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Computer-Presented Video Prompting for Teaching Microwave Oven Use to Three Adults with Developmental Disabilities

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We evaluated the use of a video prompting procedure for teaching three adults with developmental disabilities to make popcorn using a microwave oven. Training, using a 10-step task analysis, was conducted in the kitchen of the participant's vocational training program. During baseline, participants were instructed to make popcorn, but were given no further instructions or prompts. Video prompting consisted of first watching a video clip of a step being performed and then giving participants the opportunity to imitate that step. This prompting procedure was introduced in a delayed multiple-probe across subjects design. Following acquisition, video prompting was removed and maintenance in the absence of video prompting was assessed at 2, 6, and 10 weeks. Two of the three participants acquired the task when video prompting was introduced and performed at 80–100% correct during follow-up sessions. These data suggest that video prompting may be an effective instructional strategy for teaching daily living skills to adults with developmental disabilities.

KEY WORDS: video prompting; daily living skills; developmental disabilities.

Many adults with developmental disabilities experience substantial deficits in daily living skills (Jacobson & Ackerman, 1990; Kraijer, 2000). Deficits in this domain may negatively affect the person's overall quality of life (Parmenter, 1994)

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and limit the person's ability to function independently in home and community settings. For example, when individuals lack meal/snack preparation skills, they are dependent on others and may rarely, if ever, determine for themselves when and what to eat. In addition, caregivers at home or supervisors at work will have the added responsibility of preparing meals/snacks for the person. Reliance on staff to complete daily living tasks for the individual may also reduce the person's level of participation, which may increase passivity and lead to learned helplessness (Peterson & Bossio, 1989).

It stands to reason that the acquisition of daily living skills, such as meal/snack preparation skills, may represent one way to increase participation, independence, and self-determination, while perhaps also reducing passivity and preventing learned helplessness This, in turn, may enhance overall quality of life (Parmenter, 1994) and reduce caregiver burden (Haveman, van Berkum, Rejinders, & Heller, 1997). It is therefore not surprising that a considerable amount of attention is directed towards developing effective instructional procedures for teaching daily living skills to individuals with developmental disabilities (Westling & Fox, 2004).

Recent evidence suggests that presentation of instructional material via video can be effective for teaching individuals with developmental disabilities (Sturmey, 2003). Indeed, video technology was successfully applied in teaching a variety of adaptive behaviors, including conversational speech (Charlop & Milstein, 1989), meal preparation (Rehfeldt, Dahman, Young, Cherry, & Davis, 2003), perspective taking (Charlop-Christy & Daneshvar, 2003), play sequences (D'Ateno, Mangiapanello, & Taylor, 2003), self-care skills (Norman, Collins, & Schuster, 2001), spelling (Kinney, Vedora, & Stromer, 2003), spontaneous requesting (Wert & Neisworth, 2003), and social initiation (Nikopoulos & Keenan, 2003). Together these studies demonstrate that some individuals with developmental disabilities can learn by viewing instructional videos.

One general approach for configuring this type of instructional material is known as video modeling (Le Grice & Blampied, 1994). Video modeling involves making a video of someone completing a task from beginning to end (i.e., whole task presentation) The student watches the entire video and is then given the opportunity to perform the task.

Rehfeldt et al. (2003) used video modeling for teaching sandwich making to three adults with moderate to severe mental retardation. Their video showed an adult with a developmental disability completing the 17 steps for making a peanut butter and jelly sandwich. The three participants were verbally prompted to watch the entire video, which lasted 2.5 min. After watching the video, the participants were given the opportunity to make a sandwich. The results demonstrated that watching the video was sufficient to promote rapid acquisition of the sandwich-making skill for 2 of the 3 participants. The third participant already showed a high level of correct performance before watching the video. Following acquisition, all three participants maintained high levels of performance,

even though they did not watch the video prior to the 1-month follow-up session.

