-second video model of the target behavior, and a cue-to-play picture. In either case, clicked on the activity picture, which provided the cue-to-play slide either immediately or following a video of the peer engaged in the same activity and making the vocal initiation. At this point, Ray was expected to approach a classmate (none of whom, incidentally, had been coached), say "Let's play"
(or some acceptable variant of the target response), go with the peer to the pictured activity, play together with the materials, return to the computer when a timer sounded after three minutes, and click the action button to view the next activity picture. This scenario actually describes the outcome for which we hoped, and which we sought to teach with video modeling. Realistically, the minimal expectation for Ray, especially for the parachute and game which had no video modeling, was at least to play appropriately with the pictured materials for three minutes until the timer sounded. The sequence was then repeated for the next two activities. After Ray completed all three activities and clicked on the third and final action button, a photograph of his pictorial choice board appeared (see Figure 1), along with a recording of his teacher saying, “Great job, Ray! Make a choice.” A teacher would approach him at this time and he would reliably request one of the pictured items.

The instruction. Teaching children to follow basic activity schedules—which is to say, teaching them to complete a sequence of activities without relying on prompts—proceeds according to a relatively standard protocol, as presented very cogently and comprehensively by McClanahan and Krantz (1999). An initial schedule includes perhaps three or four activities that the intended learner is capable of completing on her own, but which she does not initiate. Typically, a child learns the following basic steps: (a) touch (or click) on a picture of an activity, (b) obtain the materials involved in that activity, (c) interact with the materials appropriately, (d) restore things to their proper order once the activity, whether closed or timed, has been completed, and (e) return to the schedule (notebook or computer) to turn/click to the next picture. Instruction is accomplished by prompting the child through these steps using graduated guidance (i.e., an adult responding with only the amount of physical prompting necessary to keep the child moving through the routine, and no more) delivered from behind the learner without prompting in any other form (i.e., no verbal or point cues). In our experience, children with autism in early intervention and early elementary programs have achieved an accuracy criterion of 80% to 100% independence on all steps across activities after only a week or two of guided practice. For practitioners there seem to be at least 3 keys to helping children learn to use activity schedules successfully: (a) selection of tasks that the children can perform competently; (b) faithful implementation of graduated guidance to minimize errors; and (c) provision of ample reinforcement upon completing the schedule.

The teaching that took place with Ray when he was using a video enhanced schedule is another question. For all intents and purposes, formal adult-directed instruction was nonexistent.

On most days a teacher verbally reminded Ray to “Remember to watch the video(s)” before she activated the schedule on the computer, but apart from viewing the video models while following his schedule, Ray received no instruction whatsoever with respect to making play bids. Once Ray was on schedule, teachers provided no prompting or support to approach
peers, initiate a play bid, or remain playing with them. We made this decision because we were working with a learner who had previously mastered basic schedules and we wanted to observe the unadulterated effect of introducing video-models into the context of activities he could complete independently. In other words, if we embedded the models within the schedule, would Ray naturally embed the modeled response within the activity cued by the schedule?

The outcomes. Ray, already proficient at following activity schedules when we introduced video models, learned to approach peers and ask them to play with him with the activities depicted in his new schedule when the video models were in effect. The first model was added to the schedule for tunnel: he made no initiations during the first session when this model was in place, but for the next 5 sessions he initiated for tunnel and also, for 4 of 5 sessions, for parachute, for which there was no model. He did not, during these sessions, make a play bid for game, so we introduced a video model for that activity (Figure 2). His performance, in terms of play bids, was variable for 5 sessions after the introduction of the second model, but then he made initiations for all 3 activities during 4 of the next 5 sessions. At this point we removed both video models from the schedule, and Ray continued to make initiations for all 3 activities during probes conducted with the basic computer schedule after 1 and 7 calendar days (he did not practice the activity schedule at all, nor did he have access to the materials depicted in the schedule, on days between these or subsequent probes). Twenty calendar days after the second computer probe, play bids for all activities maintained (and generalized) when Ray followed a schedule presented in notebook form. Unfortunately, 10 calendar days after the notebook probe, when we presented the materials for a free play probe, Ray only made a play bid with the tunnel (1 of the 2 activities for which he had seen a model) but not for the parachute or the game.

We can speculate that Ray’s performance would have better maintained and generalized had we given Ray practice with 3 video models, and/or more prolonged practice with models, and/or faded the video models and schedule more gradually and systematically. On the other hand, all of these modifications to our procedure could be implemented after the fact. Our interest, however—partly due to a concern with efficiency—was in the least amount of intervention necessary to achieve generalization and maintenance. We wanted to discover the effects of video modeling unsupported by any intervention other than activity schedules. In Ray’s case we learned that an initiation modeled for one activity would not necessarily generalize to two other activities presented in the context of a schedule, but that initiations would generalize to the third activity after being modeled for the other two (anecdotally, this pattern was replicated with two other initiations—“I need help” and “I’m done”—introduced at two different times during the school year with two different activity schedules [also with 3 versions and 3 activities each]). We also learned that, relative to this child’s skills and history, the discontinuation of direct programming after only 5
days of correct practice was adequate to promote generalization to pictures in a notebook, even after 27 days, but insufficient to ensure prolonged maintenance. Actually, we think that Ray's performance was quite promising, given the brief period of practice and its precipitous termination. We were unable, within the parameters of this exploratory investigation, to probe for generalization of play bids to novel activities or settings. We can report that, qualitatively, Ray's initiations were not stereotyped renditions of the model: he demonstrated variation in his volume and tone, elaboration of the "Let's play" phrase, approaches to different peers, and persistence with the same or a different peer if the initial bid was unsuccessful and even, on occasion, if a playmate left the activity before time was up.