Because video technology is still emerging as an instructional tool for individuals with developmental disabilities (Sturmey, 2003), it is important to investigate various application options. The present study sought to systematically extend the work of Rehfeldt et al. (2003) by evaluating another configuration for presenting video-based instructional materials. Specifically, we evaluated the use of a video-based task analysis for teaching three adults with developmental disabilities to make popcorn using a microwave oven. The task analysis consisted of a series of brief video clips, each showing a single step of the 10-step task. Participants viewed a step and were then given the opportunity to complete that step before viewing the next step of the task. Video clips were viewed in the training setting and during the training sessions, rather than in a separate location before each session. That is, the intervention involved a variation of video modeling in which each step of the task was prompted with a short video clip; a variation known as video prompting (Le Grice & Blampied, 1994). A further variation was that the video clips were filmed from the perspective of the person completing the task rather than from the perspective of a spectator watching another person perform the task.

Thus the present study extends previous research because the video prompting procedure differed from video modeling in several potentially important respects. First, video prompting consisted of showing each individual step of the task and then giving the participant an opportunity to perform that step before moving on to view the next step in the videotaped task analysis. In addition, the video clips were filmed from the perspective of the performer completing the task, rather than the perspective of a spectator watching someone else complete the task, as is the more typical scenario in studies using video modeling.

We hypothesized that these novel aspects of video prompting (i.e., partial task instruction and filming from the perspective of the performer) were better suited to the participants selected for, and task used in, the present study. This hypothesis was based on the fact that the participants involved in the present study had substantial deficits in adaptive behavior functioning and no history of training in meal preparation skills. Additionally, the task involved 10 discrete steps, indicating the potential need for a step-by-step training video.

METHOD

Participants

Three adult men with developmental disabilities participated in this study. All three lived in community-based group homes and attended the same vocational training program during the day. The participants' domestic living skills

Table I. Demographic Information for Each Participant, Including Diagnoses, IQ, and Vineland Age Equivalency Scores (Years:Months) for the Social, Communication, and Daily Living Skills Domains

Name	Age	Diagnosis	IQ	Social	Communication	Daily Living
Bob	36	Moderate mental retardation	43	0:7	2:1	2:7
Jim	36	Autism and moderate mental retardation	50	0:3	1:2	2:9
Tim	34	Moderate mental retardation	45	0:11	0:11	3:6

were assessed with the Vineland Adaptive Behavior Scales—Interview Edition (Sparrow, Balla, & Cincchetti, 1984). Results of the Vineland assessment indicated that all three participants were able to feed themselves using a spoon and appeared to have the motor skills necessary to make and consume popcorn using a microwave oven. They were also considered candidates for video prompting because vision and hearing acuity were reported to be within the normal range. Table I provides demographic information for each participant.

Participants were selected because results from the Vineland indicated that they had substantial deficits in domestic living skills. Specifically, all three lacked meal preparation skills. Residential and vocational staff reported that none of the three participants was able to prepare meals at home or during break/lunch times at work. In addition, none of the three had received any systematic training in the past to develop their meal preparation skills, although development of domestic living skills, including meal preparation, were habilitative priorities in their individualized service plans.

Popcorn making was selected as the target activity because staff reported that all three participants appeared to enjoy eating popcorn. Staff also reported that the participants liked to consume popcorn for snack/break times at both home and work. Furthermore, staff indicated that these three individuals did not have the skills to make popcorn independently.

Setting

The study was conducted in the kitchen of the participants' vocational program during their mid-morning breaktime. The kitchen was equipped with a refrigerator, coffee maker, sink, counters, microwave oven, storage cabinets, and a rubbish bin. Training was conduced individually with each participant to avoid incidental modeling effects.

Task and Materials

Intervention focused on teaching the participants to make a bag of microwave popcorn. The materials for making microwave popcorn included individual serving

Table II. Task Analysis for Making Microwave Popcorn

Steps in the task analysis
1. Remove bag of popcorn from its plastic wrapper
2. Open the door of the microwave oven
3. Place bag of popcorn into the oven right side up
4. Close the door of the microwave oven
5. Press the POPCORN panel to set the timer
6. Press the START panel to start the oven
7. When the popcorn is finished, as indicated by the bell, open the oven door
8. Remove the bag of popcorn from the oven and close the door
9. Open the bag of popcorn
10. Pour the popcorn into the bowl and eat

sized bags of microwave popcorn, a wooden bowl for holding the popped corn, and a microwave oven mounted above the kitchen counter at eye level for the participants. A task analysis for making microwave popcorn was selected from the Murdock Center Program Library (Wheeler et al., 1997). This task analysis was adapted to make it consistent with the features of the microwave oven used in the present study. Table II shows the 10-step task analysis used in this study.

The microwave used in this study was a Panasonic 1300 watt oven. It had a door that opened by pulling on the door handle. There was a monochromatic front plate with numbers to set the cooking time, as well as six preprogrammed panels, of which POPCORN was one. The POPCORN panel was located in the top row on the far left of the panel, and the START panel was in the second row on the far right. The microwave was adapted for training purposes by adding a cardboard template to the front plate of the microwave oven. The template covered all of the function panels except those for POPCORN and START, as these were the only two needed when making microwave popcorn We added the template to make Steps 5 and 6 easier for the participants (see Table II).

Each step of the task analysis was filmed as an individual video clip using a digital camera (Sony DSC-F828 Cyber-shot). The clips were filmed from the performer's perspective. That is, when participants viewed a video clip, they saw the step being completed from the perspective of the performer completing the task, not from the perspective of a spectator watching someone else complete the step. Each clip lasted from 4 s (Step 4) to 12 s (Step 9) with a mean length of 7.6 s. In addition to demonstrating the actions required for completing the step, each clip included a one-sentence voice-over instruction. For example, the clip for Step 1 consisted of an over-the-shoulder shot of the performer's two hands removing the bag of microwave popcorn from its plastic wrapper. While doing this, the performer—who could be heard but not seen—said: *First, take the bag out of its wrapper*. As another example, the clip for Step 6 showed a finger moving

towards and then pressing the START panel on the microwave. The camera for this shot was positioned behind and slightly to the right of the performer so that when viewing this clip, the participant saw a hand with the index finger isolated—and part of the performer's arm—moving toward and pressing the START panel on the microwave oven. As this occurred, a voice-over instructed the adult to *"Press the button that says START"*.

The set of video clips were shown to the participants on a portable Window XP-based Mercury MiniMerc™computer. The video clips were shown on the computer using commercially available software (i.e., Windows Media Player™). The computer screen measured 18.5 × 24.5 cm.

Dependent Measure and Data Collection

Using the task analysis shown in Table II as a data sheet, we recorded whether each step of the task was completed independently or not on a session-by-session basis. To be scored as independent, the first step (i.e., remove the bag of popcorn from its plastic wrapper) had to be completed within 30 s of the initial instruction (e.g., *Ok Jim, make some popcorn*). All subsequent steps had to be completed within 30 s. During intervention, steps completed within 30 s after viewing the video clip for that step were scored as independent. Data were collected during morning snack sessions that were scheduled twice per week. Sessions lasted approximately 6–8 min. At the end of each session, the participant was allowed to consume an individual serving (approximately 6 oz) of popcorn.

Experimental Design

The study involved four phases: (a) Baseline 1, (b) Video Prompting, (c) Video Withdrawal (Baseline 2), and (d) Follow-up. To demonstrate a functional relation between video prompting and independent task performance, the video prompting procedure was introduced across participants in a delayed multiple-probe design (Horner & Baer, 1978; Richards, Taylor, Ramasamy, & Richards, 1999). The initiation of Baseline 1 sessions was delayed for Bob and Tim, because they were not available to begin the study at the same time as Jim. This is why a delayed multiple-probe design was used. Acquisition criterion was 5–6 successive sessions with 100% of the steps completed independently. After Bob and Jim reached criterion, baseline conditions (Baseline 2) were re-introduced to assess post-acquisition performance without video prompting. Tim did not participate in the final two phases of this study because he failed to reach the acquisition criterion within 15 sessions.

Procedures

Baseline 1

In Baseline 1, participants were brought to the kitchen one at a time during their morning snack time and stood in front of the counter near the microwave oven. An unopened bag of popcorn and the bowl were placed on the counter in front of the participant. The participant was then given the verbal instruction: "*Ok [name] make some popcorn.*" If the participant did not complete the step within 30 s, the trainer completed the step and then instructed the participant to continue by asking: "*What's next?*" After the final step, whether completed by the trainer or participant, the participant was allowed to eat about 6 oz of the popcorn that had been made. During the session, the trainer and reliability observer (when available) recorded the number of steps that the participant completed independently.