Future directions

Strain and Kohler (1999), in a review of 20 years of teaching social skills to children with disabilities, remarked that "a fine-grain analysis of existing normative data on the social interactions of preschool children revealed that social exchanges were not begun by 'promptlike' statements from children, nor were they maintained by 'praise-like' statements from interactants. Rather, our reading of the available developmental data indicated that interactions were begun and maintained by specific social overtures that were exchanged on an equitable, or reciprocal basis" (p. 191). When we say that a child has learned to follow an activity schedule, we mean they have, given visual supports only, learned to engage independently in a number of (pre-learned) activities in sequence; that is, in the absence of "prompt-like" and "praise-like" statements. By combining activity schedules and computer technology, we have been able to teach new social skills to a similar degree of independence. What is more, we have observed in case studies (Dauphin et al., 2003; Kalaigian et al., 2002; Kimball et al., 2002) that this independence maintains when the instructional supports are faded to a simple notebook.

Krantz (2000) expressed the view that activity schedules may have special utility for social and communication skills. Adding video models to schedules holds promise for teaching such skills. Just as notebook schedules can be used to establish independent (unprompted) use of a series of picture cues, computer schedules can be used to establish independent use of a series of instructional videos. In this way, videos permit additional instructional stimuli to be incorporated into the schedule itself. Further, a child who has learned to follow a schedule and imitate a model is able to practice the instructed response immediately in the natural setting depicted in the video. This is a very different scenario than one in which a skill is taught and practiced in a discrete trial context that may differ in a number of ways from the environment where the skill is ultimately supposed to occur.

Arguing that something can be done is not an argument for doing it. We believe, however, that there are many advantages for bundling technology
in the manner we have described. Among these advantages are: (a) capitalizing on the affinity of children with autism for visual stimuli, especially when presented on computers (in a sense, the programs create their own demand); (b) improving the efficiency with which instruction can be delivered—particularly important with learners who lag behind their typically developing peers; (c) enabling precise management of instructional stimuli and contingencies, thereby facilitating not only instruction but also research, possible even expediting the manner in which one informs the other; and (d) promoting consistency, with minimal training, across providers and settings, including homes. Obviously, capitalizing on the naturally motivating properties of computers does not mean replacing the teacher as the principal architect of a child’s learning environment: the work we have described has been authored by respective children’s educators using the PowerPoint® software that comes standard on many computers. The bundling of technology may place additional resources for addressing particular objectives at teachers’ disposal, but as Ray showed us, target selection and systematic planning for maintenance and generalization are of critical importance.

While this technology is promising, there is much we still do not know about how to effectively and efficiently use it. For instance, we recognize the value of pre-existing photo-object matching skills (McClannahan & Krantz, 1999, pp. 17-19), but could some such skills be taught in the context of an entry-level activity schedule? Is it necessary to postpone teaching with activity schedules until discrete trial skills are well established? We are inclined to think not, but more conclusive answers require much additional study. Also, we see no need to reserve activity schedules for teaching receptive skills after picture exchange skills have been established (Bondy & Frost, 2002, pp. 128-132). Instead, cues encountered in a schedule could set the occasion for a child’s use of emerging expressive skills—to request a toy, ask for help, and solicit attention using speech, manual signs, or pictures, as examples. Activity schedules are flexible tools and there are opportunities for creative parents, practitioners, and researchers to advance the use of the methods, particularly with children in the early stages of teaching.

A second avenue for further research is exploring the possible breadth of learning using video enhanced schedules. That research should include analyses of play and social skills in the absence of schedule supports. Informal observations (Dauphin et al., 2003) suggest that a history of schedule following might enable positive behavioral changes outside the context of a schedule. Script fading (Krantz & McClannahan, 1993, 1998; Sarokoff, Taylor, & Poulson, 2001) and video modeling (e.g., Taylor et al., 1999) interventions may engender spontaneous commenting with familiar and unfamiliar communicative partners and with novel activities. If social skills are targeted, there may be a spillover of effects of teaching with activity schedules, resulting in reciprocal interactions and other social behaviors not expressly taught (e.g., Strain, Shores, & Kerr, 1976). Put an-
other way, play and social skills established with activity schedules might be prime candidates for "entrapment" by natural communities of reinforcement and support that are contacted off schedule (Stokes & Baer, 1977).

Finally, another intersecting avenue involves continuing research with other instructional methods as a component of the package we have presented. Matrix-training procedures, for example, may yield recombinative generalization (Goldstein & Mousetis, 1989) and thereby further improve our efficiency at ameliorating play and social skills. Self-management procedures represent another technology that has been used to improve social skills while also reducing disruptive behavior (Koegel, Koegel, Hurley, & Frea, 1992) and to teach children to play when they are not supervised (Stahmer & Schreibman, 1992); they have also been combined with activity schedules to support daily living skills (Pierce and Schreibman, 1994). The shared goals of achieving independence and socialization means that research on activity schedules and self-management inform one another. Third, whether or not it is preferable to teach a computer schedule prior to a notebook remains a question for future research. Doing so with Ray did not appear to interfere with his subsequent generalization to a notebook schedule, but it is unknown whether this effect would be true for other children. Finally, the combination of symbol-based communication (e.g., Picture Exchange Communication System, Bondy & Frost, 2002) with these other technologies suggests many possibilities worth exploring. We encourage other researchers to explore these questions as well because we believe they will take us a long way in our efforts to address the challenges (as related by Koegel, 2000; Lord, 2000; Rogers, 2000; and Schreibman, 2000) of promoting the social and communicative independence of children with autism.

References


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