Video Prompting

During this phase, participants were brought to the kitchen individually during morning snack time and stood in front of the counter near the microwave oven. An unopened bag of popcorn and the bowl were placed on the counter in front of the participant. In addition, the Mercury computer was placed on the counter to the left of the bag of popcorn and the bowl and the participants were oriented to face the computer screen. The trainer would start the video of the first step and ask the participant to *watch this*, as the trainer pointed to the computer screen. After viewing the video clip, the trainer said *now you do it*. At this point, the participant was given 30 s to complete the step. If the participant failed to complete a step within 30 s, the trainer completed the step and proceeded to show the next clip in the task analysis using the same procedure as for the first step. In other words, each participant would watch the video for one step of the task analysis, then have the opportunity to complete that step, then be shown the video for the next step of the task analysis and have the opportunity to complete that step, and so on for the remainder of the steps. No additional instructions, feedback, or prompts were delivered other than the one sentence instruction provided in the video clips. This phase continued until the participants independently completed 100% of the steps across 5–6 consecutive sessions.

Baseline 2 (Video Withdrawn)

Once the participants reached the training criterion, video prompting was removed. The procedures in place during this phase were therefore identical to

Baseline 1. It should be noted that Tim did not participate in the phase because he did not reach criterion during video prompting.

Follow-up

Follow-up sessions were conducted with Bob and Jim at 2, 6, and 10 weeks to assess maintenance. The procedures in place during this final phase were identical to those of the previous video withdrawn phase. Tim did not participate in the phase because he did not reach criterion during video prompting.

Inter-Observer Agreement

Reliability observers collected data on the number of steps performed independently during at least 20% of the sessions in each phase of the study (range 20–100%). Observers were the second author and advanced graduate students. They were trained to collect data by providing them with a data sheet, explaining the procedures, and answering any questions they had about the process. Agreement between the trainer and reliability observer on the steps performed independently was calculated on a session-by-session basis using the formula: Agreements/(Agreements + Disagreements) × 100%. The resulting percentages of agreement ranged from 90–100% with a mean of 99%.

RESULTS

Figure 1 illustrates the percentage of steps completed independently by Bob, Jim, and Tim for each session. During the initial baseline sessions, Bob completed 20–30% of the steps independently. Generally, he would open the door, put the bag of popcorn inside the oven, and close the door. However, he never first removed the bag from its plastic wrapper and was never successful in making popcorn independently during baseline. When video prompting was introduced, Bob showed an immediate increase in the percentage of steps performed correctly and reached 100% within nine sessions. When the video prompting was removed in Baseline 2, his percentage of steps completed independently ranged from 90 to 100%. During follow-up at 2, 6, and 10-weeks, Bob continued to perform at 90–100% correct. In this final phase, his one consistent error was failure to press the POPCORN panel (Step 5), which is why we continued to use the template.

Jim independently completed 0 to 20% of the steps during baseline. The steps he completed independently were opening and closing the microwave oven door. Jim showed an immediate increase in the percentage of steps performed independently when video prompting was introduced. During this phase, he reached 100% within five sessions. During Baseline 2, Jim completed 100% of the steps correctly

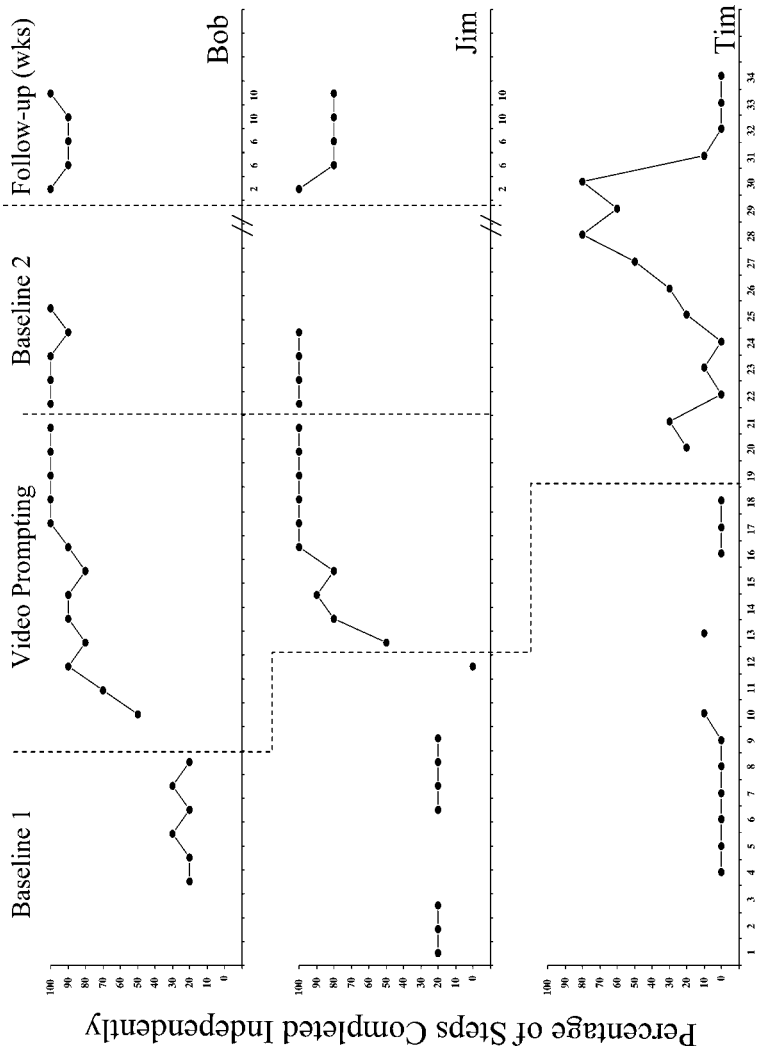

Fig. 1. Percentage of steps completed independently across sessions for Bob, Jim, and Tim.

over four sessions. During follow-up, Jim's performance ranged from 80–100% correct. In this final phase, his errors tended to occur on Step 3. Specifically, he often placed the bag in the oven upside down. This was not considered to be a critical error because the resulting product did not seem to be adversely affected. However, he also made consistent errors on Step 5 (pressing the POPCORN panel). Because this was a critical error for completion of the task, the template continued to be used for Jim.

Tim's performance ranged from 0–10% during baseline. When video prompting was introduced, he showed gradual improvement to 80%. After this, however, his performance began to deteriorate and returned to baseline levels even with continued video prompting. Training was terminated with Tim after session 34 because he failed to make progress and because he no longer seemed interested in eating popcorn or participating in training.

DISCUSSION

The percentage of task analyzed steps increased with the introduction of video prompting, and two of the three participants reached the acquisition criterion with this procedure in place. The third participant failed to reach criterion with video prompting. Following acquisition of the skill with video prompting, the two participants who reached criterion continued to perform the task without the need for continued video prompting. Independent performance was maintained at 80–100% correct during follow-up sessions conducted with the two participants who acquired the skill. Overall these results provide some support for the use of video prompting when teaching daily living skills to adults with developmental disabilities.

Our results extend the literature on the use of video in instructional programs for individuals with developmental disabilities. Whereas previous studies involved video modeling (Le Grice & Blampied, 1994; Rehfeldt et al., 2003), the present study examined a variation known as video prompting. The video prompting procedure used in the present study differed from the video modeling approach used by Rehfeldt et al. (2003) in several respects. Specifically, instead of watching the entire task analysis, participants in the present study viewed each step of the task analysis separately. In addition, the clips were viewed during training sessions, not before, and the footage was shot from the perspective of the performer. These differences between video modeling and video prompting may prove critical for some individuals. That is, there may be some individuals who would do better with video prompting compared to video modeling and vice versa. Our current research involves a direct comparison of video modeling with video prompting to assess their relative effectiveness for teaching daily living skills to adults with developmental disabilities.

While video prompting proved effective for two of the three participants in the present study, it is unclear if this approach is more effective than the use of systematic instructional procedures implemented directly by staff (Duker, Didden, & Sigafoos, 2004). The need for a video camera and computer with the appropriate software to display the video clips would seem to make this a more expensive option when compared to staff delivered training. However, it is also possible that video instruction could reduce the amount of staff time required to implement instructional programs, which would help offset equipment costs. In addition, use of video prompting or video modeling may require less expertise on the part of staff in comparison to the level of expertise required to directly implement systematic instruction. Indeed, results of the present study suggest that all staff have to do is show participants the video clips. Thus, with the video prompting procedure, there may be less need for staff to have expertise in the use of more direct response prompting and prompt fading procedures. It is also possible that staff involvement could be further reduced by teaching participants to operate the computer system so as to self-deliver the video prompts as needed. Again further research is needed to explore the effectiveness of video-based instruction compared to staff-delivered instruction.

Two limitations necessitate a cautious interpretation of our results. First, only two of the three participants reached criterion. Tim's deteriorating performance, beginning with Session 31, coincided with a death in his family and a subsequent diagnosis of depression, which was treated with anti-depressant medication. His deteriorating performance and lack of acquisition appeared to result from a general loss of interest in popcorn, as evidenced by his refusal of free samples offered at the beginning a session. We offered free samples to him prior to Sessions 32, 33, and 34 to assess the reinforcing value of popcorn. This pattern of refusal rules out the possibility of satiation as an explanation, because he did not eat any popcorn and therefore could not have been satiated. Perhaps Tim's performance could have been sustained by using additional contrived reinforcers, but this seemed counter to the concept of natural reinforcement (Ferster, 1967), and insensitive to his emotional state. Consequently, his participation in the study ended after Session 34 because he continued to show a lack of interest in making and eating popcorn.

A second reason for exercising caution when interpreting the results of this study is that the video clips included voice-over instructions. It is possible that these verbal instructions alone may have been responsible for acquisition during video prompting. However, several anecdotal observations suggest that the visual information contained in the video clips was important. Specifically, participants were observed to be highly attentive to the video. That is, they remained oriented to the computer screen when the clips were playing and intently watched each clip from start to finish. In addition, the topography of their responses closely matched that shown on the video. For example, in opening the bag (Step 9), they

would grasp the bag exactly as shown in the video. Furthermore, the timing of their responses closely followed the video clip in that they often performed the actions at the same pace as shown in the video. While these anecdotal observations suggest the participants were learning from the visual information supplied in the video clips, future research would be improved by comparing video prompting with and without embedded verbal instructions. It is possible that the use of embedded verbal instructions may enhance the effectiveness of video prompting for participants with good receptive language.

While the visual content of the video clips seemed to be important, once the task was acquired, neither Bob nor Jim appeared to be dependent on video prompting. Both continued to perform the task with a high degree of independence even when video prompting was abruptly withdrawn. In addition, both maintained a high level of performance during follow-up sessions. This suggests that video prompting not only provided an effective imitative model, but also helped to establish a chain of responses in which each response was controlled by the discriminative stimulus created by completing the previous response. It is possible that other individuals may require a more gradual withdrawal of video prompting because the abrupt withdrawal of prompts can sometimes lead to deterioration in performance (Skinner, 1968).

Teaching meal preparation skills involves some risk. As individuals gain independence in cooking, for example, there may be danger of injury. In the present study, one potential risk was exposure to steam as the bag of popcorn was removed from the oven and opened. We were cognizant of this risk and supervised the participants as they completed Steps 8 and 9 of the task analysis. None of the participants were injured in the study. In fact, all three learned to open the bag slowly while holding it away from their bodies.

Effective use of video prompting may require certain prerequisites, such as the ability to attend to the video, motor imitation skills, and the ability to profit from observational learning. All three of the participants in the present study appeared to have these abilities to some extent, but this conclusion is post hoc in that it is based on the observed increase in the percentage of steps completed independently when video prompting was introduced. Although the importance of such prerequisites must await further study, the present results suggest that video prompting may be an effective instructional strategy for teaching daily living skills to some adults with developmental disabilities.

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